

From: jho@sonic.net
Sent: Saturday, November 16, 2019 1:39 PM
To: _CityCouncilListPublic; CMOffice
Cc: susan@susan-gorin.com
Subject: [EXTERNAL] Cost of free energy

The effort to increase the percentage of electricity generated by intermittent renewable sources like wind and solar inevitably brings about large increases in the actual price of electricity that must be paid by consumers. The price increases grow and accelerate as the percentage of electricity generated from the intermittent renewables increases toward 100 percent. These statements may seem counterintuitive, given that the cost of fuel for wind and solar generation is zero. However, simple modeling shows the reason for the seemingly counterintuitive outcome: the need for large and increasing amounts of costly backup and storage – things that are not needed at all in conventional fossil-fuel-based systems. And it is not only from modeling that we know that such cost increases would be inevitable. We also have actual and growing experience from those few jurisdictions that have attempted to generate more and more of their electricity from these renewables. This empirical experience proves the truth of the rising consumer price proposition.

In those jurisdictions that have succeeded in getting generation from renewables up to as high as about 30% of their total electricity supply, the result has been an approximate tripling in the price of electricity for their consumers. The few (basically experimental) jurisdictions that have gotten generation from renewables even higher than that have had even greater cost increases, for relatively minor increases in generation from renewables. As the percentage of electricity coming from renewables increases, the consumer price increases accelerate.

No jurisdiction – even an experimental one – has yet succeeded in getting the percentage of its electricity generated from the intermittent renewables up much past 50% on an annualized basis. To accomplish the feat of getting beyond 50% and on closer to 100%, the grid operator must cease relying on fossil fuel backup power for times of dark and calm, and move instead to some form of storage, most likely very large batteries. The cost of such batteries sufficient to power a jurisdiction of millions of people is enormous, and quickly comes to be the dominant cost of the system. Relatively simple calculations of the cost of batteries sufficient to get through a year for a modern industrialized area show that this cost would imply an increase in the price of electricity by a factor of some 15 or 20, or perhaps even more."

Jack H Osborne

Sent from Windows Mail

From: jho@sonic.net
Sent: Saturday, November 16, 2019 1:03 PM
To: _CityCouncilListPublic; CMOffice
Cc: susan@susan-gorin.com
Subject: [EXTERNAL] and renewable is free?

<https://stopthesethings.com/2019/11/16/renewable-energy-regrets-intermittent-wind-solar-delivers-grid-chaos-for-californians/>

"

The only thing that's inevitable about the so-called 'transition' to wind and solar is rocketing prices and grid chaos. The inability to deliver electricity as and when it's needed, mean wind and solar have no commercial value – apart from the massive subsidies they attract.

Being commercially worthless is one thing, but dumping volumes of wind and solar into the grid one-minute, and watching their output completely collapse the next, comes with a staggering hidden cost.

To that end, Donn Dears unpacks the story behind California's duck curve."

"

1. As more and more renewables are added to the grid the amount of electricity supplied during the daylight hours is increasingly from renewables, primarily from solar in this depiction.
2. Baseload power must be quickly reduced as the sun rises to allow renewables to supply the grid.
3. When the sun sets, these same baseload power plants must suddenly ramp up to meet the demand in the evening. The sudden ramping up of the power plants damages the power plants, except hydro, and various components of the grid from thermal expansions and contractions.
4. Renewables are intermittent, the sun may go behind a cloud or the wind may stop blowing, so the baseload power plants must be cycled up and down to meet the variations in load. Power plants are less efficient when they are cycled in this manner which can cause an increase in air pollution, such as NOx."

I guess that you don't agree with this stuff, as you want to go all electric LOL

Jack H. Osborne.

Sent from Windows Mail

RECEIVED

November 15, 2019

City Clerk Dina Manis
City of Santa Rosa
100 Santa Rosa Avenue, Room 10
Santa Rosa, CA 95404

NOV 20 2019

CITY OF SANTA ROSA
CITY CLERK'S OFFICE

NORWOOD

ASSOCIATES

Government Relations

RE: Opposition to All-Electric Reach Code, Agenda Item 15.2

Dear Acting City Clerk Dina Manis:

I am submitting these comments in Opposition to Item Number 15.2 on the Agenda for the Santa Rosa City Council meeting scheduled for Tuesday, November 19th, 2019.

My name is John A. Norwood. I am the Chief of Government Relations for the California Pool & Spa Association (CPSA). CPSA is a statewide trade association that represents all segments of the swimming pool and hot tub industry in California. This includes manufacturers of equipment to operate swimming pools, hot tubs, ancillary equipment, testing and safety products, outdoor kitchens and recreation areas, swimming pool and spa builders, subcontractors, and the swimming pool maintenance and service industry.

The swimming pool and hot tub industry is an exceptional contributor to the California economy. In 2014, PK Data, Inc. opined that the swimming pool & spa industry contributed roughly \$5 billion annually to the California economy. This number did not include costs associated with the pool remodeling industry or the hot tub industry. In fact, California is the biggest market in the world for swimming pools and hot tubs. Moreover, the industry provides good-paying jobs in communities throughout California, supports numerous individuals and firms that are in the construction subcontracting business, and employs tens of thousands of people in the pool and hot tub maintenance and service business. Swimming pool contractors purchase their construction materials, i.e., steel, cement, tile, sand, lumber, electrical, plumbing, and drainage materials locally, thus supporting other local businesses. The economic effect of this industry is multiplied by the demand for pool/hot tub chemicals, toys, backyard furniture, barbeques, outdoor kitchens, fire pits, fireplaces, and lighting desired by both commercial and residential owners of swimming pools and hot tubs.

The “California Dream,” so to speak, is still a home in the suburbs with a big backyard and a swimming pool. This fact is supported by the last five years of record-breaking pool construction since the nation emerged from the 2009 economic meltdown. This trend is destined to continue as in numerous areas of the state, 50% of new home buyers are millennials, many of which desire a home with a backyard swimming pool, hot tub, or exercise pool.

The goal of eliminating the use of natural gas in California, providing incentives for home builders to construct new housing tracts without natural gas lines or hookups, or otherwise phasing out the use of natural gas, will undermine the swimming pool and hot tub business in California, resulting in a significant economic blow to the state, as well as depriving millions of Californians of a backyard place for staycations that they so desire.

In the swimming pool and spa industry, pool heaters, fire pits, fireplaces, decorative fire features, pizza ovens, barbeques, outdoor ranges, and outdoor space heating all operate on natural gas. Together these elements produce spaces in backyards that provide families a place for recreation, exercise, entertainment, and relaxation. The pool and spa industry do utilize solar heating and electric heating where possible, especially for hot tubs, but there are no current alternatives to heating swimming pools in numerous commercial settings, in coastal and mountain residential areas of the state, or at night for homeowners. The same is true for outdoor kitchens and recreational areas relative to fire pits, fireplaces, outdoor space heating, and outdoor cooking equipment.

In addition to reducing greenhouse gas emissions, one of California's major goals in this proceeding is to improve energy and housing affordability. We do not believe the elimination of natural gas in California will accomplish either. Energy costs in California are extremely high as compared to other Western states. The cost of electricity from both traditional and renewable sources is significantly higher than natural gas and not as efficient. As such, even if there were practical alternatives to natural gas for the equipment installed by the swimming pool and hot tub industry, a change would result in a higher-priced and less efficient product, thus making it more difficult for homeowners, schools, recreational and commercial facilities to be able to afford it.

Swimming pools and hot tubs use only an estimated 4% of the natural gas demand in California. This industry should not be the target of these efforts and could be exempted from efforts to reduce the carbon footprint from the way we heat residential building and water systems. However, without natural gas hookups in new residential and commercial construction, citizens of this state that reside in these areas will be deprived of all the benefits associated with access to swimming pools and hot tubs.

For all of the above reasons, we would urge the town to reconsider action on this proposed ordinance.

Sincerely,

JOHN A. NORWOOD
Norwood Associates, LLC
916-447-5053

Bliss, Sandi

From: Bailie Severson <bayrose15@gmail.com>
Sent: Tuesday, November 19, 2019 4:04 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] All-electric reach code

Dear city council members,

When voting on the all-electric reach code, please think about the future of our beautiful county and all the people who call it home. Our county has been devastated by fires directly due to climate change. Continuing the use of fossil fuels will only speed up climate change and more fires and other natural disasters will be inevitable. I was born and raised in Sonoma County and have traveled to many countries around the world and have yet to find a place more special or beautiful. This is our home. Sonoma County holds every great memory I have growing up. Please vote to preserve it by saying no to fossil fuels so the next generation can be blessed with all that makes Sonoma County so unique and special. Please, think of the people, our environment, and the bigger picture over money and profit. Thank you so much.

Bliss, Sandi

From: Tish Levee <mitzvahm@sonic.net>
Sent: Tuesday, November 19, 2019 3:09 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Today's vote on the All-electric Reach Code.

I wish to comment on the adoption of the all-electric reach code today. Unfortunately illness prevents me from doing so in person. These comments are for the public record.

I am certain that after so many people had their gas cut off during the Kincade fire, there will be pushback on this. I was in Novato during the fire with no electricity, but we did have gas, and it was wonderful that we did.

Still...there are so many reasons we need to phase out gas in homes (and literally everywhere). Natural gas is NOT a clean fuel or a bridge fuel; gas, like oil and coal, is wrapping the planet in a blanket of emissions that is overheating us all (it's a bit like putting on a down comforter in the summer). Natural gas is mainly methane, which is 80 times more potent as a greenhouse gas than is carbon dioxide.

Right now gas is cheap, but that isn't always going to be so. PG&E has asked for a 24% gas rate increase and So Cal Gas, a 42% increase, over the next couple years. What seems like good economics today won't be in the future, especially if you begin to factor in the costs to the economy of worsening the climate crisis.

While we are talking about economics, an all-electric home will cost less to build—about \$6,000-8,000 for a single family home. It will also be cheaper to maintain and operate, especially as all these new homes will be required to have solar panels if feasible, and many will choose to have batteries and get off the grid entirely. (So the blackouts won't affect them!)

All-electric homes are healthier and safer for the people living there. Gas is the leading cause of structure fires, burns, and carbon monoxide poisoning, and gas cooktops are potent sources of indoor air pollution. Cooking on a gas cooktop releases fine particulate matter, smog-like compounds, and formaldehyde, and is known to exacerbate asthma.

Not only that, but with the reality that we will have more fires in the future, what happens if the gas is NOT shut down prior to a fire reaching a home? With all the fires we've been happening, many of us forget that we also live in earthquake country. When the next "Big One" comes, it will likely rupture gas lines, and there will be no warning time to shut off the gas everywhere. We need to remember that the 1906 San Francisco Earthquake was actually the Santa Rosa Quake and the San Francisco FIRE—so much more damage was done there by the fire from ruptured gas mains.

I hope you will hold to your vision for Santa Rosa and to your commitment to lessening the climate emergency and vote, again, to adopt the all-electric Reach Code. Thank you.

For the Planet, in unity and peace,

Tish Levee, Santa Rosa Resident & climate columnist for the Sonoma County Gazette

us  us

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has. Margaret Mead

Our lives begin to end the day we become silent about things that matter. Dr. Martin Luther King

Bliss, Sandi

From: felton Al'hashimi <feltonal3@gmail.com>
Sent: Tuesday, November 19, 2019 2:09 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Natural Gas Ordinance - OPPOSE

Please note as a Santa Rosa registered voter I OPPOSE the ordinance banning natural gas in new construction.

Until such time as the California electrical grid is proven reliable, it is outrageous for so-called representatives to ban alternative sources of energy. Please acknowledge an educated and informed citizenry which is more than capable in determining which forms of energy it chooses to utilize.

In the meantime, how about that Joe Rodota Trail. Please apply your efforts to addressing actual concerns versus "solving" non-issues and creating additional hardship and costs for the long suffering citizens of this state.

Sincerely,

FELTON T. AL'HASHIMI

Felton T. Al'Hashimi
Santa Rosa Registered Voter

Bliss, Sandi

15.2

From: Locuta <locuta@earthlink.net>
Sent: Tuesday, November 19, 2019 9:36 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Electric REACH code ordinance

Dear members of the Santa Rosa City Council,

First, I support this proposal and all efforts to reduce greenhouse gas emissions and move to carbon-free energy sources.

Natural gas is one of those notions from the 1950s and 1960s that seemed like a good idea at the time, but time has proven it to be a problem. The supply infrastructure is aging; maintaining it is an enormous burden that will only increase in the future. Recently we have experienced the serious issues associated with turning off the natural gas supply and then turning it back on, one structure at a time. The sooner we get rid of the natural gas "grid" the better.

Regarding the complaints concerning forcing people to cook with electricity instead of a gas flame: most people do 99% of their cooking with a microwave oven and an InstaPot. Newer cooking options such as induction stovetops and convection ovens provide viable alternatives to cooking with gas. If someone absolutely must have the cave-man flame cooking experience, get an outdoor propane grill or a barbecue!

There is another benefit of moving away from natural gas in favor of electricity: indoor air quality is better without the combustion gasses from natural gas appliances.

It would be great to see this proposal be expanded to all new buildings of any size. Further, adding a financial incentive to include on-site electrical generation (such as solar panels or wind turbines) in these new buildings would be to everyone's benefit.

I urge you to vote yes on the proposed electric REACH code ordinance.

Thank you,

Kirsten Barquist
1275 4th Street
Suite 300
Santa Rosa, CA 95403

Bliss, Sandi

From: Joel Chaban <jchaban@allthingsconnected.com>
Sent: Tuesday, November 19, 2019 7:14 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] I support the All-Electric REACH code

Hi Citycouncil,

Dear Council members,

I'm writing to express my gratitude for your taking the initial step to approve the Electric REACH Code ordinance for new construction in Santa Rosa. Because California has mandated that all new construction have solar PVC starting December 2020, it only makes sense that all new construction be all-electric.

Please vote 'yes' on Tuesday in order to finalize this measure that takes direct action against the climate crisis. There is nothing we can do that is more important than preparing our cities and homes to be fully clean energy in light of the urgency of the crisis.

Additionally, natural gas leaks and emissions damage the health of residents, and it is on an unsustainable path backward toward fossil fuels. A home has a 50-100 year lifespan, and we know that in that time, we need to be 100% clean energy. Why waste time and money now going off the rails? We must keep new construction on the pathway that we know we must be on.

Sincerely,

Joel Chaban
jchaban@allthingsconnected.com
707-884-9280
P.O. Box 800
Gualala, CA 95445

Bliss, Sandi

From: Jen Brayton <jennifer.brayton@gmail.com>
Sent: Tuesday, November 19, 2019 6:07 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Reach code

Dear Council members,

I'm writing to express my gratitude for your taking the initial step to approve the Electric REACH Code ordinance for new construction in Santa Rosa. Please vote 'yes' on Tuesday in order to finalize this measure that takes direct action against the climate crisis. There is nothing we can do that is more important than preparing our cities and homes to be fully clean energy in light of the urgency of the crisis.

Additionally, natural gas leaks and emissions damage the health of residents, and it is on an unsustainable path backward toward fossil fuels. A home has a 50-100 year lifespan, and we know that in that time, we need to be 100% clean energy. Why waste time and money now going off the rails? We must keep new construction on the pathway that we know we must be on.

*Respectfully,
Jen Brayton*

Sent from my iPhone

Bliss, Sandi

From: tod samson <todsamson@gmail.com>
Sent: Tuesday, November 19, 2019 5:41 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Keep Gas in new construction

Hello Santa Rosa City Council,

I am a long-time resident of Santa Rosa, please keep Gas in new construction.

As I write this we are on the eve of having our electricity shut-off, again. Those of us with Gas can at least cook and heat our homes for ourselves and our neighbors who are without power. There is no real plan or timeline for when the electrical grid will be stable and electrical costs continue to rise.

Thank you for your consideration,
Tod Samson

Bliss, Sandi

From: Tony White <tonwhite@sonic.net>
Sent: Tuesday, November 19, 2019 5:01 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] All-electric Reach Code

Mayor Schwedhelm, Members of the City Council,

As a North Bay Jobs with Justice activist, I want to express my thanks for your unanimous support of increasing the minimum wage and adopting limits on rent and a just cause eviction notice policy.

To continue your strong and positive reactions to local, national and global issues, I want to urge your adoption of an all-electric ready Reach code for future residential construction.

Not only will it reduce the cost of new buildings, especially given the predicted increase in the price of natural gas, but it will immediately reduce our carbon footprint and move us towards a fossil fuel free economy.

Since natural gas includes methane, which traps 80% more heat than carbon dioxide, and is also released at extraction, eliminating natural gas from new residences will be just one of many weapons in our arsenal to fight climate change.

Given that we are ground zero for wildfires caused in part by climate change, it is very important that you support the all-electric Reach code as well as other measures to reduce our carbon emissions, especially in transportation.

Thank you!

Tony White, North Bay Jobs w/Justice

Bliss, Sandi

15.2

From: Jacob Rich <jerichsalud@gmail.com>
Sent: Tuesday, November 19, 2019 12:37 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Please Support the All Electric Reach Code

Dear Santa Rosa City Council Members,

I urge you to please support and approve the All Electric Reach Code.

The All Electric Reach Code is an important step in reducing local greenhouse gas emissions and ensuring long-term sustainability and resilience from climate change and its effects.

Please support this important change.

Sincerely,

Jacob Rich
739 Agnew Pl, Santa Rosa, CA 95401

Bliss, Sandi

B.2

From: Dynamo Girl <stansberrybeth@gmail.com>
Sent: Tuesday, November 19, 2019 12:21 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Gas Stove Ban

I am resident of the City of Santa Rosa and I OPPOSE the ban to gas appliances on new construction! Unfortunately, I work and cannot show up to the meeting today but I'm very concerned about Santa Rosa's never ending desire to pass burdensome ordinances under the guise of the "green" agenda. VOTE NO on THE BAN!

If you want to help the environment, I suggest you clean up the homeless encampments and bike trails so that the tax payers can enjoy these areas again.

Thank you for your time.

From: maitreyi siruguri <maitreyi2005@gmail.com>
Sent: Tuesday, November 19, 2019 12:14 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Please Vote "YES" on Electric REACH Code

Dear Council members,

*I have been a resident of Santa Rosa for 13 years. I have two children who are American citizens. I am not yet a home-owner. With the increasing vulnerability to wildfires, I am further demotivated to buy a home in this area. This is very **saddening** because I love this community and it has been the only home my children have known thus far. They belong to a generation that was born into a community grappling with the reality of climate change. If someday (30-40 years from now) they were to come back and buy a home in Santa Rosa, they would want to know that this is a climate resilient community and their **leaders of the past left a legacy of right decisions for their future**. In all probability they would want to buy a home that is powered by clean, renewable energy and not one that perpetuates an unsustainable path backward toward fossil fuels.*

I'm grateful that you are taking the initial step to approve the Electric REACH Code ordinance for new construction in Santa Rosa. Please vote 'YES' on Tuesday in order to finalize this measure that takes direct action against the climate crisis. There is nothing we can do that is more important than preparing our cities and homes to be fully clean energy in light of the urgency of the crisis.

We need to be 100% clean energy. Why waste time and money now going off the rails? We must keep new construction on the pathway that we know we must be on.

Respectfully,

MAITREYI SIRUGURI
585 MIDDLE RINCON RD
Santa Rosa, CA 95409

From: Bryan Petrisko <bpetrisko@gmail.com>
Sent: Tuesday, November 19, 2019 11:56 AM
To: CityCouncilListPublic
Subject: [EXTERNAL] All-Electric Reach Code

Dear City Council,

I'm writing to express my utter disbelief that you are promoting an all electric appliance rule for new construction in the City of Santa Rosa. While I think I understand your motives to promote this symbolic gesture by Santa Rosa, I would prefer that you concentrate on the truly pressing issues affecting our community: Rebuilding, keeping people from moving away, and combating the homeless epidemic that is (not hyperbole) decreasing the quality of life for many residents of Santa Rosa and making our city an increasingly less attractive place to reside or visit.

I lost my home in the Tubbs fire and am still in the process of rebuilding my home. I made the commitment to stay here and help rebuild my community. I therefore have first hand knowledge of the financial and personal sacrifice that it takes to build in this community. I also have first hand knowledge of the strict energy efficient building requirements in California. Every major component of my house - From the walls, insulation, windows, HVAC, water heater, interior and exterior lights, appliances are energy efficient. And these improvements don't come for free. They all add expense to rebuilding which will take years to recoup. But even this is not enough for you!

Now, with our impending *sixth* PGE PSPS, you are pushing for an all electric code. This is *unfathomable* and evidence that you care more for your personal agenda than for what is needed, right now, by the residents of Santa Rosa. The agenda for tonight's public hearing states, "Extensive outreach and public engagement have been executed over the past several months." Really? Is this the same outreach that was done before converting Courthouse Square to a helipad?

So let's review the current state of affairs in Santa Rosa:

1. PGE says we will have years of future public safety power shut offs.
2. The cost of living and building here are some of the highest in the country.
3. We have nearly the highest homelessness rate of any suburban area in the entire United States (Remember the 2016 homeless *state of emergency* declared in Santa Rosa? What progress have we made? Would you ride your bike down the Joe Rodota trail now?)
4. Our downtown is losing businesses due to parking and security issues (i.e. mentally ill and drug addicted homeless people).

Our city is in a downward spiral.. many people are on the tipping point of staying or leaving. This is an urgent situation... You need to be spending all, and I repeat *all*, of your time on issues that affect the ability of people to make it here. First save Santa Rosa.. then save the world. Electric appliances? Come on...

Bryan Petrisko
3517 Deer Park Drive

Bliss, Sandi

From: Jacob Rich <jerichsalud@gmail.com>
Sent: Tuesday, November 19, 2019 12:37 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Please Support the All Electric Reach Code

Dear Santa Rosa City Council Members,

I urge you to please support and approve the All Electric Reach Code.

The All Electric Reach Code is an important step in reducing local greenhouse gas emissions and ensuring long-term sustainability and resilience from climate change and its effects.

Please support this important change.

Sincerely,

Jacob Rich
739 Agnew Pl, Santa Rosa, CA 95401

Bliss, Sandi

From: Greater Cherry Neighborhood Association <greatercherry@gmail.com>
Sent: Tuesday, November 19, 2019 12:25 PM
To: CityCouncilListPublic; City Clerk
Subject: [EXTERNAL] City Council agenda #15.1 - Public Hearing on RRS CBD formation
Attachments: RSCBD.pdf

Dear Council Members,

Attached is the information we have prepared for the public hearing on the CBD formation in Railroad Square. It is attached as a pdf, but also pasted below so it would be difficult to ignore.

We are prepared to stand and deliver, as well as follow-up on the information contained.

Thank you for the opportunity to participate in this process.

Respectfully submitted,

Eric Fraser
Community Organizer
707.479-8247

Railroad Square Community Business District Formation (CBD)

Our conclusion is that the formulation of the Railroad Square is ill-advised at this time.

- 1) The Downtown Action Organization, a sister organization for the proposed RSCBD, to be administered by the same quasi-government organization, the Santa Rosa Metro Chamber, is only a few months old. Already problems have developed:
 - a. Spending in excess of 12% on administration. The actual spend on administration from all layers (City, Chamber, contractors) appears to be in excess of 30%, but may be as high as 50-60% as the accounting is not clear in separating out administrative expenses.
 - b. Data supporting the performance of the DAO is also highly suspect and does not appear to be accurate.
 - c. Therefore, the formation should be tabled until more qualitative and audited data is available.
- 2) The formation of CBD increases costs for tenants and their customers as the assessments are passed on by the property owners to their tenants, and their tenants to the consumer.
 - a. Because costs rise for the small businesses there is a chilling effect on customer visits and spend.
 - b. Rising costs for rent have a derogatory impact on employee compensation. Decreases in customer visits due to higher prices also impact employees.
- 3) The City is using the CBD process to subject property owners to pay for services they already pay for through the multiplicity of taxes and fees they pay to the City already.
- 4) The City is (potentially illegally) using the interpretation of its voting rights as a "property owner" to cast votes in support of the CBD.

- a. There is evidence that the City is colluding with the Chamber to create new revenue-producing channels for both organizations. While the Chamber supports and campaigns for politicians who support this scheme, the City is able to "double bill" for services it should be providing anyways (see point #3).
- b. Because of this financial interest, the City is willing to sacrifice property owners who do not support the CBD formulation, probably in violation of these owners' rights. The residents, and consumers (visitors) should also have an expectation of fair representation from their elected officials.
- c. The City should not be allowed to vote for or against CBD formation, and should only be involved as a facilitator.

5) The City is willing to use defective data to promote the formation of, or the performance of, CBDs and BIAs.

- a. Incongruent and suspicious sales tax data has been propagated and used to promote the proposed CBD, and defend the existing DAO.
- b. Located with the proposed Railroad Square CBD is an official California Welcome Center (CWC). The Metro Chamber, through their Visit Santa Rosa agency (in lockstep with City staff) claim that 61,177 unique visitors were "welcomed" into the CWC. This visitor count appears to include the comings and goings of staff and volunteers multiple times during any given day. The actual count of visitors is estimated to be radically smaller, maybe around 3,500 - 5,000 per year in one worksheet.

6) The recent disasters, the PSPSes, and the treat of new disasters has dramatically changed operating conditions for small businesses and disposable incomes for consumers. Now is not the time to for additional costs.

7) The costs for new services does not come close to actual value benefit creation.

- a. In spite of the cooked books for the DAO and self-aggrandizement of DAO staff and City staff, there has been little if any positive impact. The cost is in no way relative to the evidence of performance.
- b. This is indicative of a leadership vacuum found within the Council and City staff, and of a quid-pro-quo to create revenue for governmental and quasi-government agencies only.

8) People throughout all spheres of city life probably agree that their streets, sidewalks, and empty lots should be safe and clean. We can all agree that economic activity should be robust and fair. In theory, we could all agree that government should not be allowed to perpetuate schemes that include bribery, shake-downs, unrepresented taxation, and more – accept those that are here today to do exactly that!

Railroad Square Community Business District Formation (CBD)

Our conclusion is that the formulation of the Railroad Square is ill-advised at this time.

- 1) The Downtown Action Organization, a sister organization for the proposed RSCBD, to be administered by the same quasi-government organization, the Santa Rosa Metro Chamber, is only a few months old. Already problems have developed:
 - a. Spending in excess of 12% on administration. The actual spend on administration from all layers (City, Chamber, contractors) appears to be in excess of 30%, but may be as high as 50-60% as the accounting is not clear in separating out administrative expenses.
 - b. Data supporting the performance of the DAO is also highly suspect and does not appear to be accurate.
 - c. Therefore, the formation should be tabled until more qualitative and audited data is available.
- 2) The formation of CBD increases costs for tenants and their customers as the assessments are passed on by the property owners to their tenants, and their tenants to the consumer.
 - a. Because costs rise for the small businesses there is a chilling effect on customer visits and spend.
 - b. Rising costs for rent have a derogatory impact on employee compensation. Decreases in customer visits due to higher prices also impact employees.
- 3) The City is using the CBD process to subject property owners to pay for services they already pay for through the multiplicity of taxes and fees they pay to the City already.
- 4) The City is (potentially illegally) using the interpretation of its voting rights as a "property owner" to cast votes in support of the CBD.
 - a. There is evidence that the City is colluding with the Chamber to create new revenue-producing channels for both organizations. While the Chamber supports and campaigns for politicians who support this scheme, the City is able to "double bill" for services it should be providing anyways (see point #3).
 - b. Because of this financial interest, the City is willing to sacrifice property owners who do not support the CBD formulation, probably in violation of these owners' rights. The residents, and consumers (visitors) should also have an expectation of fair representation from their elected officials.
 - c. The City should not be allowed to vote for or against CBD formation, and should only be involved as a facilitator.
- 5) The City is willing to use defective data to promote the formation of, or the performance of, CBDs and BIAs.
 - a. Incongruent and suspicious sales tax data has been propagated and used to promote the proposed CBD, and defend the existing DAO.
 - b. Located with the proposed Railroad Square CBD is an official California Welcome Center (CWC). The Metro Chamber, through their Visit Santa Rosa agency (in lockstep with City staff) claim that 61,177 unique visitors were "welcomed" into the CWC. This visitor count appears to include the comings and goings of staff

and volunteers multiple times during any given day. The actual count of visitors is estimated to be radically smaller, maybe around 3,500 - 5,000 per year in one worksheet.

- 6) The recent disasters, the PSPSes, and the treat of new disasters has dramatically changed operating conditions for small businesses and disposable incomes for consumers. Now is not the time for additional costs.
- 7) The costs for new services does not come close to actual value benefit creation.
 - a. In spite of the cooked books for the DAO and self-aggrandizement of DAO staff and City staff, there has been little if any positive impact. The cost is in no way relative to the evidence of performance.
 - b. This is indicative of a leadership vacuum found within the Council and City staff, and of a quid-pro-quo to create revenue for governmental and quasi-government agencies only.
- 8) People throughout all spheres of city life probably agree that their streets, sidewalks, and empty lots should be safe and clean. We can all agree that economic activity should be robust and fair. In theory, we could all agree that government should not be allowed to perpetuate schemes that include bribery, shake-downs, unrepresented taxation, and more – accept those that are here today to do exactly that!

Respectfully submitted by Eric Fraser, greatercherry@gmail.com, 11/19/19.

Bliss, Sandi

From: Tyra Benoit <tyrabenoit@gmail.com>
Sent: Tuesday, November 19, 2019 1:00 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Please pass a REACH Code at your 11/19/19 meeting

Dear Members of the Santa Rosa City Council,

I am a Tubbs Fire Survivor (from the Wikiup area) and am currently undecided about where my future will lead me. Since I lost my home in 2017, I have lived in Healdsburg and was encouraged by the fact that the Healdsburg City Council passed a Climate Emergency Resolution (which Santa Rosa has not yet passed). However, at their very next meeting, the Council in Healdsburg was asked to consider a REACH code. They did not request further study of this important tool in the fight against climate change. I was extremely disappointed by their failure to act. This is definitely not in the best interests of Healdsburg residents. I hope that the Santa Rosa City Council will act in a more positive way.

Due to the recent Kincade Fire and the PGE power shutoffs, my future in Sonoma County is in jeopardy. A very recent article in the Press Democrat highlighted the exodus from Santa Rosa and the surrounding area. <https://www.pressdemocrat.com/news/10274262-181/time-to-say-goodbye-in>

I would consider staying in Sonoma County IF and only IF elected officials do more to recognize the increasing threat of climate change. However, this must be more than simply passing a Climate Emergency Resolution. Most jurisdictions in Sonoma County, including the Sonoma County Board of Supervisors, have now passed these resolutions. They have joined almost 1200 jurisdictions in 25 countries all over the world. However, to date, only the City of Petaluma has taken any concrete steps to truly address this crisis.

Climate Emergency Resolutions must include the implementation of policies such as REACH Codes to fight climate change. You can make a difference. We must collectively do more to prepare our cities for the future. This includes a commitment to clean energy in new construction.

At your last meeting, Council Members who were present voted unanimously in favor of the REACH code. I am currently in Idaho where I have also lived part time since the Tubbs Fire so I am unable to attend the meeting and speak in favor of this action. If I were there, I would attend your meeting and speak in favor of this REACH Code.

Thank you very much for carefully considering the passage of a REACH Code.

Sincerely,
Tyra Benoit
Retired Dean and History Instructor, Santa Rosa Junior College

Bliss, Sandi

From: Bronwen Arthur <bronwenarthur@gmail.com>
Sent: Tuesday, November 19, 2019 1:38 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] In support of Electric REACH Code ordinance

Dear Council members,

A friend encouraged me to write to you in support of your taking the initial step to approve the Electric REACH Code ordinance for new construction in Santa Rosa. It's a decision I've been thinking about and following, to the extent that I'm able, and I'd encourage you to vote 'yes' today in order to finalize this measure that takes direct action against the climate crisis.

It's a move that makes a lot of sense, given the lifespan of a home and the need for us to move quickly towards 100% renewable energy. Certainly the timing of the vote is unfortunate, when we've recently had several PSPS events and another one is looming. I can understand how some would feel an even stronger need to have the option of gas to heat water, the home, and to cook. And I can understand how some would feel like putting additional restrictions on building will slow home construction when we really need to speed it up. But when we look at where we need to get with our emissions, do we really have a choice but to do all we can? Hopefully taking this step will push us in the right direction, while opening us to other possibilities for weathering PSPS conditions that don't involve a reliance on gas.

Just know that, as a Santa Rosa resident, I'm supportive of making the difficult choices now that will put us on the right path for the future.

Thanks so much,
Bronwen Arthur
Santa Rosa, CA

Bliss, Sandi

From: Ben Granholm <ben@westernpga.org>
Sent: Tuesday, November 19, 2019 1:53 PM
To: Schwedhelm, Tom
Cc: [CityCouncilListPublic](#); Guhin, David; CMOOffice; McGlynn, Sean
Subject: [EXTERNAL] City of Santa Rosa Adoption of All-Electric Reach Code
Attachments: WPGA Letter RE Santa Rosa Reach Codes - 11.19.19.pdf

Good afternoon Mayor Schwedhelm,

I apologize for the delay in my response, but appreciate you getting back to me letting me know that you would not be able to meet prior to/or be in attendance at last week's City Council meeting.

As you know, last week the Council voted to adopt the All-Electric Reach Code portion of the proposed Building Code update. During the question and discussion period by the Council, a few comments were made that we would like to clarify/reinforce. Please see our attached letter detailing those remarks.

Due to the reasons outlined in our letter, we hope the Council will reconsider adopting the current version of the All-Electric Reach Code, remove propane from the definition of "All-Electric Building or Design," and help provide Santa Rosa residents with much needed energy resiliency and diversity.

Please do not hesitate to contact me with any questions you may have.

Thank you,

Ben Granholm
Regulatory Affairs Specialist
Western Propane Gas Association
2012 H Street, Suite 203
Sacramento, CA 95811
Cell: (530) 205-5641
www.westernpga.org

From: Schwedhelm, Tom <tschwendhelm@srcity.org>
Sent: Monday, November 11, 2019 3:06 PM
To: Ben Granholm <ben@westernpga.org>
Subject: RE: [EXTERNAL] Meeting to discuss Santa Rosa All-electric Reach Code

Hi Ben,

I'm sorry that I wasn't able to get back to you last week. As you're aware, the City was dealing with multiple PSPS events in addition to the Kincade Fire, so much of last week was spent reorganizing/prioritizing our schedules. Unfortunately, I won't be attending tomorrow's City Council meeting as I'll be traveling to a previously scheduled Homelessness Senior Leadership training. I'm disappointed that the rescheduling of the All-Electric Reach Code has fallen when I'm out of state. I appreciate the information you've provided.

Tom

Tom Schwedhelm | Mayor

Santa Rosa City Council

100 Santa Rosa Avenue | Santa Rosa, CA 95404

Ofc. (707) 543-3017 | Mobile (707) 326-4495

tschewedhelm@srcity.org

From: Ben Granholm <ben@westernpga.org>

Sent: Wednesday, November 6, 2019 1:10 PM

To: Schwedhelm, Tom <tschewedhelm@srcity.org>

Subject: [EXTERNAL] Meeting to discuss Santa Rosa All-electric Reach Code

Good afternoon Mayor Schwedhelm,

My name is Ben Granholm with the Western Propane Gas Association (WPGA), I also left you a voicemail earlier today. I am reaching out to see if it would be possible for myself and a couple of our members from Santa Rosa to meet with you prior to the first reading of the proposed All-Electric Reach Code at the Council meeting on Tuesday, November 12th.

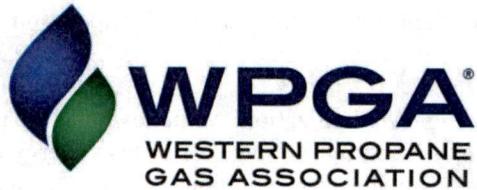
During your comments at the September 24th Study Session, both you and Councilmember Sawyer indicated that you'd like to hear more about the "All-Electric Favored" option and that you believe this may be more timely. If possible, we'd like to connect with you to see if more information on the "All-Electric favored" option has been released and share why we believe moving forward with the proposed "All-Electric" Reach Code is misguided.

I have also attached the letter WPGA submitted on 10/14 prior to the 10/22 Council meeting that was postponed.

If you have any questions, please do not hesitate to contact me. I hope we are able to connect to discuss this critical issue prior to the Council meeting next Tuesday.

Thank you,

Ben Granholm
Regulatory Affairs Specialist
Western Propane Gas Association
2012 H Street, Suite 203
Sacramento, CA 95811
Cell: (530) 205-5641
www.westernpga.org



November 19, 2019

Tom Schwedhelm, Mayor
City of Santa Rosa
Attn: Santa Rosa City Council
100 Santa Rosa Avenue
Santa Rosa, CA 95404
citycouncil@srcity.org

SUBMITTED VIA EMAIL

RE: City of Santa Rosa Adoption of All-Electric Reach Codes

Dear Mayor Schwedhelm:

Thank you for the opportunity to comment on the City of Santa Rosa's proposed All-Electric Reach Code aimed at reducing greenhouse gas emissions in the building sector. The Western Propane Gas Association (WPGA) seeks to be a valuable contributor in both the development of this code and the policies and procedures that may emerge as a result of these discussions.

During the November 12th City Council meeting, the Council and staff made a number of comments that we would like to clarify/reinforce:

1. It was falsely noted by one of the city's energy consultants that there are no homes in Santa Rosa that are built with plumbed in propane. We would like to inform the Council that Santa Rosa actually has roughly 800 propane users within city limits. While we understand that the Reach Code only impacts new homes, it is worth noting that a number of Santa Rosa residents currently rely on propane for their everyday needs and were able to heat their homes, cook and perform various other everyday tasks during the Public Safety Power Shut Offs, despite losing electricity.
2. Staff also noted that the City Council Climate Action Plan Subcommittee took a "Neutral" position on propane, recognizing that propane can still play a valuable role in the clean energy transition. Yet, still included propane in the definition of "All-Electric Building" or All-Electric Design" effectively disregarding the benefits that propane can provide, not just during the transition, but as a clean, non-methane, and low-cost fuel source.
3. WPGA is concerned that the cost analysis provided by staff and approved by the California Energy Commission does not take into account the cost to plumb a house with propane. Staff conceded during the hearing that the cost analysis is focused primarily on natural gas and did not provide figures comparing propane to electricity. As we mentioned in our comments last week, there is no significant cost differential between plumbing a house with propane and electricity, especially once you factor in the cost of fuel and much needed energy resiliency that consumers receive if allowed to build in propane plumbing.
4. Finally, 82 Santa Rosa residents have taken the time to submit letters to the Council in support of a smart, comprehensive, clean energy plan for Santa Rosa. With the sixth round of Public Safety Power Shut Offs in seven weeks slated to occur early tomorrow, it is vital that the Council provide alternate clean energy options to consumers when building new homes. During both of the recent fires in the Santa Rosa area, many propane users were either evacuated or in perilous proximity to the fires. The threat of losing a home and having to rebuild is of large concern to these residents and

we hope the Council takes their opinion into careful consideration before finalizing this All-Electric Reach Code.

While we applaud efforts for building decarbonization, we believe that the proposed All-Electric Reach Code is fundamentally misguided. The city is setting the stage for a clean energy desert, leaving many customers in the dark and/or saddled with a costly single energy solution. For the reasons stated above and many others, the Western Propane Gas Association asks that the Council and staff take a more holistic approach and recognize the need for energy resiliency and diversity in Santa Rosa and remove propane from the definition of "All-Electric Building" or All-Electric Design."

The Western Propane Gas Association appreciates your work in this area and looks forward to working with you as the City of Santa Rosa and State strive to reduce greenhouse gas emissions through comprehensive clean energy solutions.

Sincerely,



Ben Granholm
Regulatory Affairs Specialist

cc: Sean McGlynn, City Manager
David Guhin, Assistant City Manager/Community Development and Engagement

Bliss, Sandi

From: AudieAhn Haggard <audieahn@gmail.com>
Sent: Tuesday, November 19, 2019 2:01 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Natural Gas Ordinance - Oppose

Please note as a Santa Rosa registered voter I OPPOSE the ordinance banning natural gas in new construction.

Until such time as the California electrical grid is proven reliable, it is outrageous for so-called representatives to ban alternative sources of energy. Please acknowledge an educated and informed citizenry which is more than capable in determining which forms of energy it chooses to utilize.

In the meantime, how about that Joe Rodota Trail. Please apply your efforts to addressing actual concerns versus "solving" non-issues and creating additional hardship and costs for the long suffering citizens of this state.

Sincerely,

Audie A. Haggard

Audie Ahn Haggard
Santa Rosa Registered Voter

Bliss, Sandi

From: Dianne Monroe <dian nemonroe12@gmail.com>
Sent: Monday, November 18, 2019 1:49 PM
To: CityCouncilListPublic; Combs, Julie; Fleming, Victoria; Olivares, Ernesto; Rogers, Chris; Sawyer, John; Schwedhelm, Tom; Tibbetts, Jack
Subject: [EXTERNAL] Adopt Reach Codes

Dear City Council members,

I'm writing to urge you to adopt the Reach Code in regards to All Electric new building construction.

These comments are also for the public record.

There are many good reasons for adopting the Reach Code.

With 2 major fires in our area in the past 3 years, fueled in part by climate change, Santa Rosa is on the forefront of climate crisis. We have the opportunity and obligation to also be in the forefront of climate change mitigation. All Electric construction is one way to do so.

All Electric construction is better for the environment.

Methane, the main component of natural gas, is more than 80 times more potent a greenhouse gas than carbon dioxide.

All electric buildings are cheaper to build and maintain, making them ultimately cost effective.

All electric buildings are also safer and healthier. Gas is the leading cause of structure fires, burns, and carbon monoxide poisoning, and gas cooktops are potent sources of indoor air pollution.

Thank you for hearing my comments, and for taking action to mitigate our climate crisis through all electric buildings.

Dianne Monroe
95401

Bliss, Sandi

From: Teri Shore, Greenbelt Alliance <tshore@greenbelt.org>
Sent: Monday, November 18, 2019 5:47 PM
To: [_CityCouncilListPublic](#)
Subject: [EXTERNAL] Fwd: Support All-Electric Reach Code - Greenbelt Alliance
Attachments: AllElectricReachCodeGASupport11.19.19.pdf

Sent from my iPhone, sorry for typos or short responses.

Begin forwarded message:

From: Teri Shore <tshore@greenbelt.org>
Date: November 18, 2019 at 2:43:53 PM PST
To: CityCouncil@sonomacity.org, Tom Schwedhelm <tschewedhelm@srcity.org>
Cc: "Guhin, David" <dguhin@srcity.org>
Subject: Support All-Electric Reach Code - Greenbelt Alliance

November 19, 2019

Mayor Tom Schwedhelm and
City Council of Santa Rosa
City Hall
100 Santa Rosa Avenue
Santa Rosa, CA 95404

Via email

Re: Urgent - Support of All-Electric Reach Codes to Address Climate Change Emergency

Greenbelt Alliance is again writing in support of the proposed All-Electric Reach Code to ensure that the City of Santa Rosa can accelerate its path to a climate-healthy future. Bold steps forward on climate action are essential now. Public health and safety is more at risk than ever with the damaging and disruptive wildfires, power outages and evacuations we have been facing due to decades of climate inaction.

Greenbelt Alliance urges the City Council of Santa Rosa to take this first bold step and adopt a new all-electric building code beginning in 2020 to require new residential construction up to three stories to be independent of the natural gas network, eliminating gas hookups and appliances like gas-fueled stoves, water heaters and clothes dryers.

Taking this action will demonstrate the City of Santa Rosa's commitment to addressing the climate change emergency and creating a climate resilient community for the next generation. The way we grow now and into the future will determine how well we adapt to climate change and start to reduce generation of greenhouse gas emissions.

Adopting an all- electric Reach Code will leverage the city's initiatives to focus growth in the downtown and city center and providing more affordable housing close to jobs, services, schools and transit.

Here are a few facts to consider:

1. Natural gas is ~85% methane. Methane is a greenhouse gas with over 100 times the heat-trapping potential of CO₂. Continuing to build natural gas homes and associated infrastructure means we are going backwards on our climate goals.
2. Sonoma Clean Power, our public electricity supplier, indicates that building an all-electric home could actually be several thousand dollars cheaper, due to the ability to do without gas main extensions and connections.
3. Replacing gas appliances with electric appliances results in healthier indoor environments. We are required to install carbon monoxide (CO) detectors in all new residential construction due to the hazards associated with combustion appliances. Electric appliances do not carry similar hazards
4. Replacement Induction Cook-tops are great alternatives to natural gas and 90% of users say they like it better than cooking with gas.

Thank you for your consideration.

Sincerely yours,



Teri Shore, Regional Director, North Bay

--

Teri Shore
Regional Director, North Bay

Greenbelt Alliance
555 Fifth Street, Suite 300 A | Santa Rosa, CA 95401
1 (707) 575-3661 office | 1 (707) 934-7081 cell | tshore@greenbelt.org
greenbelt.org | [Facebook](#) | [Twitter](#)

Santa Rosa Office
555 Fifth Street, Suite 300 A
Santa Rosa, CA 95401
(707) 575-3661

November 19, 2019

Mayor Tom Schwedhelm and
City Council of Santa Rosa
City Hall
100 Santa Rosa Avenue
Santa Rosa, CA 95404

Via email

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Thank you for your consideration.

Sincerely yours,



Teri Shore, Regional Director, North Bay

Bliss, Sandi

From: Steve Bush <sbush@scds.org>
Sent: Monday, November 18, 2019 5:30 PM
To: [CityCouncilListPublic](#)
Subject: [EXTERNAL] All-electric reach code

Dear Member of the Santa Rosa City Council,

I want to strongly encourage you to move forward with the all-electric reach code. I have been a teacher in Santa Rosa for decades now and I am very concerned for the children. We must act to end the use of fossil fuels as fast as we possibly can. I just read the "Implications of Climate Change for the US Army," a report from the United States Army War College, and they are concerned that the military will not be able to deal with the effects of climate change occurring in just the next twenty years! We need to do anything and everything we can and the all-electric reach code would make a significant difference for our area.

Thank you,
Steve Bush

--
Steve Bush
Kindergarten Teacher
Sonoma Country Day School

"Actions express priorities," Mahatma Gandhi

From: christine hoex <choex@sbcglobal.net>
Sent: Monday, November 18, 2019 3:13 PM
To: [CityCouncilListPublic](#)
Subject: [EXTERNAL] All Electric Reach Code

Dear Santa Rosa City Council Members,

I am writing in support of the All Electric Reach Code that is to be voted on tomorrow's meeting.

There is detailed and itemized information to support this vote for All electric homes. I would, however like to address a more emotional aspect of this issue. I have found that people are nervous about this change because it appears at first to be taking away a service they rely on. Gas heat, gas stove cooking. And during the fires some relied on gas to heat water when the electricity was off. These people will not lose their gas heat for water, cooking or anything else. This needs to be clarified. Nothing is being taken away from already existing homes. What they are getting in the city of Santa Rosa is the very beginnings of a new infrastructure that will support a livable planet. We need your leadership to make this move, showing the way and educating the public on why this is important. You are all local leaders. In these times of rapid change we need local leaders like yourselves to LEAD on sometimes difficult issues. This All Electric Reach Code makes good sense. We need you to support this move away from fossil fuels and not be cowed by public anxiety.

I am including a list of facts compiled by Petaluma architect Pete Gang. Facts are important. Understanding and addressing people's concerns is also important and it's good leadership.

Thank you for your work,
Christine Hoex
350 Sonoma steering committee.

1. All of the current literature substantiates the fact that **all-electric new homes are less expensive to build than mixed-fuel homes**. The most significant cost savings result from the avoided costs of installing the underground gas piping (from the gas main to the gas meter) and the gas piping inside the home.

According to the [2019 Cost-effectiveness Study: Low Rise Residential New Construction, released by California Energy Codes and Standards](#), incremental cost savings for an all-electric new single-family home (compared to a mixed-fuel new home) are estimated to be \$6,171.

According to an April 2019 study funded by Southern California Edison, SMUD, and the LA Department of Water and Power titled [Residential Building Electrification in California](#), initial cost savings are estimated to be in the range of \$3,000 to \$10,000.

According to a September 2018 report prepared by TRC Solutions for the City of Palo Alto titled, "[City of Palo Alto 2019 Title 24 Energy Reach Code Cost Effectiveness Analysis DRAFT](#)," the **costs saved by not installing natural gas in residential new construction** — including plan review, street cut fee, connection charge to existing main, gas meter, gas piping within the residence, and the cost of appliances — total **\$6,314** (assuming iron piping).

2. [Applies in Sonoma County]: Even greater cost savings are available to fire survivors who choose to rebuild all-electric: the [Advanced Energy Rebuild program](#) (offered jointly by Sonoma Clean Power, PGE, and BAAQMD) offers financial incentives of up to \$17,500 per home.

3. Many builders conflate discussion of optional all-electric reach codes with discussion of mandatory changes in the upcoming 2019 CA Energy Codes (which take effect January 1, 2020). The 2019 Energy Codes will require installation of a PV system of sufficient size to provide for the electric needs of a mixed-fuel home (typically a ~2.5 kW system). Even though this added feature has been proven cost-effective over a 30-year timeframe, it is expected to add around \$10,000 to the cost of a new home (at approximately \$4 per watt).

4. Not only does all-electric construction result in reduced initial costs, homeowners will see reduced ongoing utility costs due to efficiencies of 300% or more that are typical of electric heat-pump technologies used for heating/cooling and water heating. In contrast, gas appliances have a theoretical maximum efficiency of only 100%.

5. Builders also mention that their customers don't like cooking on electric stoves. They are thinking of the old radiant coil electric cooktops. Few of these customers are familiar with electric induction cooktops, which are the new standard. Sacramento Municipal Utility District (SMUD) reports that 91% of people who try cooking on an electric induction cooktop, prefer it over gas.

6. Replacing gas appliances with electric appliances results in healthier indoor environments. We are required to install carbon monoxide (CO) detectors in all new residential construction due to the hazards associated with combustion byproducts. Electric appliances do not carry similar hazards.

7. The California Energy Commission acknowledges that we are moving inexorably toward all-electric buildings and away from using natural gas.

8. PGE acknowledges that we are moving inexorably toward all-electric buildings and away from using natural gas. In a letter dated August 21, 2019 to Windsor Town Manager Ken McNab, PGE Vice President Robert S. Kenney states, ***"PG&E welcomes the opportunity to avoid investments in new gas assets that might later prove underutilized as local governments and the state work together to realize long-term decarbonization objectives. With all this in mind, PG&E supports local government policies that promote all-electric new construction when cost effective."***

9. When builders attempt to compare the greenhouse gas emissions of gas appliances with those of electric appliances, they typically limit their discussion to CO2 emissions and neglect to mention emissions of CH4, or methane, which comprises ~85% of natural gas. We now understand that **methane is a relatively short-lived greenhouse gas with over 100 times the heat-trapping potential of CO2 on an annual basis.** Fugitive emissions of methane occur at all points in the production, distribution, and storage of natural gas and are currently conservatively estimated to be around 3% of production.

10. 90% of the natural gas used in California is imported from out of state and obtained through hydraulic fracturing, or fracking. It is now widely understood that fracking is associated with a long list of catastrophic consequences, including aquifer depletion, aquifer contamination, destruction of landscapes, air pollution, and widespread physical and mental health consequences.

11. Builders sometimes suggest that instead of working to reduce or eliminate the use of natural gas in buildings we should work on reducing emissions from the transportation sector. It's not an "either-or." We need to do **all of the above.**

12. Builders sometimes bemoan the fact that these proposed changes are happening so fast. The reason that we are calling it a climate emergency is because **it is an emergency.** One responds to an emergency with appropriate alacrity.

Thank you for your vision and your courage!

Bliss, Sandi

From: Debbie Haworth <debbihaworth@gmail.com>
Sent: Monday, November 18, 2019 5:17 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Eliminating Gas in new homes in Santa Rosa

I am writing to voice my concerns regarding the recent vote on no gas in newer homes. As a resident of Santa Rosa I feel this should be a vote for the entire community not just for the city council to decide.

I have always preferred gas appliances over electric because they are cheaper to run and you can still use your stove top if the power goes out. With the recent changes in the PG&E shut offs, the gas appliances have been a god send, we still have a stove top to cook on and hot showers.

Please reconsider this decision and/or open it up to let the residents decide what they want to do, after all we live here too.

Thank you,

Debbie Haworth

Bliss, Sandi

From: Jeff Rooney <jrooneymt@gmail.com>
Sent: Monday, November 18, 2019 8:55 PM.
To: Combs, Julie; Fleming, Victoria; Olivares, Ernesto; Rogers, Chris; Sawyer, John; tschwehelm@srcity.org; Tibbetts, Jack; _CityCouncilListPublic
Subject: [EXTERNAL] Public Comment on "Reach-Code" deliberations

Dear Council,

I send this note as my public comment on the section of your Tuesday meeting regarding Reach Code as I cannot attend the meeting.

Like so many of us I am grappling with what is upon us now, one disaster after another with a growing recognition that climate change is a euphemism for climate catastrophe. We are in it deep.

So what do we do to address the fever that Mother Nature has? Do we engage in wishful thinking that it will pass or do we see it as urgent thing to cool down.

Clinging to infrastructure and building models that got us here is business as usual to my mind. As I understand it the ideas of adopting "reach codes" that specify a clear shift to all electric buildings is a start in that direction. I feel at this point every opportunity to shift gears in the non fossil fuel direction is urgent. In fact, I feel every town, city and country should adopt the language that we are in a climate change emergency and make policy changes reflect that.

I know it won't be easy for myself or anyone else to power down away from how petroleum has lubricated the gears of our societies. But here we are.

For further reference I quote from another piece on the subject of reach codes that I feel is relevant to your deliberations:

An all-electric Reach Code has MANY advantages:

- **Easier.** All-electric code can be contained in a few as two pages, avoids complex compliance or EDR margins complications and extra design time, is easier and faster for building and planning staff to apply, and is easier for builders, contractors, installers, architects, developers, and consumers to understand. All-electric buildings are also generally faster to design, permit, and build, and gives everyone a level playing field.
- **Future Proof.** All-electric code today prevents a complex, costly switch to electricity in the future, when the price of gas goes up, due to diminishing demand, and when regulations beyond the city level will dictate it. PG&E has asked for a 24% gas rate increase and So Cal Gas, a 42% increase, over the next couple years, and this is just the beginning. Do not strand your buildings with expensive and outmoded gas infrastructure.
- **Cheaper.** All-electric are cheaper to build, usually \$6,000-8,000 for a single family home, and cheaper for occupants to maintain and operate, saving the typical residential customer money on their utility bills due to the remarkable efficiency of modern electrical appliances.
- **Healthier and Safer.** All-electric buildings are healthier and safer for occupants. Gas is the leading cause of structure fires, burns, and carbon monoxide poisoning, and gas cooktops are potent sources of indoor air pollution. Cooking on a gas cooktop releases fine particulate matter, smog-like compounds, and formaldehyde, and is known to exacerbate asthma.

I thank you all for your deliberations and trust you will weigh my words and all others on this matter. How we move forward from here on will serve the health and well being of our youngest among us and the very planet whose embrace on which we depend.

Warmly,

Jeff Rooney
Santa Rosa resident
(707)480-6678

Bliss, Sandi

From: Sunny Galbraith <galbraithsunny@gmail.com>
Sent: Tuesday, November 19, 2019 7:15 AM
To: CityCouncilListPublic
Subject: [EXTERNAL] Please vote yes to finalize electric REACH code tonight

Dear Council members,

Thank you so much for taking the first step to approve the Electric REACH code ordinance for new construction. I urge you to vote yes at tonight's meeting in order to finalize this measure. Banning natural gas in new home construction is a powerful direct action to address the climate crisis. I am working to have my city, Sebastopol, pass the same electric REACH code as well, and deeply appreciate the Santa Rosa Council's leadership on this issue.

Sincerely,
Sunny Galbraith
350 Sonoma

Bliss, Sandi

From: mark cownie <theoldstoveguy@hotmail.com>
Sent: Tuesday, November 19, 2019 7:15 AM
To: CityCouncilListPublic
Subject: [EXTERNAL] gas appliance ban

I am an appliance technician and gas appliances are better than electric for longevity and repairs. Also I have seen more fires in clothes dryers that are electric than gas. When PG&E shuts off the power there is still a usable gas stove top, hot water. During the power outages my customers were able to use their stoves (with instructions) and still make do. If everyone buys a GASOLINE generator to power their household appliances won't it defeat the purpose?

Bliss, Sandi

From: V Jacobi <vjacobi@sonic.net>
Sent: Tuesday, November 19, 2019 5:40 AM
To: [CityCouncilListPublic](#); Schwedhelm, Tom; Rogers, Chris; Combs, Julie; Fleming, Victoria; Olivares, Ernesto; Sawyer, John; Tibbets, Jack
Subject: [EXTERNAL] Re: Please Support the All Electric Reach Code ASAP

Dear Mayor Schwedhelm and Members of the City Council,

Again, please SUPPORT the All Electric Reach Code! If you need me to repeat the very important reasons why this will help get us going in a better direction please let me know. CLIMATE SOLUTIONS ARE URGENTLY IMPORTANT. Thanks.

--
Warmly,
Roni
Veronica "Roni" Jacobi

www.OurGreenChallenge.org

"Climate Change is not just another issue in this complicated world of proliferating issues. It is the issue that, unchecked, will swamp all other issues."
- Ross Gelbspan in *The Heat Is On*

On 2019-09-23 23:02, V Jacobi wrote:

Dear Mayor Schwedhelm and Members of the City Council,

I'll be brief, it is an emergency!

The long term impact of installing natural gas infrastructure now, which is ~85% methane (a greenhouse gas with over 100 times the heat-trapping potential of CO₂), is REINFORCING a PATH in the WRONG DIRECTION, TOWARDS MORE CLIMATE SUFFERING.

The world is watching, and so am I. Please make us proud, rather than sad, angry etc.

Please support an all-electric reach code.

--
Sincerely and Warmly (in numerous ways),
Roni

www.OurGreenChallenge.org

"Climate Change is not just another issue in this complicated world of proliferating issues. It is the issue that, unchecked, will swamp all other issues."
- Ross Gelbspan in *The Heat Is On*

Bliss, Sandi

From: franger1@aol.com
Sent: Tuesday, November 19, 2019 7:19 AM
To: CityCouncilListPublic
Subject: [EXTERNAL] Gas availability

Banning gas use in homes is ridiculous.

I see this as a political power play by city government to force residents to Sonoma Clean Power which is nothing more than another useless bureaucracy. All of the power consumed in the city is generated at The Geysers and is as green as possible.

Sent from AOL Mobile Mail
Get the new AOL app: mail.mobile.aol.com

Bliss, Sandi

From: Terri Moon <moon900@sonic.net>
Sent: Monday, November 18, 2019 11:50 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] All electric REACH code

Dear City Council Members,

I'm writing to encourage you to adopt the proposed all-electric reach code in Sonoma County. I also request that you include my comments below in the public record.

I'm a community member who enjoys cooking and have always preferred using gas stoves to electric ones. Yet given our current Climate Crises, I believe it is time to stop doing business as usual and I'm content to adopt electric stoves for cooking for this reason. It is a sacrifice that will protect all community members from gas leaks and explosions in an emergency situation such as a wildfire or earthquake. In addition, the new electric cooktop stoves are easier to clean and I don't mind cooking on them as I did with the coil-type electric stoves because the heat stops when I turn them off and starts when I turn them on (I don't need to wait for the coils to heat up or cool off)-which was why I had preferred gas. In addition, I find I'm less likely to burn myself with the new electric stoves since they don't actually get hot to the touch, so they are personally safer to use.

I'm content to make the transition to all electric because it is time to transition from fossil fuels to solar power and other green sources of energy. This transition will create new jobs that are safer, protect our community's air, soil, water, and other community resources and support health and well-being in ways that fossil fuels simply cannot do. I also hope that making the change now might prevent species from going extinct, including humans.

Even power shutoffs (which it seems will be happening more frequently in the future, in order to protect us from wildfires and record-high wind speeds) will be less disruptive if we transition now to solar and wind because they don't create sparks like the well-worn and vulnerable current fossil fuel based system does. It is time to meet all of our energy needs with more sustainable and renewable energy, which will also create more safety within our community. This week you have the opportunity to initiate the first step in the process of transitioning to green energy by adopting the all-electric REACH code ordinance.

I had planned to attend the City Council Meeting tomorrow night, specifically to speak to each of you about my support for the all-electric REACH code ordinance. Sadly, I have a doctors appointment at 6:45 pm in Petaluma and since I have no idea how long it will take to complete the appointment, I thought I'd let you know via email, in case I don't make it in person.

With gratitude for your consideration and support of our transition to renewable and sustainable energy sources, Terri Moon.

Terri Moon, MS, Harmony at Home

Mediation, Empathy & Heart-Based Communication (NVC) Training www.TerriMoon.com, 707-709-8574 (home/office), 707-591-1872 (cell/text)

Bliss, Sandi

From: June Brashares <june.brashares@gmail.com>
Sent: Monday, November 18, 2019 10:58 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] Nov. 19 Agenda Item: All-Electric Reach Code and Affordable Housing Developers
Attachments: 3 Joanna Ladd - Chinatown CDC DoE.pdf

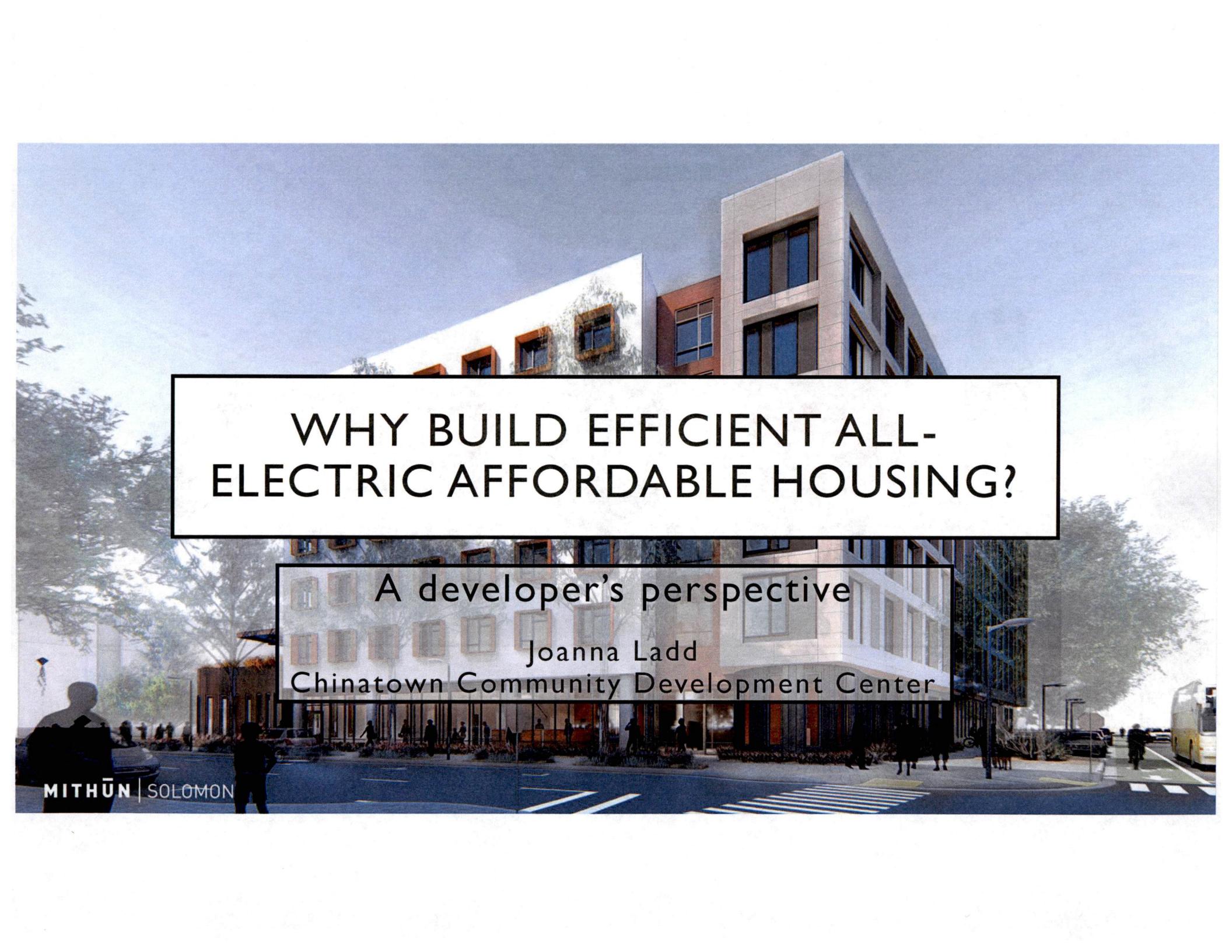
Dear Santa Rosa City Councilmembers,

I am emailing you regarding the All-Electric Reach Code item on your Meeting Agenda for Tuesday, November 19th.

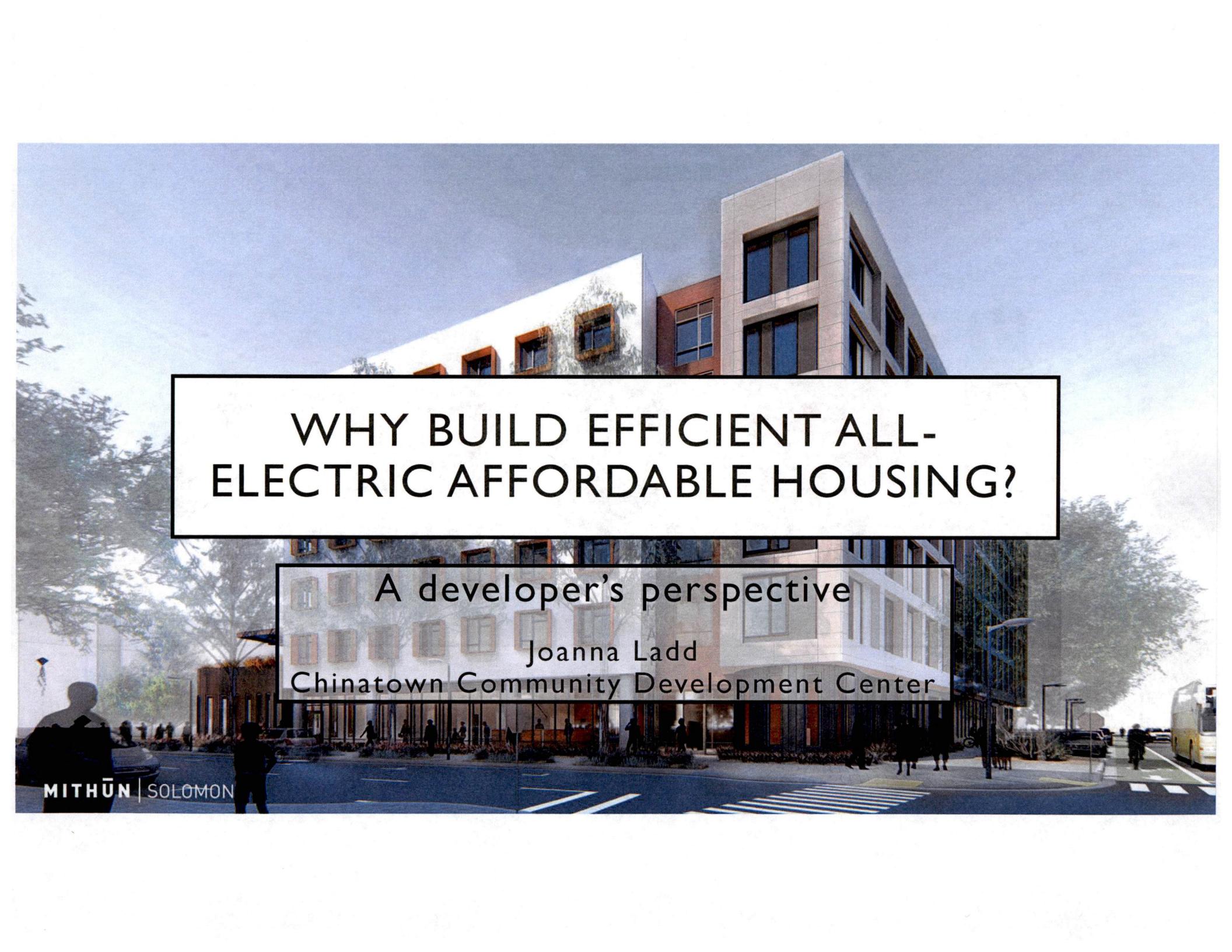
On the [webinar](#) "Policy & Program Design for Building Electrification: Centering Advocacy on Equity and Inclusion", expert Richard Chien, Senior Program Specialist at San Francisco Department of the Environment, makes the point that affordable housing developers in San Francisco are willingly leading the way to building all-electric housing. The affordable developers are motivated to build all-electric to meet their resilience goals, meet health goals, and reduce the cost of new construction. I contacted Richard Chien who amiably provided me additional information including the attached slides from Joanna Ladd, owner of Chinatown Community Development Center. The slides convey some of the progression, reasons why, and how, affordable housing developers are embracing the benefits of building all-electric.

Knowing that the development of affordable housing is a topic of great importance to you, I wanted you to have this encouraging information. There are many additional examples of current affordable housing projects with all-electric systems in San Francisco, including: Casa Adelante Housing (2060 Folsom), Maceo May Veterans Apts (Treasure Island), Balboa Upper Yard (Outer Mission), Blocks 52 & 54 (Hunter Point Shipyard) and Florida Family Apartments (Mission neighborhood).

Thank you for your consideration,
June Brashares



WHY BUILD EFFICIENT ALL-ELECTRIC AFFORDABLE HOUSING?

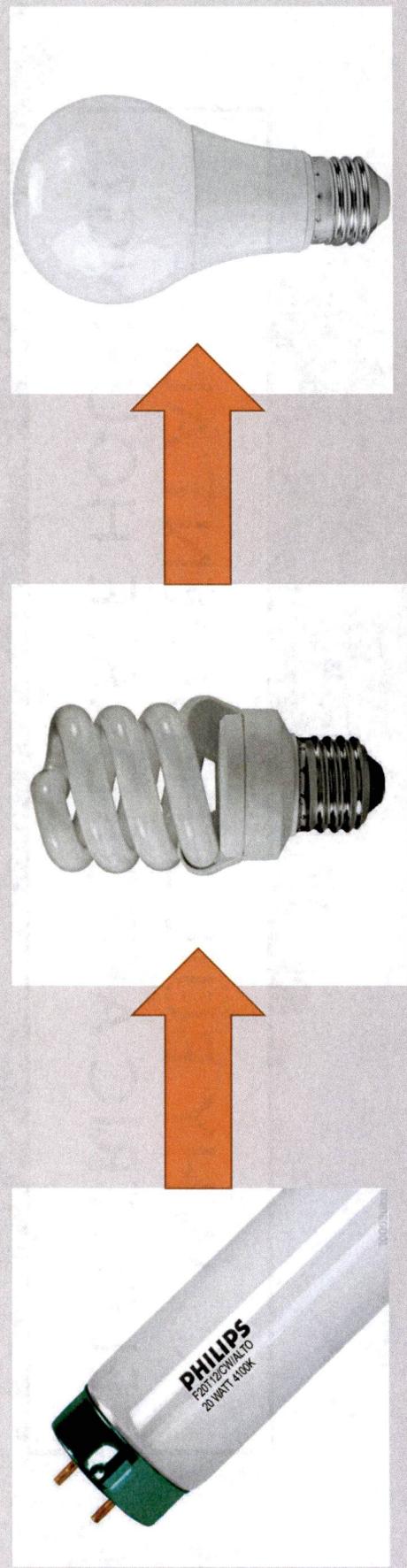


A developer's perspective

Joanna Ladd
Chinatown Community Development Center

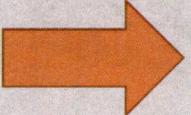
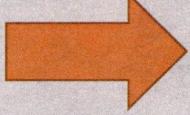
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CHANGES IN GREEN BUILDING SINCE ~2010

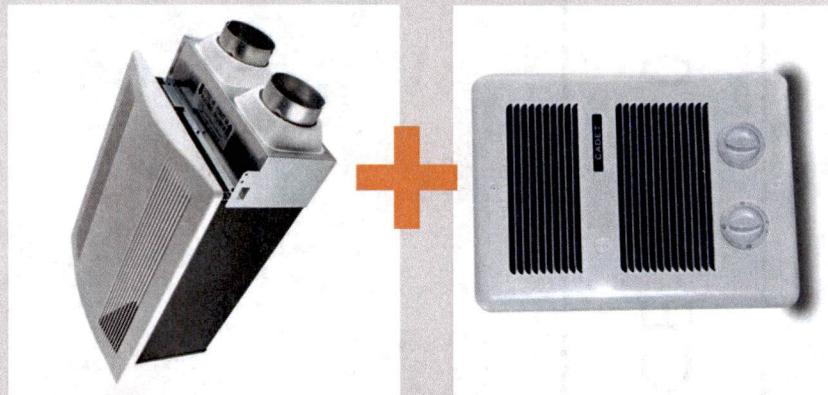


CHANGES IN GREEN BUILDING SINCE ~2010

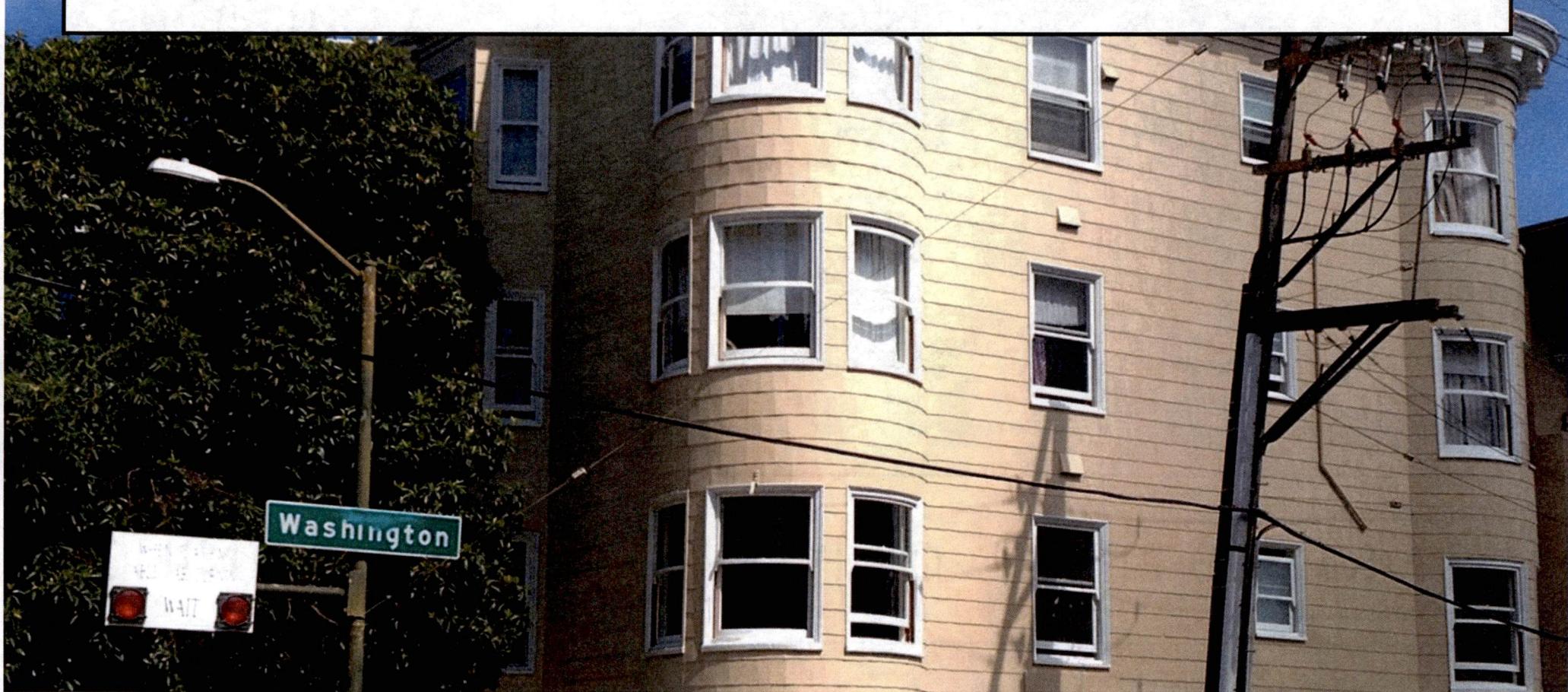


3+ gpf  **1.3 gpf**  **0.8 gpf**

CHANGES IN GREEN BUILDING SINCE ~2010



CHINATOWN CDC'S PATH TO GREEN BUILDING



CHINATOWN CDC'S PATH TO GREEN BUILDING

Successes

- Benchmarking
- Visible capital improvements
- Resident engagement
- Interdepartmental collaboration



CHINATOWN CDC'S PATH TO GREEN BUILDING



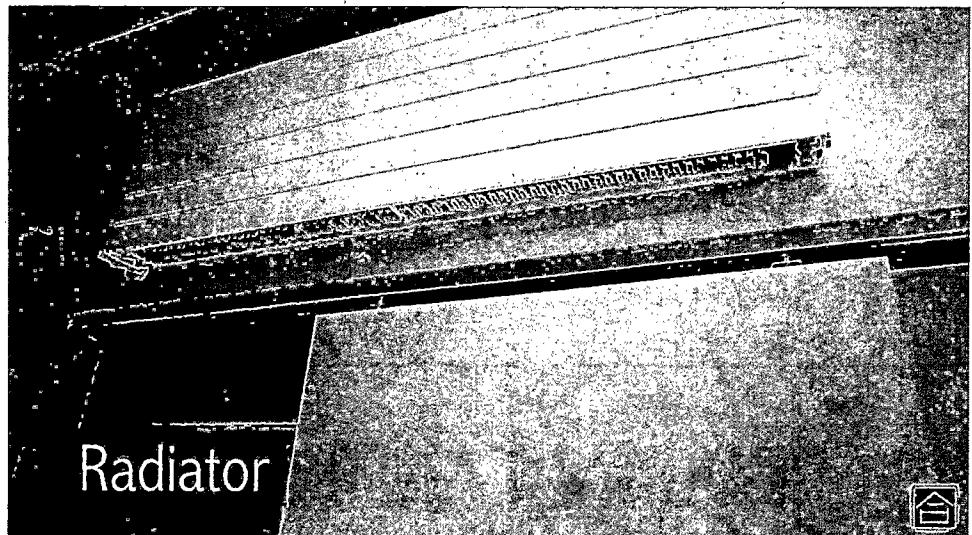
Challenges

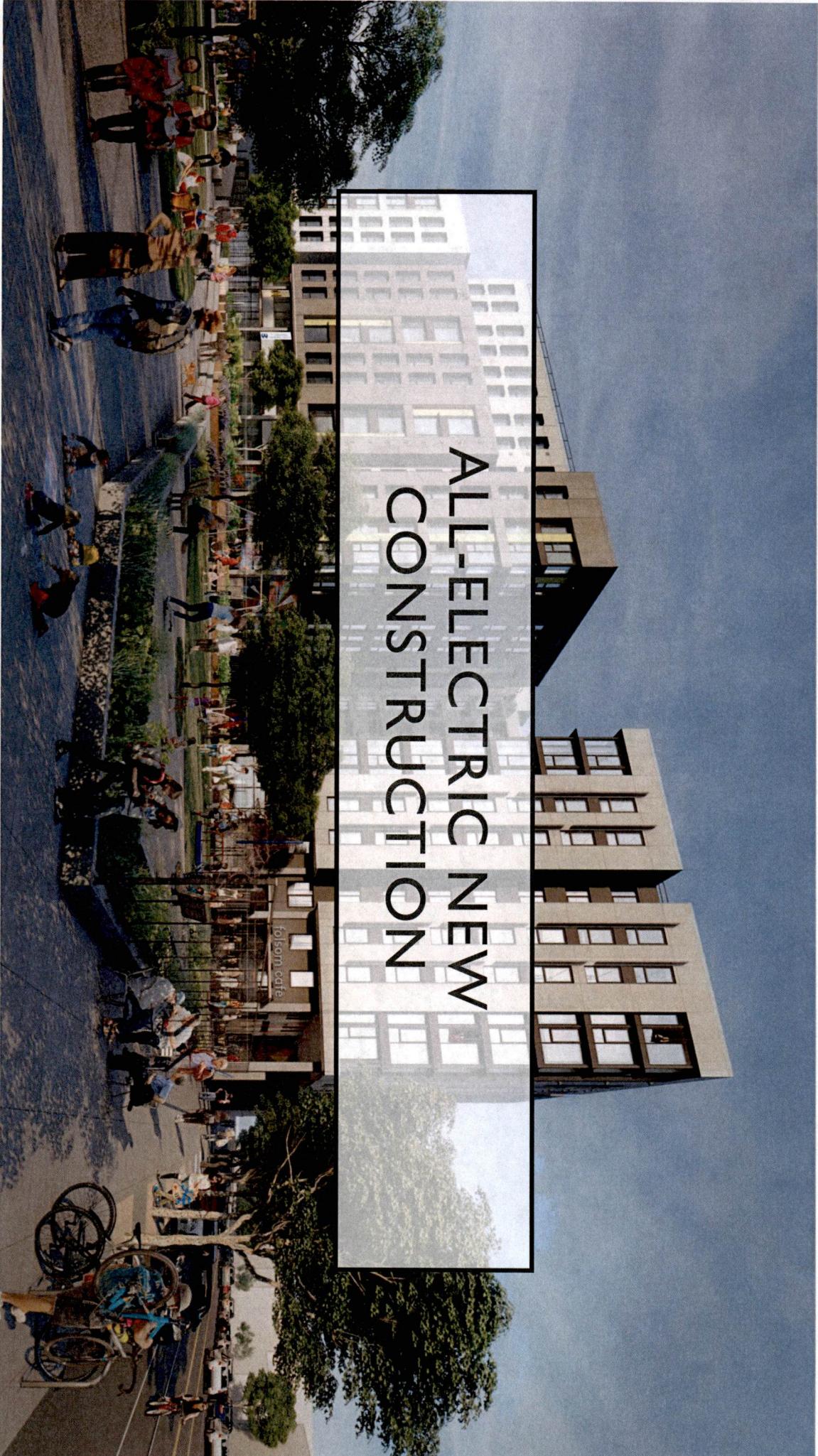
- Pace of change
- Variety of systems
- Few maintenance vendors
- Competitive market for maintenance staff

CHINATOWN CDC'S PATH TO GREEN BUILDING

Challenges – Hydronic Heat

- Up-front capital cost
- Commissioning
- System complexity
- Potential for leaks
- Noisy – even when off
- Slow to heat the room





ALL-ELECTRIC NEW CONSTRUCTION

DESIGN PRINCIPLES FOR 2060 FOLSOM & MACEO MAY APARTMENTS

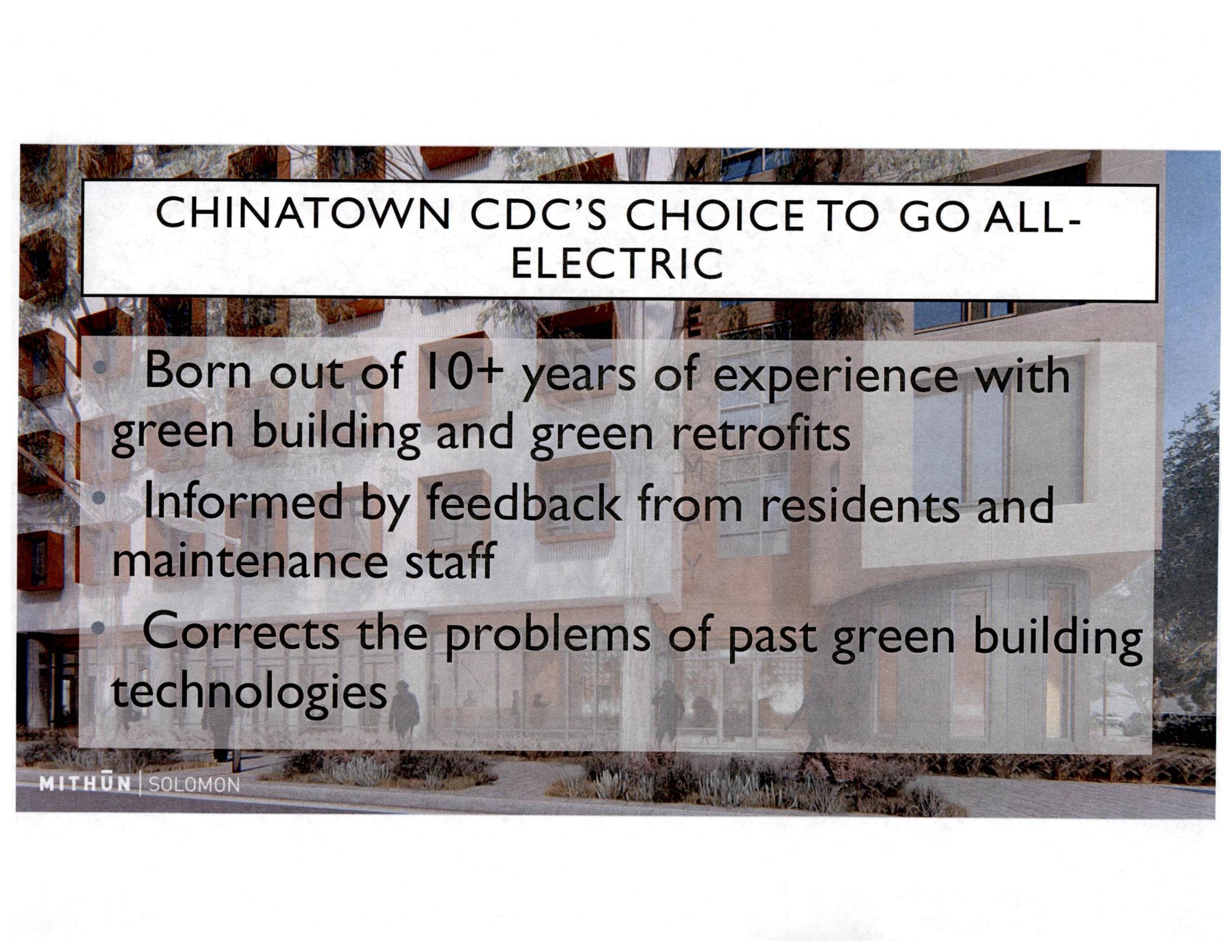
- 1. High standards for energy efficiency**
- 2. Up-front capital cost**
- 3. Long-term operating cost**
- 4. System simplicity & ease of maintenance**
- 5. Be conscious of resident/user experience**

ALL-ELECTRIC BUILDINGS – BENEFITS FOR DEVELOPERS

1. Energy efficiency: better than code
2. Up-front cost: neutral
3. Long-term cost: built-in future-proofing
4. System simplicity:
 - No concerns with envelope & electric heat
 - Mitigated concerns about ERVs & electric heat pump DHW
5. Resident experience: electric heat + better indoor air quality

ALL-ELECTRIC BUILDINGS – BONUS BENEFITS!

- Single energy provider
- Disaster resilience
- Adaptability:
 - Net-zero energy ready
 - Can add batteries for time-of-use pricing



CHINATOWN CDC'S CHOICE TO GO ALL-ELECTRIC

- Born out of 10+ years of experience with green building and green retrofits
- Informed by feedback from residents and maintenance staff
- Corrects the problems of past green building technologies



CONTACT

Joanna Ladd
Senior Project Manager &
Development Strategist
Chinatown CDC
jladd@chinatowncdc.org

Bliss, Sandi

From: Randy Rued <mailmandolin@gmail.com>
Sent: Monday, November 18, 2019 7:05 PM
To: CityCouncilListPublic
Subject: [EXTERNAL] No gas?

No way! I would have had cold meals and cold showers when the electricity was out.

Do not have only electric appliances.

Randy Rued
129 Coronado Cir, Santa Rosa, Ca 95409

Thanks,
Randy Rued
Claire Rued

Bliss, Sandi

From: Susan Rose <susanrose@sonic.net>
Sent: Tuesday, November 19, 2019 8:32 AM
To: CityCouncilListPublic
Subject: [EXTERNAL] Vote on Ban on Gas Appliances in New Construction

To Santa Rosa City Council Members,

I am writing to encourage you to vote NO on this issue. Although I'm sure you have heard all my reasons from MANY others, I will reiterate them here:

1. An issue this far reaching should be decided by the people (i.e a vote) and not by just 6 people.
2. In light of the current PG&E issues, taking gas off the table is very short-sighted.
3. The impact to the environment by using electric only is minimal and frankly not worth the cost.

Thank you for your consideration,

Susan Rose

Santa Rosa Resident

Bliss, Sandi

15.2

From: M. Alima Silverman <alimas@sbcglobal.net>
Sent: Tuesday, November 19, 2019 10:45 AM
To: CityCouncilListPublic
Subject: [EXTERNAL] All Electric Reach Code for New Housing

Honorable Mayor and Council Members,

Although the All Electric Reach code for New Housing is optional for jurisdictions to adopt, it is a critical part of your agenda to address climate change and to meet your greenhouse gas emissions reductions commitments. I strongly urge you to adopt the Reach code and thereby become one of the leading communities in the Bay Area.

Alima Silverman, Architect LEED AP
Santa Rosa, California

Bliss, Sandi

15.2

From: Karen Wigylus <karen.wigylus@msrlegal.com>
Sent: Tuesday, November 19, 2019 10:53 AM
To: City Clerk
Cc: Matt Henderson
Subject: [EXTERNAL] Confirmation of letter and attachments to City Council, City of Santa Rosa for 11/19/19 City Council Meeting

Good morning Dina,

This will confirm our telephone conversation of your receipt this morning of Miller Starr Regalia's letter and 22 attachments which will be printed out for counsel and put on the public record for today's City Council meeting – agenda item 15.2. Again, please do not hesitate to contact us if you have any further questions.

Thank you and kindest regards, Karen.

Karen Wigylus | Miller Starr Regalia

Legal Assistant to Arthur F. Coon / David E. Harris / Matthew C. Henderson / Brian D. Shaffer
1331 N. California Boulevard, Fifth Floor, Walnut Creek, CA 94596
t: 925.935.9400 | d: 925.941.3273 | f: 925.933.4126 | karen.wigylus@msrlegal.com | www.msrlegal.com



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matthew.henderson@msrlegal.com

November 19, 2019

Via Email and Hand Delivery

City Council
City of Santa Rosa
City Hall
100 Santa Rosa Ave.
Santa Rosa, CA 95404
Email: citycouncil@srcity.org

Re: City of Santa Rosa Proposed Adoption of All-Electric Residential Reach Code (November 19, 2019 City Council Meeting Agenda Item No. 15.2)

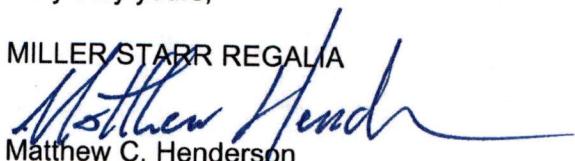
Dear Mayor Schwedhelm, Vice Mayor Rogers, and City Councilmembers:

As you are aware, this firm represents William Gallaher in conjunction with the above-referenced matter. As we have expressed in the past, our client is extremely concerned with the potentially adverse planning, and environmental and health and safety effects that may occur from adoption and implementation of the All Electric Reach Code/Natural Gas Ban ("Reach Code") currently being considered for adoption as a local ordinance by the City of Santa Rosa ("City").

In spite of my prior correspondence on this issue I did not receive notice that the City was holding a second reading of the Reach Code ordinance today. I also do not see any of the comments we previously provided in the staff report for the ordinance. Accordingly, I am enclosing herewith my prior correspondence on the Reach Code, as well as recent articles relating to both past and potential future PG&E shutdowns which have directly impacted the City and its residents. I request that my correspondence and attachments be included in the administrative record of the City's proceedings.

Very truly yours,

MILLER STARR REGALIA


Matthew C. Henderson

MCH:klw/ encls.

cc: Sean McGlynn (w/encls.; CMOffice@srcity.org)
Sue A. Gallagher, Esq. (w/encls.; via fax, 707-543-3055)
Dina Manis (w/encls.; CityClerk@srcity.org, dmanis@srcity.org)
Arthur F. Coon, Esq.

GLLR\56389\2189947.1

Offices: Walnut Creek / San Francisco / Newport Beach

500,000 in California Are Without Electricity in Planned Shutdown

Pacific Gas & Electric is cutting electricity as a precaution against sparking wildfires in high-wind conditions.



By Thomas Fuller

Published Oct. 9, 2019 Updated Oct. 10, 2019



A hardware store in Piedmont, Calif., on Tuesday, ahead of a planned power shut-off by the state's largest utility.
Jim Wilson/The New York Times

CALIFORNIA BLACKOUTS *Read the latest on the PG&E power outage.*

SAN FRANCISCO — A deliberate power outage that spanned large parts of Northern California on Wednesday sent hundreds of thousands of people scrambling for gasoline and other essentials as strong, gusty winds and months of dry weather put the state on alert for wildfires.

The state's largest power utility, Pacific Gas & Electric, said it had cut power to 500,000 customers soon after midnight. A second round of cuts affecting 250,000 more customers in the hills surrounding the San Francisco Bay Area had been scheduled for noon but was delayed.

"It's all dependent on weather conditions," said Jeff Smith, a spokesman for the company. Mr. Smith could not give a new time for the next round of blackouts, though a Police Department in the East Bay of San Francisco said the new power shut-off time was 8 p.m.

While PG&E said that hundreds of thousands of customers would lose power, an entire apartment building can be considered a single customer. Once the two phases are complete, around 2.5 million people will be without electricity, according to one estimate.

The power company described Wednesday's cuts as a precaution, hoping to prevent its electrical equipment and power lines from sparking blazes in dangerous conditions.

[Sign up for our daily newsletter about news from California [here](#).]

These are not your average California winds.

Meteorologists compared the winds forecast for Wednesday to those that propelled fires through wine country two years ago.

Hannah Chandler-Cooley, a meteorologist in the National Weather Service's Sacramento office, said a strong weather system moving through the Great Basin was causing the high winds across Northern California.

"Northerly winds first and foremost really dry out the area," she said, a risky combination with grasses and vegetation in the summer and fall, when there has not been much rain.

Ms. Chandler-Cooley said the region rarely gets north winds, which blow for only a few days just a few times a year, and can cause trees to topple or limbs to fall — often on power lines. Adding to her concern are forecasts of "pretty extreme winds," with sustained speeds of 20 to 30 miles per hour and gusts at 35 to 45 miles per hour or higher in some areas, like mountain canyons.

While the power outage may help prevent sparks, she urged residents to practice fire safety, recalling that several wildfires last year were caused not by downed power lines but by human activity. The Carr fire spread after sparks from the wheel rim of a car fell on dry grass.

The utility is trying to avoid a repeat of the deadly fires that have ravaged the state.

The company has been found responsible for dozens of wildfires in recent years, including the state's deadliest, an inferno in and around the town of Paradise last November that killed 86 people.

Over the summer the utility turned off power to less-populated areas in Northern California, but this shut-off is by far the company's most extensive, affecting large parts of the San Francisco Bay Area.

More than half of all counties in California — 34 out of 58 — are expected to be affected by the power cut, according to PG&E, one of the country's largest utilities.

The outages have upended daily life for many in the Bay Area.

Officials in Santa Rosa, about 50 miles north of San Francisco, said they had responded to multiple traffic collisions, including five with injuries, at intersections without power. "Please slow down and treat all intersections without power as a four-way stop," city officials said on Twitter.

[In NYT Parenting: Mothers band together to save breast milk during the outage.]

For residents in assisted-care homes or dependent on medical equipment in their own homes, the power cutoffs added to their daily challenges and stoked the worries of family members.

"My father is in a nursing home in Santa Rosa working on backup power," Daisy Pistey-Lyhone of Santa Rosa said. A sister with a disability, who lives in a nearby apartment complex, still had power on Wednesday, but Ms. Pistey-Lyhone was busy trying to make contingency plans.

In Oakland, Stacey Milbern, who uses a ventilator for breathing and needs other medical devices, spent more than two hours on Tuesday afternoon calling PG&E to try to find out whether her home would lose power and whether she would get additional assistance.

She learned that her home did fall in an area affected by the outage. But she still had her power on Wednesday afternoon. "Honestly, I have so much privilege. I work full-time from home," she said. "But for the everyday disabled person, it's so scary."

As of late Wednesday afternoon, PG&E spokesman Jeff Smith could not confirm whether any Bay area hospitals would lose power during the second phase of planned shut-offs, which are expected to take place Wednesday evening.

"There may be some hospitals that are in the footprint, but we won't know for sure," Mr. Smith said. "We're working extensively with locations like hospitals to ensure that they have an emergency plan."

Turning the power back on could take as long as five days.

PG&E anticipates that it will begin turning power back on starting Thursday, when winds subside.

But re-energizing power lines is a tricky process, even after the winds subside. Sumeet Singh, a PG&E vice president, said in a briefing Tuesday night that technicians will need to inspect "every inch" of line before restoring power. That could take as long as five days, he said.

PG&E's website was down for many people, right when they needed it.

On Wednesday morning, Pacific Gas & Electric customers across Northern California said they were frustrated by difficulties getting information about blackouts and when power might be restored. Many blamed the utility for cutting power before they believed it was really necessary.

"There hasn't been even the slightest bit of wind in the entire county," Candace Bennyi, whose power was cut in Sonoma County, wrote in an email:

"One would have expected PG&E to at least wait to see if there was actually going to be an event that warranted such a move."

The utility's website was working only intermittently — something Ms. Bennyi mentioned, too.

In Santa Rosa, Ms. Pistey-Lyhne woke up without power in her home, which she said was at the edge of where the power cutoff had been planned in her neighborhood.

Though Ms. Pistey-Lyhne made preparations for the blackout, she expressed concern that many others in the region were left unaware. She said that she had found out only on Tuesday afternoon that the power would be shut off overnight.

"I don't think PG&E did a great job," she said, despite the local government's work on improving emergency preparedness and communications. "It was less than 12 hours' notice."

Residents have been stocking up on generators and water.

Shoppers emptied supermarket shelves of batteries, water and other essentials, with many hitting the stores on Tuesday night and early Wednesday while power was still on.

In the small beach town of Montara, just down Route 1 from San Francisco, Heidi Kay and her partner, Steve Christie, took an inventory on Wednesday of their few supplies, which amounted to little more than granola bars, oatmeal and fruit, said Mr. Christie, 49. "We haven't really stocked up on anything," he said.

Ms. Kay, 39, had driven to the nearby town of San Bruno to buy a few groceries after finding the Target near her office had been practically stripped bare.

The hardware store was also "out of everything," she said, so Montara residents were taking matters into their own hands on the neighborhood social app Nextdoor.

"Everyone on there is in search of a generator," she said. "It's mad chaos."

Over the summer, stores in Northern California reported higher-than-usual sales of gasoline generators. For those who missed out, PG&E established around 30 facilities stocked with bottled water and outlets to charge electronic devices.

Lines at gas stations were 20 cars deep on Tuesday night, reported Gary Bowman of Grass Valley in the Sierra Foothills area midway between Sacramento and Reno, Nev. But on Wednesday morning, as he and his wife searched for a restaurant to have breakfast in, he found the area "deader as a doornail."

Mr. Bowman, a recently retired schools superintendent who also spent 10 years as a wildland firefighter, said he would spend the day working on his two-acre property, where he tames the undergrowth to help keep fires at bay.

"We've had power outages in the deep winter when the cold and darkness are issues," he said, "so to get something like this in October, when it's 70s and sunny, is not so bad."

Mass transit is running, but many schools are canceling classes.

The main mass transit systems serving the San Francisco Bay Area — BART and Caltrain — said they would maintain service.

A number of schools in San Jose and Oakland said they would close for as long as there was no power. The University of California, Berkeley, canceled classes on Wednesday.

The East Bay Municipal Utility District, a water utility, said its pumping capacity would be affected by the shut-off and urged its customers to minimize water use and turn off their irrigation systems.

How much does a power cut reduce the risk of wildfire?

PG&E, which filed for bankruptcy in January in the face of tens of billions of dollars in wildfire liabilities, has been repeatedly castigated and admonished by a judge overseeing an effort to improve the company's safety culture and remove vegetation near its electrical lines.

The deliberate power cuts have been described by PG&E as a way to lower the risk of fire while the company proceeds with its vegetation-trimming program. But by no means does it remove the risk of fires entirely.

Climate change, years of drought and the construction of houses and communities in wildland areas have all contributed to the spate of intense and deadly fires in California in recent years. In addition to electrical equipment, the direct causes of the fires have included lawn mowers, campfires, arson and, in one case, a man trying to plug a wasp's nest with a metal spike.

Wildfires that ignite in extreme wind conditions can be very difficult to bring under control, firefighters say. The deadliest fires of the past two years — the one that razed Paradise last year and the wine country fires of 2017 — both occurred in similar conditions to the ones that meteorologists are forecasting this week.

Thomas Fuller reported from San Francisco. Reporting was contributed by Jill Cowan and Sona Patel from Los Angeles; Lauren Hepler from San Jose, Calif.; Scott Bransford from Winters, Calif.; and Dan Levin and Adeel Hassan from New York.

Thomas Fuller is the San Francisco bureau chief. He has spent the past two decades in postings abroad for The Times and the International Herald Tribune in Europe and, most recently, in Southeast Asia. [@thomasfullerNYT](#) • [Facebook](#)

[READ 551 COMMENTS](#)



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F 925 933 4126
www.msrlegal.com

Matthew C. Henderson
Direct Dial: 925 941 3271
matthew.henderson@msrlegal.com

September 4, 2019

Town of Windsor Town Council
Town Civic Center
9291 Old Redwood Highway, Bldg. 400
Windsor, CA 95492
TownCouncil@TownofWindsor.com

Re: Proposal by Town of Windsor to Adopt All-Electric Residential Reach Code/Natural Gas Ban

Dear Town Councilmembers:

This firm represents William Gallaher in conjunction with the above-referenced matter. Our client is extremely concerned with the potentially adverse planning, and environmental and health and safety effects that may occur from adoption and implementation of the All Electric Reach Code/Natural Gas Ban currently being considered for adoption as a local ordinance by the Town of Windsor ("Town").¹ Based on an Agenda Report prepared by Interim Town Manager Ken MacNab for the Town's April 17, 2019 Town Council meeting, the Town is exploring possible incorporation of all-electric reach code provisions into its 2019 California Building Code Update, assertedly in order to achieve energy and cost savings and reductions in local GHG emissions. The Town has also placed a proposed reach code ordinance on the Town Council agenda for the September 4, 2019 meeting (agenda item no. 10.1) with an accompanying staff report ("Staff Report").

We write to emphasize that the Town cannot lawfully enact this ordinance as it now stands, for several reasons. First, the ordinance is premised on information not made available in sufficient advance of the meeting for meaningful public review or comment. Moreover, that information consists of a "2019 Cost-effectiveness Study: Low-Rise Residential New Construction" dated July 17, 2019 ("Study"), which is insufficient to support the proposed findings in support of the ordinance.

Second, the Town must comply with the California Environmental Quality Act ("CEQA"; Pub. Resources Code, § 21000 et seq.), which requires it in this case to prepare and certify a robust and legally-compliant Environmental Impact Report

¹ A "reach" code is so called because it "reaches" beyond the State's Title 24 energy efficiency requirements by enacting different or more stringent regulations on energy efficiency related aspects of new residential and/or commercial construction.

("EIR") that fully analyzes and discloses all of the project's potentially significant environmental impacts and potentially feasible mitigation measures and project alternatives that could reduce such impacts to a less-than-significant level.

The April 17 Agenda Report acknowledges that "[f]uture actions related to the potential adoption of an all-electric reach code will be subject to Environmental Review, at which time the appropriate environmental documents, prepared in accordance with the requirements of the California Environmental Quality Act (CEQA), will be presented to the Council for consideration prior to any action being taken." (April 17 Agenda Report, p. 3.) The Staff Report for the September 4 meeting then concludes that the ordinance is exempt from CEQA review under section 15061 and 15308 of the CEQA Guidelines. Adoption of an all-electric reach code is clearly a discretionary "project" subject to CEQA; that substantial evidence supports a "fair argument" that this project may have one or more significant adverse environmental effects; and no exemption from CEQA applies; therefore, that an EIR must be prepared, certified and considered before such adoption may occur.

I. INSUFFICIENCY OF THE COST EFFECTIVENESS ANALYSIS

As the Staff Report recognizes, the requirements of section 10-106 of the state Building Energy Efficiency standards include the mandate that the Town adopt "[a] determination that the [reach code] standards are cost effective," which require "findings and supporting analyses on the energy savings and cost-effectiveness of the proposed energy standards." (Cal. Code Regs., tit. 24, § 10-106.) The only material submitted in support of the proposed ordinance is the Study. This is insufficient, for several reasons.

First, the Study was only provided to the public on August 29, 2019, less than a week before the ordinance goes before you for a decision. This does not allow for informed comment by the public or informed decisionmaking by the Town Council. It is manifestly unfair to provide the public and interested stakeholders less than one week to read, digest, and comment upon a technical document such as the Study. Basic fairness requires the Town to withdraw the proposed ordinance and give the public time to fully digest the analysis proffered in its support.

Second, it is not clear that the Study satisfies the mandates of section 10-106. It purports to analyze the cost effectiveness of a reach code for the entire state. (Study, p. 1 & Ex. A.) Section 10-106 requires that a local agency make its own "findings and supporting analyses of the energy savings and cost-effectiveness of the proposed energy standards." (Cal. Code Regs., tit. 24, § 10-106, subd. (b)(2).) Relying on a general statewide study does not satisfy this standard.

It is also not clear from the Study whether or not it accounts for tiered electricity pricing and how that would apply to all-electric construction under the proposed ordinance. It is also unclear as to whether all-electric construction would lead to

residential units that cannot meet the requirements of the Building Energy Efficiency Standards in Part 6 of Title 24 of the California Code of Regulations, which would preclude building altogether.

Accordingly, the proposed ordinance is not supported by the requisite cost-effectiveness analysis, and therefore does not satisfy the mandate of section 10-106. The Town therefore cannot enact the reach code.

II. CEQA REQUIREMENTS

Under CEQA's well-established standards, an agency is required to prepare an Environmental Impact Report ("EIR"), rather than a Negative Declaration, whenever substantial evidence in the record supports a "fair argument" that a project *may* have a significant effect on the environment. (*No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal.3d 68, 75, 82; *Quail Botanical Gardens Found. Inc. v. City of Encinitas* (1994) 29 Cal.App.4th 1597, 1602; *Friends of "B" Street v. City of Hayward* (1980) 106 Cal.App.3d 988, 1002.) Courts apply the "fair argument" test as a standard of judicial review for agency decisions to adopt a Negative Declaration. (See, e.g., *Gentry v. City of Murrieta* (1995) 36 Cal.App.4th 1359, 1399; *Stanislaus Audubon Society, Inc. v. County of Stanislaus* (1995) 33 Cal.App.4th 144, 150; *Quail Botanical Gardens Found. Inc.*, *supra*, 29 Cal.App.4th at 1602.) The "fair argument" standard of review applies to mitigated negative declarations. (*Sierra Club v. California Dept. of Forestry and Fire Protection* (2007) 150 Cal.App.4th 370, 382; *Citizens for Responsible and Open Government v. City of Grand Terrace* (2008) 160 Cal.App.4th 1323, 1331-1332; see also Pub. Resources Code, §21064.5 [defining "mitigated negative declaration"].)

In other words, if a non-exempt project *may* cause a significant effect on the environment, the lead agency *must* prepare an EIR. (Pub. Resources Code, §§ 21100, 21151; Cal. Code Regs., tit. 14, § 15064, subd. (a)(1)(f)(1).) An EIR may be avoided only if the lead agency properly finds no substantial evidence in the initial study or elsewhere in the record that the project may significantly affect the environment. A project "may" have a significant effect on the environment if there is a "reasonable possibility" that it will result in a significant impact. (*No Oil, Inc.*, *supra*, 13 Cal.3d at 83, n.16; *Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296, 309.) A "significant effect upon the environment" is defined as "a substantial or potentially substantial adverse change in the environment." (Pub. Resources Code, § 21068; Cal. Code Regs., tit. 14, § 15382.) If *any* aspect of the project may result in a significant environmental impact, an EIR must be prepared even if the overall effect of the project is beneficial. (Cal. Code Regs., tit. 14, § 15063, subd. (b)(1); *County Sanitation Dist. No. 2 v. County of Kern* (2005) 127 Cal.App.4th 1544, 1580.)

As is evident from the above-cited legal authorities, CEQA sets a very "low threshold" for requiring preparation of an EIR (*Pocket Protectors v. City of Sacramento* (2004) 124 Cal.App.4th 903, 928; *Bowman v. City of Berkeley* (2004)

122 Cal.App.4th 572, 580; see also *Sundstrom v. County of Mendocino, supra*, 202 Cal.App.3d at p. 310), such that if any substantial evidence supports the requisite "fair argument" that a project may have a significant environmental effect, the lead agency must prepare an EIR – even if it is also presented with other substantial evidence indicating that the project will have no significant effect. (*No Oil, Inc. v. City of Los Angeles, supra*, 13 Cal.3d at p. 85; *Brentwood Association for No Drilling, Inc. v. City of Los Angeles* (1982) 134 Cal.App.3d 491, 503-504; *Friends of "B" Street, supra*, 106 Cal.App.3d at 1002; Cal. Code Regs., tit. 14, § 15064, subd. (f)(1).) Under the "fair argument" test, the lead agency may not weigh the competing evidence to determine who has a better argument concerning the likelihood or extent of a potential environmental impact, but must direct the preparation of an EIR to resolve the issue. (See, e.g., *Friends of "B" Street, supra*, 106 Cal.App.3d at 1002; *Architectural Heritage Association v. County of Monterey* (2004) 122 Cal.App.4th 1095, 1109, 1122.)

"Substantial evidence" is evidence that has ponderable legal significance, i.e., evidence that is reasonable, credible and of solid value (*Stanislaus Audubon Society, Inc. v. County of Stanislaus* (1995) 33 Cal.App.4th 144, 152; *Newman v. State Personnel Board* (1992) 10 Cal.App.4th 41, 47; *Pennell v. Pond Union School Dist.* (1973) 29 Cal.App.3d 832, 837), and has been defined in the CEQA context as "enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached." (Cal. Code Regs., tit. 14, § 15384(a); see also, Pub. Resources Code, §§ 21080(e), 21082.2(c); Cal. Code Regs., tit. 14, § 15064, subd. (f)(5).) "Substantial evidence" is defined by the CEQA Guidelines to include, inter alia, "expert opinion supported by facts." (Cal. Code Regs., tit. 14, § 15384, subd. (a); see *id.* at § 15064, subd. (f)(5).) Opinion evidence submitted by a qualified expert, showing that significant impacts may occur from a project, is normally conclusive, and requires preparation of an EIR under the "fair argument" standard. (See, e.g., *City of Livermore v. LAFCO* (1986) 184 Cal.App.3d 531, 541.) "Statements by members of the public may [also] constitute substantial evidence that a project may have a significant effect on the environment." (1 Kostka & Zischke, *Practice Under the California Environmental Quality Act* (Cont.Ed.Bar 2d ed. 2015), § 6.42, pp. 6-46.1 to 6-47, and cases cited; see also *Pocket Protectors v. City of Sacramento* (2004) 124 Cal.App.4th 903, 928 ["Relevant personal observations of area residents on nontechnical subjects may qualify as substantial evidence for a fair argument."].)

III. SUBSTANTIAL EVIDENCE SUPPORTS A "FAIR ARGUMENT" THAT AN ALL-ELECTRIC REACH CODE IS A DISCRETIONARY PROJECT THAT MAY HAVE SIGNIFICANT UNMITIGATED ADVERSE ENVIRONMENTAL IMPACTS IN A NUMBER OF AREAS, THUS REQUIRING PREPARATION OF AN EIR

A. The Proposed Ordinance Is a CEQA "Project."

There can be absolutely no doubt that a proposed local ordinance adopting a reach code, such as the one being proposed for consideration by the Town, is a "project" that is subject to CEQA review. CEQA broadly defines "projects" to include any activities directly undertaken by public agencies which have the potential to ultimately culminate in physical change to the environment. (*City of Livermore v. Local Agency Formation Com.* (1986) 184 Cal.App.3d 531, 537; *Bozung v. Local Agency Formation Com.* (1975) 13 Cal.3d 263, 277-278, & fn. 16.) The Supreme Court and Courts of Appeal "ha[ve] given the term "project" a broad interpretation and application to maximize protection of the environment." (*Tuolumne County Citizens For Responsible Growth, Inc. v. City of Sonoma* (2007) 155 Cal.App.4th 1214, 1222-1223, and cases cited; see *Aptos Council v. County of Santa Cruz* (2017) 10 Cal.App.5th 266, 278; *McQueen v. Board of Directors* (1988) 202 Cal.App.3d 1136, 1143.)

The courts' broad definition of a CEQA "project" is compelled by the plain language of the CEQA statutes and Guidelines. Thus: "'Project' means an activity which may cause either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and which is any of the following: (1) An activity directly undertaken by any public agency." (Pub. Resources Code, § 21065, subd. (a).) "[T]his division shall apply to discretionary projects proposed to be carried out or approved by public agencies, including, but not limited to, the enactment and amendment of zoning ordinances. . . ." (Pub. Resources Code, § 21080(a)). While a reach code is not a classic "zoning ordinance," it operates like a zoning ordinance because it "ha[s] the effect of [r]egulat[ing] the use of buildings, structures, and land" (*People v. Optimal Global Healing, Inc.* (2015) 241 Cal.App.4th Supp. 1, 8), and as a local law regulating those areas it shares, for purposes of CEQA, the key attribute of zoning ordinances. (See *Morehart v. County of Santa Barbara* (1994) 7 Cal.4th 725, 750 ["The purpose of a zoning law is to regulate the use of land."].)

Zoning ordinances and local ordinances akin to them are categorically CEQA "projects." The CEQA Guidelines, in relevant part, define "project" as "the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and that is any of the following: (1) An activity directly undertaken by any public agency including but not limited to... enactment and amendment of zoning ordinances..." (Cal. Code Regs., tit. 14, § 15378, subd. (a)(1).) Indeed, under CEQA's broad definition of a "project," ordinances, laws and regulations

affecting the use of land or structures have consistently been held to be CEQA "projects" over the course of many decades. (See, e.g., *Apartment Assn. of Greater Los Angeles v. City of Los Angeles* (2001) 90 Cal.App.4th 1162, 1169 ["Ordinances passed by cities are clearly activities undertaken by a public agency and thus 'projects' under CEQA."], citing 60 Ops. Cal. Atty. Gen. 335, 338 (1977); *County Sanitation Dist. No. 2 v. County of Kern* (2005) 127 Cal.App.4th 1544, 1558 [treating County ordinance restricting sewage sludge application on County lands as project under CEQA and further holding "CEQA requires the preparation of an EIR whenever substantial evidence supports a fair argument that an ordinance will cause potentially significant environmental impacts"]; *id.* at p. 1578 ["Amendment or adoption of an ordinance is a legislative act subject to review under section 21168.5"], citations omitted; *Plastic Pipe & Fittings Assn. v. California Building Standards Com.* (2004) 124 Cal.App.4th 1390, 1412 ["A regulation fitting the description of a discretionary project is a discretionary project under CEQA."]; *Rosenthal v. Board of Supervisors* (1975) 44 Cal.App.3d 815, 823 ["In view of the fact that city ordinances were the subject matter in the *No Oil* case, it appears that it was held impliedly therein that adopting an ordinance was a project within the meaning of the Environmental Quality Act"], citing *No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal.3d 68 [impliedly holding adoption of zoning ordinance permitting drilling of oil test wells was project within meaning of CEQA].)

B. The Proposed Project Is Not Exempt.

There can further be no doubt that a project proposing adoption of an all-electric reach code is not subject to any exemption from CEQA. Yet the staff report for the proposed ordinance cites two CEQA exemptions – the so-called "common sense" exemption, and the class 8 exemption for actions that are protective of the environment. Neither applies here.

CEQA's "common sense" exemption may properly be invoked *only* when the lead agency can declare "with certainty that there is no possibility that the activity in question may have a significant effect on the environment." (Cal. Code Regs., tit. 14, § 15061, subd. (b)(3).) "In the case of the commonsense exemption, the agency has the burden to 'provide the support for its decision before the burden shifts to the challenger. Imposing the burden on members of the public in the first instance to prove a possibility for substantial adverse environmental impact would threaten CEQA's fundamental purpose of ensuring that government officials 'make decisions with environmental consequences in mind.'" (California Farm Bureau Federation v. California Wildlife Conservation Bd. (2006) 143 Cal.App.4th 172, 186, citing *Davidon Homes v. City of San Jose* (1997) 54 Cal.App.4th 106, 116, quoting *Bozung, supra*, 13 Cal.3d at 283.) "A remote or outlandish possibility of an environmental impact will not remove a project from the common sense exemption, but if legitimate reasonable questions can be raised about whether a project might have a significant impact, the agency cannot find with certainty the project is exempt." (*id.* at p. 194, citing *Davidon Homes, supra*, 54 Cal.App.4th at pp. 117-118.)

"[T]he primary duty to comply with CEQA's requirements must be placed on the public agency. To make faithful execution of the duty contingent upon the vigilance and diligence of particular environmental plaintiffs would encourage attempts by agencies to evade their important responsibilities. It is up to the agency, not the public, to ensure compliance with [CEQA] in the first instance." (*Concerned Citizens of Costa Mesa, Inc. v. 32nd Dist. Agricultural Assn.* (1986) 42 Cal.3d 929, 939, citing *County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 205.) "CEQA places the burden of environmental investigation on government rather than the public." (*Leonoff v. Monterey County Bd. of Supervisors* (1990) 222 Cal.App.3d 1337, 1347 ["CEQA contemplates serious and not superficial or pro forma consideration of the potential environmental consequences of a project."].)

"[A] party challenging what is essentially a claim of the commonsense exemption under Guidelines section 15061, subdivision (b)(3), unlike a party asserting an exception to a categorical exemption, need only make a "slight" showing of a reasonable possibility of a significant environmental impact. (*Davidon Homes, supra*, 54 Cal.App.4th at p. 117.) It is the lead agency that has the burden of establishing the commonsense exemption, i.e., that there is *no* possibility the project may cause significant environmental impacts. "[T]he agency's exemption determination must be supported by evidence in the record demonstrating that the agency considered possible environmental impacts in reaching its decision." (*California Farm Bureau Federation, supra*, 143 Cal.App.4th at 195-196, citing *Davidon Homes, supra*, 54 Cal.App.4th at 117, *East Peninsula Ed. Council, Inc. v. Palos Verdes Peninsula Unified School Dist.* (1989) 210 Cal.App.3d 155, 171.)²

With respect to the class 8 exemption under section 15308 of the Guidelines, such can only be used for an action that constitutes a preservation of the environment. (*Save Our Big Trees v. City of Santa Cruz* (2015) 241 Cal.App.4th 694, 707.) Here, the proposed reach code cannot be said to rise to this standard as it merely substitutes one source of energy for another, without any sufficient analysis as to whether that substitution will actually yield any benefit to the environment.

In this context the case of *Dunn-Edwards Corp. v. Bay Area Air Quality Management Dist.* (1992) 9 Cal.App.4th 644 is instructive. There, the Bay Area Air Quality Management District sought to use the class 8 exemption for regulations reducing the solvent in architectural coatings. The Court of Appeal held that in spite

² A lead agency intending to invoke the common sense exemption thus has the burden to consider the record and facts in the case before it prior to doing so. (*Muzzy Ranch, supra*, 41 Cal.4th at 386 ["Insofar as it failed to consider the record in determining that adopting the TALUP fell within the common sense exemption, the Commission erred."]) "An agency obviously cannot declare "with certainty that there is *no* possibility that the activity in question may have a significant effect on the environment" (Cal. Code Regs., tit. 14, § 15061, subd. (b)(3)) if it has not considered the facts of the matter." (*Id.* at p. 387, citing *Davidon Homes, supra*, 54 Cal.App.4th at 117.)

of the fact that the regulations imposed more stringent standards there was not sufficient evidence in the record justifying the conclusion that it would actually protect the environment. The exact same analysis applies here, for the reasons discussed throughout this letter. There is simply no basis for the Town to conclude that the reach code will not have a potentially significant impact on the environment. Thus, reliance on the class 8 exemption is not warranted. (See *International Longshoremen's & Warehousemen's Union v. Board of Supervisors* (1981) 116 Cal. App.3d 265.)

Finally, note also in this context that section 10-106 of the Building Energy Efficiency Standards upon which the Town relies requires the submission of materials in support of an application for a reach code. The specific submittals required do not extend to a notice of claimed exemption but a "negative declaration or environmental impact report, required pursuant to the California Environmental Quality Act, Public Resources Code Section 21000 et seq." (Cal. Code Regs., tit. 24, § 10-106, subd. (b)(4).) The provision clearly does not contemplate the use of an exemption because a reach code will invariably require environmental analysis under CEQA. Thus, the reliance on an exemption here is plainly in error.

C. The City Must Conduct an Initial Study and Prepare an EIR Prior to Considering Adoption of an All-Electric Reach Code Ordinance.

Because proposed adoption of an all-electric reach code is a project that is subject to CEQA, and does not qualify for any exemption from CEQA review, the Town is required to conduct an initial study to determine whether it may have any significant environmental effects; if the initial study shows the project does not qualify for a negative declaration, the Town must prepare an EIR. (*Muzzy Ranch Co. v. Solano County Airport Land Use Com.* (2007) 41 Cal.4th 372, 380-381.) The Town's good faith performance of such a study here will show that adoption of an all-electric reach code may have significant and adverse environmental effects in numerous areas, including, but not limited to, aesthetics, recreation, utilities/service systems, GHG emissions, land use/planning, population/housing, air quality, wildfire, public safety, energy, hazards and hazardous materials, and public services. A few of these numerous areas of potentially significant impact are discussed in further detail below.

- **Hazards/Public Safety.** Ironically, an all-electric reach code ordinance is being considered at a time when the supply of electrical power to the Town and surrounding communities may be less reliable and subject to more and longer planned outages than ever before. (See attached August 15, 2019 Press Democrat article, "PG&E Map Sheds Light On Planned Power Outages In Sonoma County."³ As noted in the article, the "unprecedented" planned power outages are

³ See <https://www.pressdemocrat.com/news/9898428-181/pge-map-sheds-light-on>.

expected to "cover all of Cloverdale, Cotati, Healdsburg, Sebastopol and Windsor" and critics of the planned outages have "point[ed] to impacts on public safety, businesses and disabled people who rely on access to electricity." The article states "[a] prolonged, widespread outage... could have the potential to be very disruptive, officials acknowledged, posing problems ranging from cell phone service to storage of food." An announcement of the Petaluma Fire Department is quoted as stating: "ATM machines won't work, gas stations won't be able to pump gas, traffic signals will be out, garage doors will need to be opened manually.... Are you ready?" Without adequate battery storage of electricity, or an alternative power source, such as natural gas which powers backup generators and other appliances, "all-electric" homes and businesses will be subject to hazards and risks to public safety during outages when heat, lighting, water, refrigeration, food, and air conditioning may be unavailable.

Given the risk of blackouts, some residents will rely on propane or gasoline generators or other combustible sources of power which are more prone to accident or spillage than fixed natural gas lines. There is no discussion of the risks or impacts associated with such increased usage, including air quality, GHG, and fire impacts.

Note also that the 2018 Camp Fire, the deadliest in California history, was apparently caused by electrical transmission lines.⁴ There is no analysis whatsoever in the Staff Report or any supporting materials as to any potential increase in fire risk from expanded electrical service facilities which the reach code would necessitate. Instead, the Staff Report claims, without supporting evidence, that "natural gas infrastructure is a potentially significant source of fire." (Staff Report, p. 4.) Suffice it to say the Town cannot accuse natural gas of providing a wildfire risk without supporting evidence while ignoring the fact that electricity lines gave rise to the most lethal California wildfire ever less than a year ago.

- **Utilities/Service Systems/Wildfire.** The CEQA Guidelines Appendix G checklist – a template for the initial study the Town is required to conduct under CEQA – requires evaluation of the question of whether the project would "[r]equire or result in the relocation or construction of new or expanded ... electric power, natural gas, or telecommunications facilities, the construction of which could cause significant environmental effects?" Projects requiring significant new construction to rely solely on electricity as a power source clearly have the potential to result in the installation,

⁴ See, e.g., https://www.fire.ca.gov/media/5038/campfire_cause.pdf.

upgrading, and/or maintenance of associated infrastructure (e.g., roads, fuel breaks, power lines), and where such occurs in or near areas of high fire hazard the resulting environmental impacts must also be studied. (See Appendix G, Section XX WILDFIRE [listing potential impacts such as impairment of adopted emergency response and evacuation plans, exacerbation of wildfire risks, and other human safety and environmental risks and impacts].) And, as noted above, the most deadly fire in California history was started not by natural gas facilities, but by electrical lines. Moreover, also as noted above, increased generator use may give rise to its own increased risk of fire.

Similarly, the Staff Report and Study do not analyze whether the existing electrical grid is sufficient to satisfy the demand of all new construction under a 100% electricity standard. Given PG&E's warnings about potential blackouts, the grid's ability to handle this new demand is questionable at best. Moreover, the Staff Report and Study do not sufficiently discuss the sources of the additional electricity required under the proposed reach code, nor the impacts related to those sources. Natural gas powered plants will naturally obviate most if not all of the supposed benefit of gas-free construction. Wind and solar have well-known impacts relating to wildlife, aesthetics, etc.⁵ And hydroelectric power comes with its own suite of impacts as well, including harm to anadromous fish and other species⁶ and the risk of failure and flood (as with the Oroville Dam crisis of 2017). In fact, hydroelectric facilities in California and the west are being removed, making this source of power uncertain for future electricity needs.⁷

- **GHG/Air Quality.** While the cursory four-page April 17 Agenda Report appears to proceed on the assumption that GHGs are the *only* concern and impact at issue, such a facile assumption is clearly incorrect. An all-electric reach code would eliminate gas-powered

⁵ See https://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html; https://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html.

⁶ See <https://www.fs.fed.us/pnw/publications/lind/lind6.pdf>; https://www.researchgate.net/profile/Liba_Pejchar/publication/11779066_A_River_Might_Run_Through_It_Again_Criteria_for_Consideration_of_Dam_Removal_and_Interim_Lessons_From_California/links/004635277e83e0f755000000/A-River-Might-Run-Through-It-Again-Criteria-for-Consideration-of-Dam-Removal-and-Interim-Lessons-From-California.pdf.

⁷ See <http://www.klamathrenewal.org/>.

heaters, stoves, water heaters, built-in outdoor barbeques, gas burning fireplaces, fire pits, and, as noted above, gas-powered backup generators to protect against losses, disruptions and safety problems from blackouts of a fragile and overburdened electrical grid. Alternative fuel sources – such as wood, gasoline or charcoal – exist for many of these amenities, and could be substituted for the cleaner-burning natural gas that the proposal would eliminate, leading to greater GHG emissions and air quality impacts. Such unintended, but clearly reasonably foreseeable, adverse environmental consequences must be fully evaluated under CEQA. (See, e.g., *Rodeo Citizens Association v. County of Contra Costa* (2018) 22 Cal.App.5th 214 [recognizing that to extent captured butane and propane were used to displace use of other fuels such as coal, home heating fuel, fuel oil, diesel, kerosene, gasoline and ethanol, they would also displace GHG emissions otherwise resulting from use of those alternate fuels].) For example, propane barbeques produce only one-third of the GHG emissions of charcoal barbeques (*id.* at p. 226), and natural gas is similarly a much cleaner burning fuel than charcoal, wood or gasoline. Moreover, the increased use of gasoline or propane generators may also give rise to air quality and/or GHG impacts that are completely unanalyzed in the Staff Report.

Population and Housing/Human Impacts. Projects that would displace substantial numbers of people or housing, or render housing unaffordable, may have significant adverse impacts on the environment and human beings that require CEQA analysis and mitigation. (See CEQA Guidelines, Appdx. G, Section XIV.) To the extent an all-electric reach code could, for example, substantially increase the cost of new multi-family apartment dwelling construction and/or retrofitting, it could lead to increased rents, unaffordable housing, and tenant displacement from the same, with resulting adverse human impacts. Alternatively, renters or home buyers may prefer residences with traditional gas appliances and therefore show a greater propensity to move outside of the Town and commute. Tenant displacement, in and of itself, has been recognized as a significant adverse environmental impact subject to CEQA analysis and mitigation. (*Lincoln Place Tenants Assn. v. City of Los Angeles* (2007) 155 Cal.App.4th 425 [holding CEQA mitigation measures designed to mitigate tenant displacement impacts of project, contained in a vesting tentative map, were enforceable and did not conflict with Ellis Act].) Public entities possess the power under

existing law “to mitigate adverse impacts on displaced tenants.” (*San Francisco Apartment Assn. v. City and County of San Francisco* (2016) 3 Cal.App.5th 463, 484, citing *Pieri v. City and County of San Francisco* (2006) 137 Cal.App.4th 886, 892; see Gov. Code, § 7060.1.) As explained by the *Lincoln Place* Court of Appeal, “CEQA... is made relevant... by the Ellis Act’s explicit exceptions for a public agency’s power to regulate, among other things,... the mitigation of adverse impacts on persons displaced by reason of the withdrawal of rental accommodations. *Such items are the common focus and byproducts of the CEQA process....*” (*Lincoln Place Tenants Assn.*, *supra*, 155 Cal.App.4th at 451, emph. added.) Indeed, the Supreme Court has recently reaffirmed “that CEQA addresses human health and safety” and “that public health and safety are of great importance in the statutory scheme.” (*California Building Industry Assn. v. Bay Area Air Quality Management Dist.* (2015) 62 Cal.4th 369, 386, citations omitted.) CEQA’s “express language... requires a finding of a “significant effect on the environment” ([Pub. Resources Code,] § 21083(b)(3)) whenever the “environmental effects of a project will cause substantial effects on human beings, either directly or indirectly.”” (*Id.* at p. 386, emphasis in original.)

- **Land Use/Planning.** Given the foregoing, the Staff Report’s analysis of the consistency of the proposed ordinance with the Town’s General Plan is absurdly abbreviated, consisting of less than two pages and citing a mere five goals and policies out of the more than 250 pages that make up the General Plan.⁸ (Staff Report, pp. 4-5.) While the Town has discretion in interpreting and applying its General Plan, it cannot do so in a way that frustrates the purpose of the General Plan. (*Napa Citizens for Honest Government v. Napa County Board of Supervisors* (2001) 91 Cal.App.4th 342, 378-381.) The analysis in the Staff Report is far too brief to fully address the proposed ordinance’s consistency with the General Plan and its overall purpose. Accordingly, further analysis of this issue is required.

⁸ See https://www.townofwindsor.com/DocumentCenter/View/21498/Final-Town-of-Windsor-2040-General-Plan_2018-06-04.

IV. CONCLUSION

While Mr. Gallaher reserves all rights to submit further comments, arguments, and evidence, it is evident for the reasons set forth above that (1) the Town cannot lawfully make the findings required to enact the proposed reach code ordinance, and (2) a full and robust EIR that complies with CEQA must be prepared and certified before any ordinance adopting an all-electric reach code can be considered by the Town for approval.

Very truly yours,

MILLER STARR REGALIA

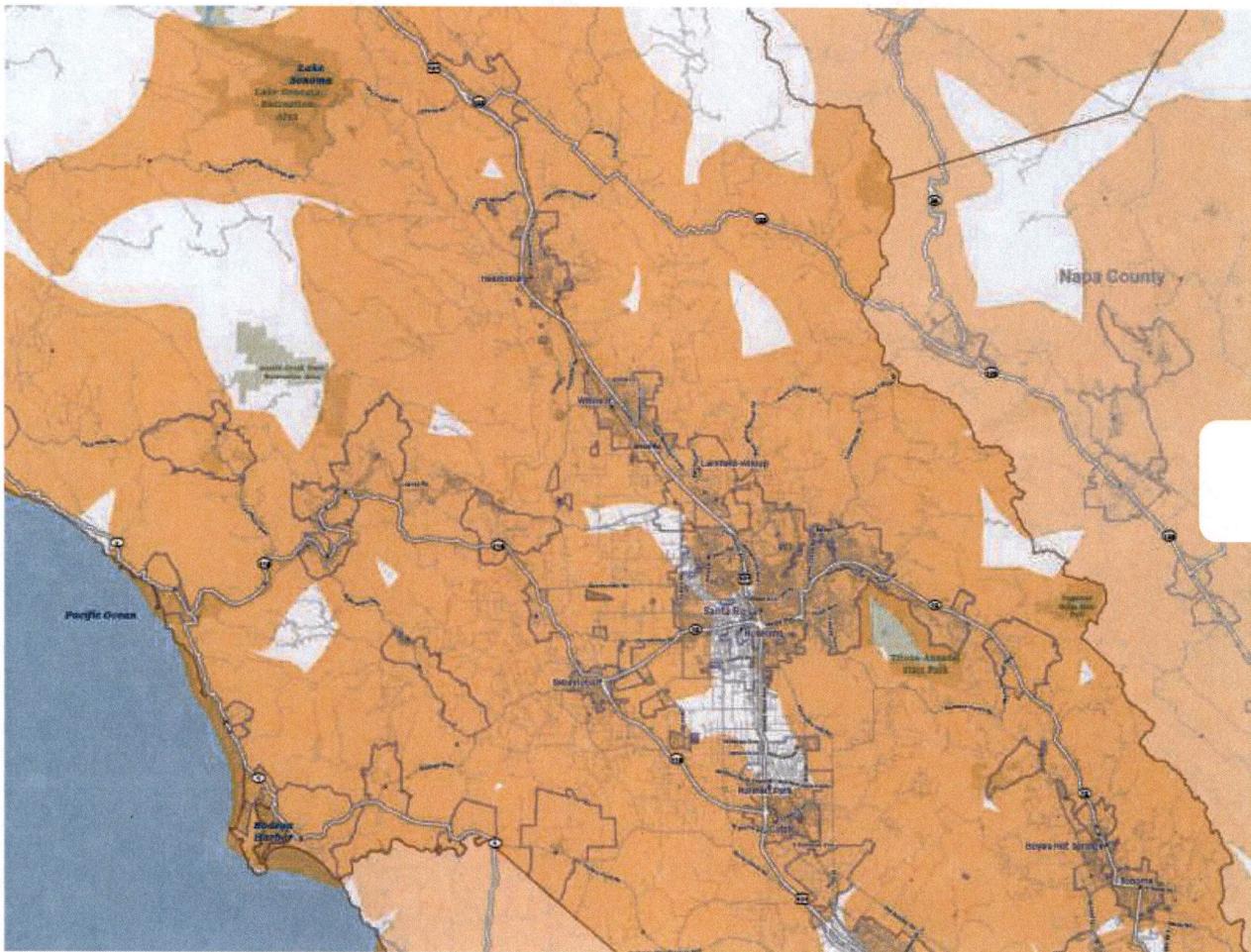


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PG&E map sheds light on planned power outages in Sonoma County



SLIDE 1 OF 3

PG&E could shut off power for several days to reduce fire risk this summer and fall. This map shows the areas that could be affected by the planned outages. (PG&E)



WILL SCHMITT

THE PRESS DEMOCRAT | August 15, 2019

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A majority of Sonoma County's cities and much of the surrounding North Bay could be affected under the wide-scale planned power outages that PG&E has signaled it intends to use to reduce the risk of its equipment sparking devastating wildfires, according to a map the utility company provided earlier this month to local government officials.

The map, obtained this week by The Press Democrat, illustrates the unprecedented scope of fallout for local electricity customers, showing areas that are more likely to have their power cut during periods of hot, dry, windy weather that can give rise to catastrophic fires.

The map's orange "affected areas" cover all of Cloverdale, Cotati, Healdsburg, Sebastopol and Windsor. Though PG&E has said that any of its 5.4 million customers in Northern and Central California could be affected by planned outages, swaths of Santa

Rosa, Petaluma, and Rohnert Park are not tinted orange.

The map also indicates that much of northern Marin, southern Lake and western Napa counties could be affected by planned outages. Southern Mendocino County appears largely unaffected outside of the Highway 101 and Route 128 corridors.

"The planning maps show which areas are more likely to experience a shut off when gusty winds and dry conditions, combined with a heightened fire risk, are forecasted to threaten a portion of the electric system," PG&E spokeswoman Deanna Contreras said in a statement. "The maps show potential areas of more likely distribution-level and 70kV and below transmission-level impacts. They are approximate and show potential de-energization areas only. Additional areas could be impacted. PG&E is working to make these same planning maps available to customers through our website very soon."

PG&E has conducted a series of preemptive power outages since last fall in an effort to curb fire risk associated with its equipment, which the state determined sparked many of the most destructive wildfires in 2017 and 2018. Going forward, the planned shutoffs could extend not just to small power lines connected to homes and businesses but to the large transmission that carry power across the state.

The utility's critics have blasted the outage plans, pointing to impacts on public safety, businesses and disabled people who rely on access to electricity. State legislators on Wednesday added to the scrutiny, suggesting that the bankrupt utility and other electricity providers would err on the side of power shutoffs to shield themselves from mounting wildfire liabilities.

"We are approaching the one-year anniversary of the first public safety power shutoff by this utility and it is past time that PG&E gets their act together," said state Sen. Mike McGuire, D-Healdsburg, a member of the Senate's committee overseeing energy, utilities and communications. "All of the measures addressed in the meeting yesterday should have been discussed prior to launching last October's public power safety shutoffs. We're talking about all these details after the fact and it's unacceptable."

PG&E, meanwhile, had urged local governments to withhold public release of the new North Bay outage map, arguing it lacked context and could be misleading to viewers. Sonoma County last week released a blurred version of the map that was illegible. A source with access to a legible version provided the map to The Press Democrat.

PG&E declined to make a subject-matter expert available this week to answer more detailed questions about the map and the methodology used to chart the scope of planned power outages. Contreras said the utility would provide additional information when it makes the maps public.

Preparing For Planned Outages

Make sure PG&E has your current contact information by going online to www.pge.com or calling 1-800-743-5000.

Get local emergency alerts: Go to SoCoAlert.com or call 866-939-0911, press "0" at the menu and ask the operator for assistance in registering.

For a closer look at the map, including the ability to zoom in on certain areas, go [here](#)

Learn how to prepare for power outages by going to www.ready.gov/power-outages

For a list of resources to help in planning for disaster go to pressdemocrat.com/prepare

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The utility is preparing to release maps of its entire service area through its website in the next few weeks, officials said.

The North Bay map was provided this month to officials in Sonoma County and Santa Rosa through a secure data portal to help them plan for PG&E's outages. Though most of Sonoma County is marked as "affected," local officials have cautioned that the likelihood of an outage affecting the entire county is very low.

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A prolonged, widespread outage, however, could have the potential to be very disruptive, officials acknowledged, posing problems ranging from cellphone service to storage of food.

"This is a significant new challenge," Chris Godley, Sonoma County's emergency management director said last week. "It's been a generation since we've seen large-scale power outages in Sonoma County."

PG&E has said it intends to provide advance notice to its customers and the public before cutting power, and Contreras said the utility also will provide "maps of impacted areas in a variety of formats."

"We've always said that while customers in high fire-threat areas are more likely to be affected, any customer could have their power shut off because the energy system relies on power lines working together to provide electricity across cities, counties and regions," she said. "The specific area and number of affected customers will depend on forecasted weather conditions and which circuits PG&E needs to turn off for public safety."

Amid the scorching heat this week, the Petaluma Fire Department highlighted the potential for such outages and called on residents to be prepared.

"PG&E may cut power to all of Petaluma this summer and fall for several days," the fire department wrote in an announcement about the opening of cooling center in town. "ATM machines won't work, gas stations won't be able to pump gas, traffic signals will be out, garage doors will need to be opened manually..... Are you ready?"

Staff Writer Alexandria Bordas contributed to this report. You can reach Staff Writer Will Schmitt at 707-521-5207 or will.schmitt@pressdemocrat.com. On Twitter @wsreports.

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September 11, 2019

VIA E-MAIL AND U.S. MAIL

Kenneth MacNab
Town Manager
Town of Windsor
9291 Old Redwood Highway
Windsor, CA 95492
kmacnab@townofwindsor.com

Re: Town of Windsor Proposed Adoption of All-Electric Residential Reach Cod

Dear Mr. MacNab:

As you know, this firm represents William Gallaher in conjunction with the above-referenced matter. I write concerning two issues with respect to the Town's contemplated adoption of the all-electric residential "reach" code, which the Town Council first acted upon at its September 4, 2019 hearing.

Prior to that hearing, at which I personally appeared to object to the project on Mr. Gallaher's behalf, I submitted a 13-page letter (with an enclosed August 15, 2019 Press Democrat article) to the Town on behalf of my client, recognizing that such was too late to be included in the agenda packet.¹ As you will no doubt recall, however, I asked on the record at the hearing for confirmation that the letter had been received by the Town and would be included as part of the record with respect to the Council's action, and staff confirmed that it had been received and would be so included. However, after checking the online portal for the Town Council agenda of September 4, 2019, I noted that three other letters are now included with respect to the ordinance (item 10.1), but not my letter. Accordingly, I would appreciate further written confirmation that my letter is part of the record with respect to the ordinance.

In addition, please treat this letter as a formal request to send to my attention copies of any notice the Town issues with respect to CEQA compliance for the adoption of

¹ Note, however, that CEQA expressly provides that the submission of objections and alleged grounds of an agency's noncompliance with CEQA may properly be submitted, for purposes of exhausting issues and obtaining standing to litigate, at any time "prior to the close of the public hearing on the project." (Pub. Resources Code, § 21177, subds. (a), (b).) The letter was clearly timely for this purpose.

Kenneth MacNab
September 11, 2019
Page 2

the ordinance, as is required by Public Resources Code sections 21092.2 and 21167, CEQA Guidelines section 15062, or otherwise.

Thank you for your attention to these matters, I very much appreciate it. Please do not hesitate to contact me should you have any questions or concerns about the foregoing.

Very truly yours,

MILLER STARR REGALIA



Matthew C. Henderson

MCH:dfl

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September 18, 2019

VIA E-MAIL AND U.S. MAIL

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Town Manager
Town of Windsor
9291 Old Redwood Highway
Windsor, CA 95492
kmacnab@townofwindsor.com

Re: Town of Windsor Proposed Adoption of All-Electric Residential Reach Code
(September 18, 2019 Town Council Meeting Agenda Item No. 10.1)

Dear Mr. MacNab:

This letter is sent on behalf of our client William Gallaher with respect to the above-referenced matter. Thank you for providing the link to the agenda item and staff report and confirming that my prior letter is part of the administrative record for the Town's consideration of the proposed reach code ordinance.

This letter is sent to briefly respond to the agenda report's summary discussion of the proposed ordinance's claimed exemption under the California Environmental Quality Act (CEQA), Public Resources Code section 21000 et seq. More specifically, that abbreviated discussion does not substitute for the robust environmental analysis required under CEQA, and does not support the application of the categorical exemptions under sections 15061(b)(3) and 15308 of the CEQA Guidelines.

The first point that bears mentioning is that none of the CEQA discussion set forth in the agenda report was provided before the first reading of the proposed ordinance. This has precluded the opportunity for meaningful public review, comment, and participation in the Town's consideration of the ordinance.

More fundamentally with respect to the exemption under Guidelines section 15308, the Town has the burden of establishing that there is substantial evidence in the record that the exemption applies. (*California Farm Bureau Federation v. California Wildlife Conservation Board* (2006) 143 Cal.App.4th 173, 178.) As for the common sense exemption under section 15061(b)(3):

In the case of the common sense exemption, the agency has the burden to provide the support for its decision before the burden shifts to the challenger. Imposing the burden on members of the public in the first instance to prove a possibility for substantial adverse environmental impact would frustrate CEQA's fundamental purpose of ensuring that government officials make decisions with environmental consequences in mind.

(*Id.* at p. 179, quoting *Davidon Homes v. City of San Jose* (1997) 54 Cal.App.4th 106, 116, internal quotation marks omitted.) Thus: “[T]he agency's exemption determination must be supported by evidence in the record demonstrating that the agency considered possible environmental impacts in reaching its decision.” (*Davidon Homes v. City of San Jose*, *supra*, 54 Cal.App.4th at p. 117.) The cursory discussion in the agenda report provided only shortly before the ordinance's second reading falls far short of this standard. There is simply no evidence in the record that the Town has taken any of the myriad potential serious environmental impacts from the ordinance into account in its decisionmaking. The burden to overcome the commonsense exemption is “slight.” (*Ibid.*) Between additional impacts from alternative sources of electricity (wind, solar, hydroelectric), fire risk, land use impacts, blackouts (and associated health and safety impacts), generator usage, etc., there is more than sufficient cause to believe the ordinance may have environmental impacts that take it out of the commonsense exemption.

In a related vein, much of the discussion of the claimed exemptions for the ordinance rests on the speculative premise that it will have an overall beneficial effect on the environment. For instance, the agenda report states, “[T]he all-electric code requirement is expected to have a net benefit to the environment through the reduction of GHG emissions.” (Agenda Report, p. 5.) Even assuming the truth of this premise, such an approach is improper under CEQA, which does not allow for a “net benefit” analysis. (*County Sanitation Dist. No. 2 v. County of Kern* (2005) 127 Cal.App.4th 1544, 1577, 1580.) As the Court of Appeal has aptly observed, “There may be environmental costs to an environmentally beneficial project, which must be considered and assessed.” (*California Farm Bureau Federation v. California Wildlife Conservation Board*, *supra*, 143 Cal.App.4th at p. 186.) Ignoring such costs by dismissing them out of hand, without any actual analysis of pertinent facts, is not permitted by CEQA.

The potential for significant environmental impacts here is not academic and is more than borne out by the limited record that does exist. For instance, while the agenda report downplays the potential impacts of power outages on all-electric homes, the Town has a web page specifically set up for potential PG&E outages.¹ That page specifically encourages Town residents to “[c]onsider alternate power generation choices,” the only examples of which are mentioned are backup generators. The

¹ <https://www.townofwindsor.com/1175/PGE-PSPS>.

web site then links to a PG&E document on backup generators,² as well as a PG&E page on generator safety.³ For those residents whose entire home is run on electricity, the need for a backup generator is even more vital. And what of those who rely on electric cars? Blackouts are not limited to the summer, for instance, and where electricity is the only source for home heating in the winter months, a blackout can have serious health consequences, particularly for the elderly or chronically ill. And what of the additional impacts arising from generator use? Or even backup battery use, should such prove practicable? The record is entirely silent on these questions.

Similarly, the proposed ordinance itself and the discussion in the agenda report are lacking in detail or meaningful analysis. For instance, it is somewhat perplexing that the Town would tout the necessity of the ordinance in proposed Article 1, which discusses the impacts of climate change on a broad level, while the agenda report downplays the scope of the ordinance's impacts. If the level of increased electricity usage is so slight, then so is the concordant decrease in natural gas usage. In that case, why is the ordinance so essential? Why does the agenda report downplay the risk of fire from electrical facilities, which are known to have caused the most lethal wildfire in California history less than a year ago? On what basis does the Town assume it will only construct 150 or fewer units of low-rise residential housing per year? How does the Town's floating solar project account for increased electricity demand in the winter? In short, the discussion in the agenda report is cursory, relies on unsubstantiated assumptions, and ignores evidence of actual impacts the ordinance may cause.

This is not the only deficiency in the discussion in the agenda report. To invoke a categorical exemption means that there must be substantial evidence that the activity proposed fits within the reasonable scope of the language of the exemption. To fall within the Class 8 exemption, the activity (here, adoption of the ordinance) must be one taken by "regulatory agencies, as authorized by state or local ordinance...." Regulatory agencies are political divisions of the state, such as counties and state agencies. It is not at all clear that the Town qualifies as such. Along the same lines, to fall within the scope of the Class 8 exemption, the action to ensure environmental protection must be taken in a context "where the regulatory process involves procedures for the protection of the environment." Many of the state regulatory agencies traditionally thought of as such have certified regulatory programs which are exempt from normal CEQA procedural requirements because the Secretary for Resources has found they meet statutory criteria whereby they protect the environment in a manner equivalent to CEQA without following the CEQA process. The Town does not have, and has certainly not followed here, any

² https://www.townofwindsor.com/DocumentCenter/View/22898/FINAL_Backup-Generation-Fact-Sheet_20190531

³ https://www.pge.com/en_US/safety/electrical-safety/electric-generator-safety/electric-generator-safety.page

regulatory process that includes procedures for the protection of the environment. To the contrary, it has skipped the usual state-mandated process typically applicable to discretionary city actions by improperly claiming an exemption from CEQA and the requirement to do an initial study of the broad area of potential impact areas listed in Appendix G. Thus, under the plain language of the Class 8 exemption, it does not apply here.

Even if the ordinance were subject to a categorical exemption, it is clear that the unusual circumstances exception would apply, rendering the exemption inapplicable. (See Guidelines, § 15300.2, subd. (c).) Accordingly, substantial evidence supports a finding that the project presents unusual circumstances giving rise to the impacts discussed here, in our prior letter, and in other comments and correspondence to the Town. These unusual circumstances include, but are not limited to, the following: PG&E's express planned electricity service interruptions and/or blackouts that will potentially last for days in this and other Sonoma County areas, creating very serious health and safety problems if power is actually out that long and not resumed from a non-grid source; the jurisdiction and cumulative study area jurisdictions are in very high fire danger areas, increasing both the likelihood and seriousness of electricity blackouts; there are well-known serious traffic problems on Highway 101 making even longer commutes to Santa Rosa from northern cities by displaced homebuyers and renters who want a choice other than all-electric more environmentally harmful. Accordingly, even assuming arguendo the categorical exemption applies, there is more than a fair argument that the adoption of the ordinance may have significant adverse environmental effects due to unusual circumstances which require actual analysis in a legally adequate initial study pursuant to CEQA.

This leads to another deficiency in the agenda report's CEQA discussion. What of cumulative impacts? (See Guidelines, § 15300.2, subd. (b).) If other jurisdictions in Sonoma County or Northern California more broadly enact similar ordinances, the increase in the demand for electricity will be potentially much greater than that from the Town's alone, and so would the related impacts. What of increased generator usage? The impacts of battery purchases, which require the mining of elements such as lithium that comes with its own set of environmental problems?

In conclusion, I want to emphasize that climate change is real, and the goal of reducing greenhouse gas emissions is a laudable one. However, the law of unintended consequences applies to even the best-intended legislation. In the words of economist Thomas Sowell: "There are no solutions. There are only trade-offs." Without meaningful environmental review under CEQA, neither the Town nor the public is in a position to understand what trade-offs the ordinance may entail. A half-baked "net benefit" "analysis" is legally insufficient. Accordingly, an environmental impact report must be prepared and certified before the Town may lawfully adopt the ordinance.

Kenneth MacNab
September 18, 2019
Page 5

Thank you for your and the Town's attention to this matter. Please do not hesitate to contact me should you have any questions or concerns about the foregoing.

Very truly yours,

MILLER STARR REGALIA


Matthew C. Henderson

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October 15, 2019

VIA E-MAIL AND U.S. MAIL

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kmacnab@townofwindsor.com

Re: Town of Windsor Proposed Adoption of All-Electric Residential Reach Code (October 16, 2019 Town Council Meeting Agenda Item No. 11.2)

Dear Mr. MacNab:

As you know, this office represents William Gallaher with respect to the above-referenced matter. Thank you for providing courtesy notice of the second reading of the Town Council's proposed ordinance enacting the all-electric reach code.

I will not here recite the multiple bases of my client's opposition to the ordinance which I have previously provided in correspondence and comment at a prior Town Council meeting. However, I will note for the record that the timing of the Town's action on the proposed ordinance is curious given the highly publicized PG&E power outages that affected much of Northern California, including parts of the Town, only last week.

The PG&E shutdowns highlight a number of issues that the proposed ordinance presents that have yet to be addressed. Given the highly publicized nature of the outages, future homebuyers will naturally be more wary of purchasing all-electric homes. Will this cause such homes to sell for lower prices, thereby discouraging developers from building them? Will that cause the price of existing homes in Windsor to increase? Will it also encourage development in other areas without an all-electric reach code, thereby negating the code's purpose, increasing commute distances, and giving rise to traffic, air quality, and greenhouse gas impacts? Will the owners of all-electric homes be more likely to use generators, creating additional fire risks as well as air quality and greenhouse gas impacts? Will homes built under the reach code be equipped with storage batteries, which entail their own environmental impacts? As one of the attached articles notes, even homes equipped with solar power systems are affected by power outages, and battery systems "generally have up to two hours of backup power." How may this affect

Kenneth MacNab
October 15, 2019
Page 2

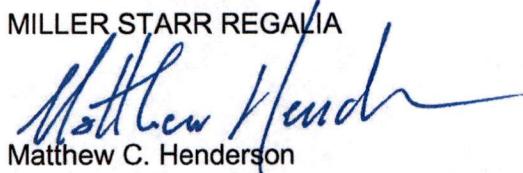
those relying on electrical power for heat in cold weather, particularly the elderly and sick? And note that deliberate shutdowns by PG&E are not the only source of outages; winter storms, earthquakes, fallen trees, wildfires, and even increased demand for electricity may also cause them as the attached document shows. The risk of power outages for all-electric homes is real, and entails any number of potential effects as discussed here and in my prior correspondence.

These questions are not academic, and the cursory analysis in the staff report does not address them. I have attached a number of recent articles on the PG&E shutdown which touch on these and other issues. Given the existence of these issues, it is plain that enactment of the ordinance is not exempt under CEQA. Accordingly, the Town must at the very least prepare an initial study before it can enact the ordinance.

Thank you for your and the Town's attention to this matter. Please do not hesitate to contact me should you have any questions or concerns about the foregoing.

Very truly yours,

MILLER STARR REGALIA



Matthew C. Henderson

MCH:klw

Enclosures

cc: Jose M. Sanchez, Esq. (jsanchez@meyersnave.com, townclerk@townofwindsor.com)
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Arthur F. Coon, Esq. (arthur.coon@msrlegal.com)

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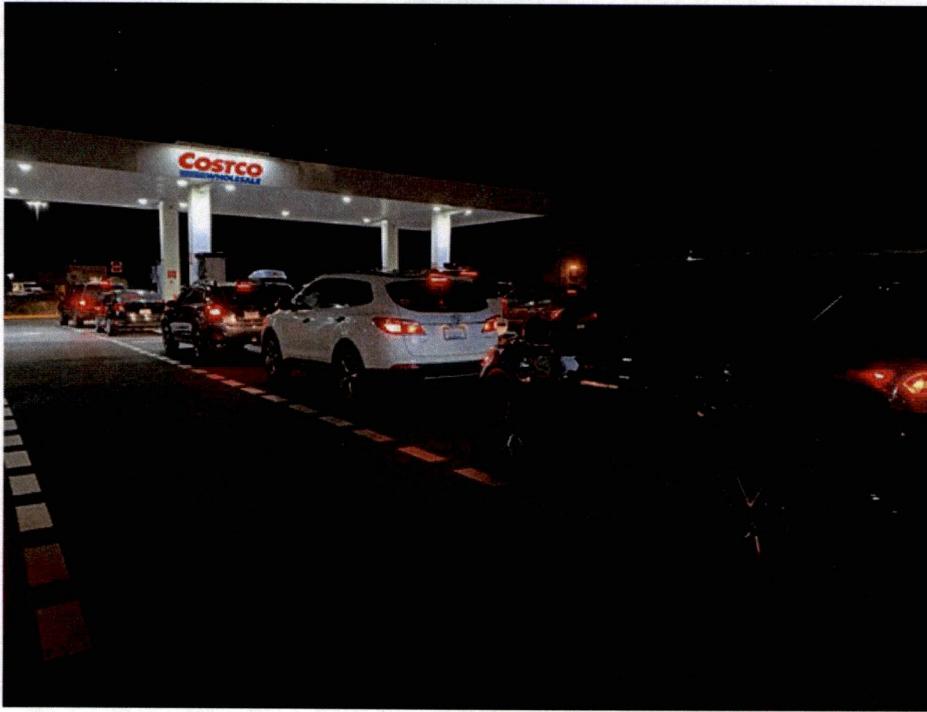
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Eureka, County Seek Info on Impacts of Shutdown While Newsom Wants PG&E to Pay

POSTED BY KIMBERLY WEAR

ON TUE, OCT 15, 2019 AT 10:47 AM

[click to enlarge](#)

MARK MCKENNA

Eureka and the county of Humboldt want to hear from you about last week's power shutdown.

The city of Eureka and the county of Humboldt are asking residents to help officials assess the economic damages and impacts to families as a result of PG&E's Oct. 9 shutdown of the power grid.

The blackout was what is known as a "public safety power shutoff," a mechanism enacted by PG&E when certain weather outlooks arise — in last week's case dry

about the author

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Bio:

Kimberly Wear is the assistant editor of the *North Coast Journal*.

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conditions and strong winds — that substantially increase the risk of a devastating wildfire.

According to a release from Eureka, the city is seeking the information via email reports because it is “pursuing a State Emergency Declaration that may in turn offer assistance to those businesses that incurred a loss.”

“Even if Eureka is not successful in securing the Emergency Declaration, we would like to know what this loss of power cost each of our businesses,” the city’s release states.

The county’s survey, which is available online ([click here](#)), is more extensive and looks to measure not just economic losses, but also how residents found out about the shutdown and how prepared they were, as well as how they were able to receive information during the outage.

Meanwhile, Gov. Gavin Newsom has sent a letter to PG&E urging the company to pay \$100 per residential customer and \$250 per small business “as some compensation for their hardships,” according to a release from his office.

“Californians should not pay the price for decades of PG&E’s greed and neglect,” Newsom says in the release. “PG&E’s mismanagement of the power shutoffs experienced last week was unacceptable. We will continue to hold PG&E accountable to make radical changes — prioritizing the safety of Californians and modernizing its equipment.”

Read the Eureka release below:

The City of Eureka is asking all businesses to provide the City with a report regarding estimated losses related to PG&E’s Public Safety Power Shut-off. Eureka is pursuing a State Emergency Declaration that may in turn offer assistance to those businesses that incurred a loss. Even if Eureka is not successful in securing the Emergency Declaration, we would like to know what this loss of power cost each of our businesses.

Please e-mail an estimate of the losses your business sustained due to the power outage. Include the name of your business, address and amount of financial loss of either product or revenue due to the outage. This information will be used to establish an overall loss sustained by businesses and government during the Public Safety Power Shut-off.

Information can be emailed to:

*Swan Asbury, Economic Development
sasbury@ci.eureka.ca.gov*

Facebook post from the Humboldt County Office of Emergency Services:

Humboldt County is powered up and back in business! Please keep an eye out for a survey that will be posted on the county website and linked here. We would like to hear from the community about how the power outage affected your family and/or business, and how we can improve preparedness and communication efforts.

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Tags: Survey, city of Eureka, county of Humboldt, PG&E, Public Safety Power Shutoff, outage, businesses, economic losses, state emergency declaration, Image

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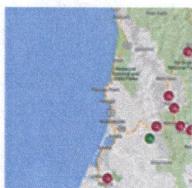
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by Thadeus Greenson



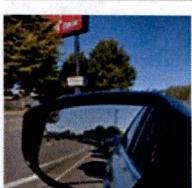
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SECOND UPDATE: Shutdown to Hit Humboldt

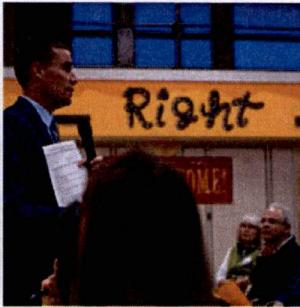
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What You Need to Know About Backup Generation

May 2019

Power outages can happen at any time

Backup electric generators can be a part of any preparedness plan. Backup electric generators operate as a stand-alone power source and are not connected to PG&E's power grid. Generators are typically powered by solar with backup storage, battery, natural gas, gasoline, propane or diesel fuel.

Determining if a generator is right for you

Electric backup generators can keep the lights on, help appliances stay running, save perishable food, and power essential equipment and electronics during a power outage. Generators can also be expensive, noisy, and pose safety hazards. It's important to understand how to safely operate your generator before an emergency occurs. This means doing regular safety checks and being sure you have enough fuel to last a few days.

Consider these factors when deciding whether you need a generator:

- ENERGY NEEDS** | Do you own certain devices or equipment that need to keep functioning in the event of a loss of power? How crucial is it for you to have power during an extended outage? This is especially important for customers who are dependent on life-support equipment or require special heating or cooling needs for a medical condition.
- NOISE** | Are there community ordinances where you live or work that restrict or limit the decibel level allowance for outdoor equipment?
- COST** | Generators can cost thousands of dollars. Take any immediate needs into consideration as you examine which generator option may be the best choice for you.

Choosing the right generator

If you decide to purchase a generator, explore what kind of generator will work for you.

Factors to consider include:



YOUR ENERGY NEEDS

Generators can produce enough electricity to power your phone and laptop or your whole home. Consider what critical items, appliances and equipment you would need during an outage.



FUEL PREFERENCES

Your preference may be determined by environmental concerns, accessibility, affordability, and available space for secure generator storage. Some fuel types are: gasoline, propane, natural gas, diesel and renewable energy.



INSTALLATION REQUIREMENTS

No matter what type of generator you have, whether small-battery operated, portable or permanent standby, always consult the owner's manual for detailed instructions and safety guidelines prior to operation.

Visit pge.com/backupgeneration for more information

Using your generator correctly and safely

If you don't understand how to use your generator, you risk damaging your property, endangering your life and endangering the lives of PG&E crews who may be working on power lines in your community.



FOR YOUR SAFETY: Understand and follow all safety instructions provided by the manufacturer. Never connect any generator to another power source, including PG&E power lines.

Portable generator safety

- Be sure that the power needs of the device (electric load) is supported by your generator and does not exceed the manufacturer's specifications.
- Position your generator where its exhaust can vent safely to prevent carbon monoxide poisoning, which can be fatal.
- Only use extension cords that are properly sized for an individual generator's electric to prevent overheating. The American Wire Gauge (AWG) chart can be utilized to determine which extension cord is right for you.
- Keep cords out of high-traffic areas so they don't present a tripping hazard.
- Never run cords under rugs or carpets where heat can be generated or where damage to a cord may go unnoticed.



Do

- Purchase the right generator
- Plan and test generator before use
- Put safety first!



Don't

- Run a portable generator in the garage or the rain
- Ignore instructions
- Store fuel inside the house

Permanent-standby generator safety

- Installation requires a licensed electric contractor or other qualified professional.
- Ensure electricity from your generator does not flow or "backfeed" into PG&E's power lines. The most common way to prevent backfeeding is to install a "double-pole, double-throw transfer switch" along with your permanent standby generator.
- Any additions or adjustments to your house wiring should be inspected by your city or county building department.
- Once installation is complete, call PG&E at **1-800-743-5000** to let us know about your back-up system. PG&E line workers will then be aware of your generator when working on an outage in your area.

Always be prepared.

Power outages can occur because of extreme weather and high fire danger conditions, natural disasters, storms, earthquakes or other unforeseen events. Backup generation can be a helpful tool in any emergency preparedness kit. For solar customers, please note that during an electric power outage, your solar system will not function unless designed to work with a battery or standby generator. For more information, call your solar or battery provider. Additional tips on how to prepare for an emergency or extended outage can also be found at pge.com/beprepared.

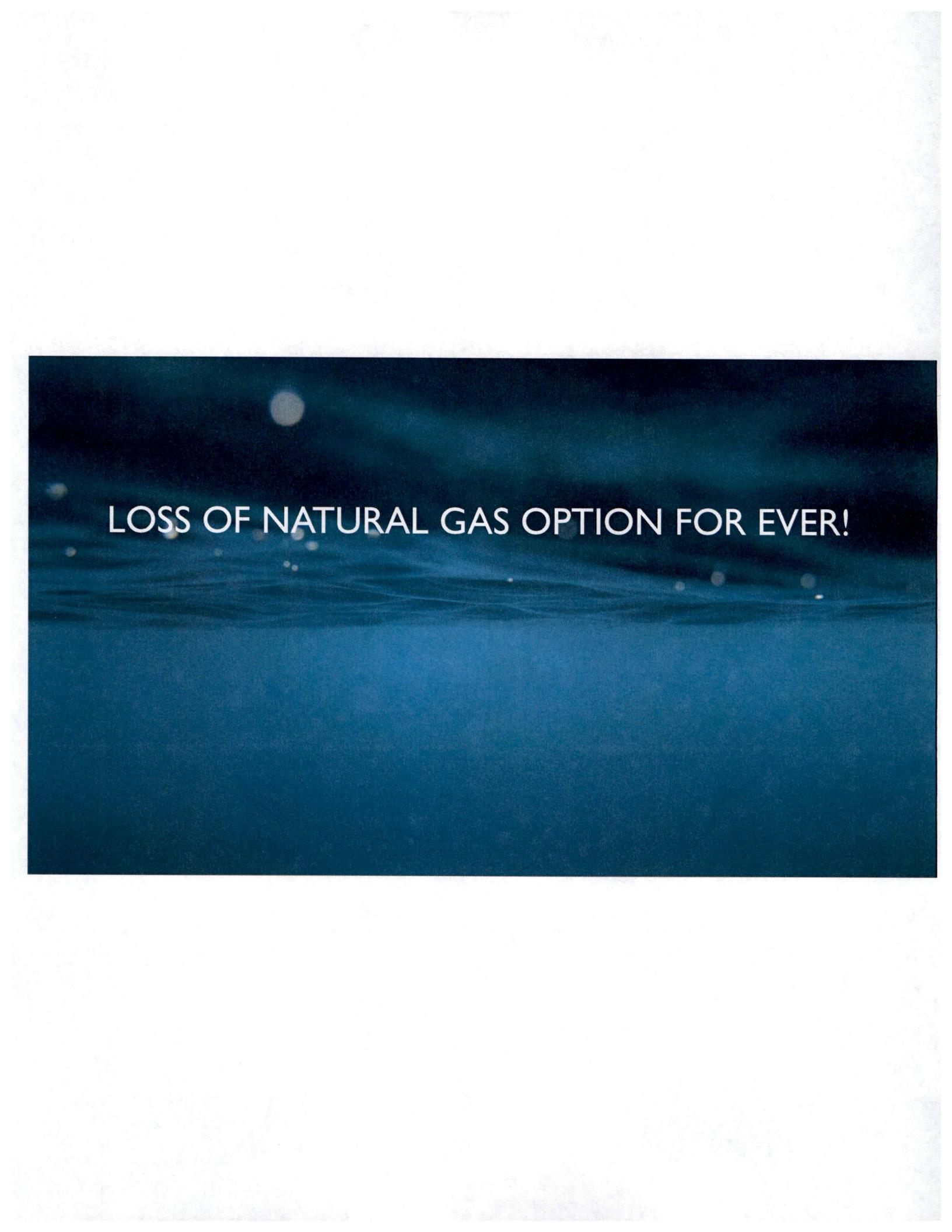
From: [Michael Fitzpatrick](#)
To: [Bruce Okrepkie](#); [Sam Salmon](#); [Dominic Foppoli](#); [Debora Fudge](#); [Esther Lemus](#)
Cc: ["Michael Fitzpatrick"](#)
Subject: Meeting comment on REACH code
Attachments: [Loss of natural gas option for ever!.pdf](#)

To Windsor Town Council

Re: REACH code

I have attached a quick presentation outlining the need to retain gas in the street. It addresses some of the overlooked areas within staff's report. I have no issue with all electric I do not believe this is the way to get there.

Michael Fitzpatrick
211 Othello Ct
Windsor Ca
Phone 291-2126



LOSS OF NATURAL GAS OPTION FOR EVER!

WHAT IS IT THAT WE ARE LOSING

- Loss of on-site generation during power shut offs for those with medical needs.
Diesel generation would present environment risks with site storage
- Loss of gas distribution to future commercial sites
- The inclusion of commercial parcel in the Arata north developments would be without gas if this ordinance passes
 - Running the gas extension for just commercial would be cost prohibitive
 - Spreading The cost over the entire parcel would now be illegal.
- All single-family homes and multi family will now have Air Conditioning (heat pumps are air conditioners that operate in reverse when heating) the study made the assessment that all home have air conditioning already.
Not sure how this save energy?
- Current on-site gas use is in the 96 % efficiency range for both space and water heating.

Where will the additional electric power come from?
NATURAL GAS

Natural Gas Fired Power Plants

State-of-the-art combined-cycle gas turbine (CCGT) efficiency now exceeds 60%, with expected improvements to 65% efficiency over the next decade. Top open-cycle gas turbine (OCGT) efficiency is at around 42%, up from around 35% in 1990.

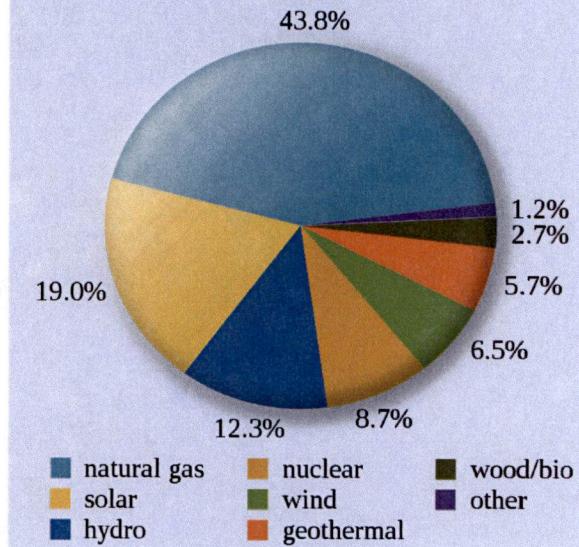
THIS EFFICIENCY IS NOT GOING TO HELP THE CO₂ EMISSIONS

IEA: Tracking Progress: Natural gas-fired power 5/16/2017

SOURCE OF ELECTRIC ENERGY GENERATION IN CALIFORNIA

- 43% Of our electrical supply is derived from natural gas
- In home natural gas is burned at higher efficiencies thus less co2
- Moving to electric will not eliminate co2. It just moves it to a different location.

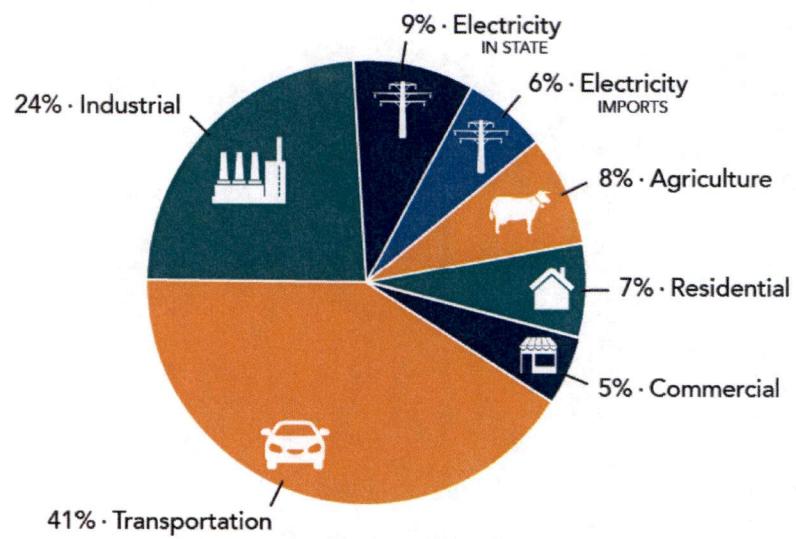
Sources of Electricity Generation
California - 2018



CO 2 EMISSIONS PER SECTOR

Please note that electric and gas usage is included within the 7% co2 attributable to residential.

This proposal has selected the wrong target, if co2 reduction is truly the goal.



424.1 MMTCO₂e
2017 TOTAL CA EMISSIONS

YOU HAVE SELECTED THE WRONG TARGET .

WHY SHOULD WE TRUST THE MODEL?

News in Focus Business & Money Science & Tech Lifestyle & Health Policy & Public Interest People & Culture

LEED Certification Fails to Increase Energy Efficiency, Says Environmental Policy Alliance

Release of D.C. Energy Benchmarking Data Shows LEED-Certified Buildings Use More Energy and are More Expensive

NEWS PROVIDED BY
[Environmental Policy Alliance](#) →
Feb 28, 2014, 05:08 ET

SHARE THIS ARTICLE



LEED EXPOSED DETERMINED ENERGY CONSUMPTION BY COMPARING THE WEATHER-NORMALIZED, SOURCE ENERGY USE INTENSITY, OR EUI (A UNIT OF MEASUREMENT THAT REPRESENTS THE ENERGY CONSUMED BY A BUILDING RELATIVE TO ITS SIZE), FOR BOTH BUILDINGS CERTIFIED BY THE USGBC AS "GREEN" AND THOSE THAT HAVE NOT GONE THROUGH THE USGBC'S EXPENSIVE PERMITTING PROCESS. FOR LEED-CERTIFIED BUILDINGS, THEIR EUI WAS 205, COMPARED TO 199 FOR NON-CERTIFIED BUILDINGS. IRONICALLY, USGBC'S HEADQUARTERS (WHICH HAS ACHIEVED THE HIGHEST LEVEL OF LEED CERTIFICATION) IS EVEN WORSE AT 236.

ELECTRIC RATES

CALIFORNIA RANKS 7TH MOST EXPENSIVE

Rank	State	Ave /KWH	Rank	State	Ave /KWH	Rank	State	Ave /KWH
1	HI	33.43	18	DC	13.87	35	MS	11.94
2	CT	23.35	19	MN	13.86	36	GA	11.75
3	AK	22.65	20	KS	13.58	37	FL	11.73
4	MA	22.27	21	MD	13.45	38	NE	11.69
5	RI	20.95	22	AZ	13.25	39	MT	11.66
6	NH	20.72	23	IN	13.06	40	WY	11.57
7	CA	18.89	24	OH	12.93	41	NC	11.54
8	ME	18.14	25	AL	12.9	42	ND	11.41
9	VT	17.39	26	VA	12.46	43	OR	11.25
10	NY	17.38	27	SC	12.38	44	KY	11.18
11	NJ	16.8	28	NV	12.34	45	TN	10.99
12	MI	15.74	29	NM	12.21	46	UT	10.5
13	WI	15.34	30	MO	12.2	47	OK	10.42
14	PA	14.24	31	SD	12.17	48	ID	10.37
15	IL	14.14	32	TX	12.06	49	AR	10.19
16	IA	14.02	33	CO	12.02	49	LA	10.19
17	DE	14	34	WV	11.98	51	WA	9.81

This is not way to help the affordability gap. More funds will be required to pay utility cost. Get the electric rates more in line with the nation and some of these features would be utilized with out a mandate.

THINGS TO CONSIDER BEFORE YOU VOTE

- The report that is behind this was not, as is indicated in your staff report, done by the "Statewide Codes and Standards Program," (a state of California Program) it was commissioned by PG&E and the consultant paid for with "public goods" funds from the California Public Utilities Commission. (see report face page)
- The staff report stated that natural gas posed a danger to Windsor in the event of an earthquake but fails to bring forward the fact that the cause of the most destructive fire in in this region was caused by electric wires.
- There is great energy saving with some of these new fixtures, but they are not co2 free. Co2 at another location is still co2.
- **YOU must make a finding that this change will not result in more energy being used.**
 - I submit that with the addition of Air Conditioning to all new structure there will be an increase in energy used.
 - Heat pump water heater are slow to heat and are backed up with electric resistance heating elements
- **YOU must make a finding that there is no additional cost associated with this program,**
 - I submit that the mechanical cost will be considerable higher than are projected in this report due the fact most home in the entry level do not have Air Conditioning included as a standard feature in our climate zone.
 - I would implore you to keep natural gas in the joint trench. Omitting it will be to expensive to correct.
 - This was the only way to make this program cost effective which, should make you question it.

NCBE Board votes to oppose '*Reach Codes*' being considered by several local Sonoma County cities

We've been warning NCBE members that the so-called '*Reach Codes*' were moving along quickly in some local cities and that is precisely what's happening.

At least five local jurisdictions have begun the process of holding study sessions and community outreach meetings to get input on the concept of having all new residential construction be constructed as electric-only effective January 1st, 2020.

At its August meeting last Monday, NCBE's Board of Directors voted overwhelmingly to oppose the adoption of Reach Codes in local cities after hearing reports on the potential of higher building costs and the loss of an option for gas appliances and service for new homebuyers, even if that were their preference.

The '*Reach Codes*' would be more restrictive than the State Codes that go into effect next January 1st and would require all 3-story and under residential buildings be all-electric with no gas hook-ups as an option.

Town of Windsor Town Council
9291 Old Redwood Highway Windsor,
California 95492

October 12, 2019

You are tasked with deciding on amending the California Building Code with a mandate of all electric in newly constructed residential construction up to 3 stories in height. There are 2 finding that must be made, for you to find in the affirmative.

- 1) The amendment as crafted will not cause the structure to use more energy.
- 2) The amendment as crafted will not increase the cost of construction

Town staff have assembled a plethora of documentation that values this action as a Green House Gas (GHG) reduction measure, GHG reduction is not part of the findings, and must not influence you, or effect your ability to make a finding on the facts presented pertaining to the 2 findings that need to be made.

Attached please find factual estimates procured from local contractors licensed by the state of California to perform work in the particular phase.

I say factual because the modeled energy report does not include any factual cost information. They rely on "internet pricing" for products, without mark up and delivery/ handling charges, all of which will be included when bidding a project.

The report did not reference or put forth any licensed contractors estimates used to create their pricing. They did not reference any contractors from the local stock, again a comparison of apples to oranges. Staff has also failed to seek contractor pricing for these measures, and relied on the report, even though they have been constantly informed the prices suggested by the author are not factual and completely out of line with construction cost and practices.

With the facts now available to you, there is absolutely no dispute that all electric will cost more on the initial instalation, and as such does not meet the burden imposed by the state that no action may be taken that creates additional cost.

I have included also additional cost that would result according to the Towns assumptions, that the PV system would need to be almost doubled in size, even if this were to be backed out there is still a significant increase in construction costs.

Page 2-6 of the staff report

(Therefore, the size of the PV system installed for new low-rise residential development would likely exceed the minimum required by the Building Code, resulting in a decrease in the use of electricity. For purposes of this analysis, the Town has assumed that the average PV system installed will be a 4.87-kilowatt system, which is smaller than the current average system installed in Sonoma County, but larger than the minimum system required under the 2019 Building Code)

The building code system according to the staff report need only be 2.8 – kilowatt

This additional PV cost is not included in the cost-effective study.

Michael Fitzpatrick
211 Othello CT.
Windsor

COST ESTIMATES FROM LOCAL CONTRACTORS
BASE LINE SINGLE STORY HOME 2000 sf

INSTALL GAS MAIN AND SERVICE LATERAL	\$	1,200.00
PG&E 50 % REFUND ON COST. (NET SAVINGS)	\$	(600.00)
INSTALL GAS IN THE HOUSE (NET SAVINGS)	\$	(2,700.00)
ADDED ELECTRIC CHARGES FOR 220 AMPERAGE OUTLETS	\$	1,800.00
CHANGE FAU TO HEAT PUMP COST DIFFERENTIAL	\$	6,315.00
NEW HOME COST INCREASE FOR ALL ELECTRIC	\$	4,815.00

Staff has indicated that there assumption on added energy offset are based on a PV system that is 2KW larger than code required @ \$3.50/kw (pricing is from table 4 of staffs energy analysis)	\$	7,000.00
<i>Pg 2 of 6 Protection of the environment</i>		

Total added expense to a new home	\$	11,815.00
--	-----------	------------------



September 24, 2019

Cal Custom Building Services, Inc.

Re: Proposal for gas line

Craig,

Oak Grove Construction Co. (OGC) is pleased to submit the following proposal.

Our current market rate pricing to install 2-inch HDPE gas main in open, common occupancy joint trench, complete with fusion tee and residential service riser, tracer wire and marking tap is \$1,200.00 This price assumes all trenching, sand backfill and compaction is performed by the joint trench subcontractor. Price also assumes 60 LF of lot frontage and up to 40 LF of $\frac{1}{2}$ " service lateral. Pricing specifically excludes PG&E meter and connections. Please advise if we can be of further assistance.

Best Regards,

Doug Hamilton

President, OGC

From: Michelle Boom
To: Craig Lawson
Subject: Gas Line within Home
Date: Tuesday, September 24, 2019 10:02:12 AM

Hi Craig -

Per our discussion, to provide gas to a standard 2,000sf track-type home would be approximately \$2,700.00. This includes running pipe from the meter to (1) dryer, (1) range/stove, (1) water heater, (1) fire place, and (1) furnace. This does not include the site work to bring it from the services to the meter and does not include any cost of appliances or connection.

Please let me know if you need any further information.

Thank you.

Michelle Boom

Contract Administrator
LeDuc & Dexter, Inc.
Lic. #548129
707/575-1500 - Phone
707/575-8535 - Fax

www.leducanddexterplumbing.com

"Whether you think you can or you think you can't, you're right." ~ Henry Ford



ELECTRIC

Contractor License Number 1008300
572 Martin Avenue Ste. A
Rohnert Park, CA 94928
707-595-3837

Cost Comparison:

To: Craig Lawson

In Regard to: Pricing exercise, all electric appliances

Craig,

Per your request, RCA performed a pricing exercise to compare the cost to install power for (4) household appliances that commonly use both gas and electrical power versus appliances that use strictly electrical power. The comparison showed an increased cost of \$1,800 to power the (4) all-electric appliances. Items impacted include increased wire and breaker size and specialized receptacles.

Signed,

By: _____

A handwritten signature in black ink, appearing to read "Michell Eads".

Date: September 23, 2019

Michell Eads, Project Manager, RCA Electric, Inc.



To Whom it May Concern:

The following information is for the price difference for a Nature Gas Heater only with no Air Conditioning and for a Heat Pump System that does both Heating and Cooling. This cost is based on pricing for a 2000 square foot home.

Gas Heater only no Air Conditioning

- (1) Gas Furnace
- (1) PVC Flue

\$2002.00

Split System Heat Pump

- (1) Indoor Air Handler
- (1) Outdoor Heat Pump & Added Field Labor
- (1) Freon Lines & Added Field Labor
- (1) Heat Strip
- (1) Concrete Pad

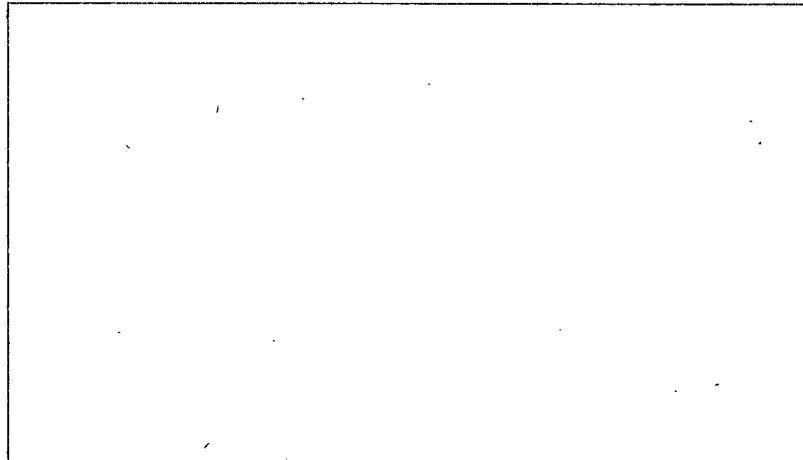
\$8317.00

Thank You,
Jeff Pratt
Simpson Sheet Metal, Inc.
Residential Estimator

Many Shasta PG&E customers have ongoing medical needs. How'd they fare during the outage?

Michele Chandler, Redding Record Searchlight

Published 10:05 a.m. PT Oct. 11, 2019 | Updated 4:33 p.m. PT Oct. 12, 2019



In Mountain Gate last Friday, diabetic Michelle Morrow had been without power at her home since Tuesday night.

She's always concerned about keeping her insulin — which she must administer once a day — at the proper temperature.

"With Type 1 diabetes, I rely on insulin for everything," Morrow said. "Without it, I would literally die."

So she packed her refrigerator with three solid 10-pound blocks of ice bought at WinCo Foods.

Down in Redding, Dan Janssens' 90-year-old mother, Mia, struggles with chronic lung disease.

With no power at their north Redding house during Pacific Gas and Electric Co.'s widespread shutoffs to minimize wildfire risk, the device they typically use to fill heavy metal canisters with oxygen didn't work.

Previous: [PG&E says it's making efforts to notify customers with critical needs](#) (/story/news/local/2019/10/09/pg-e-says-its-making-efforts-notify-customers-especially-those-critical-needs/3913805002/)

That's why Janssens came to Shasta College on Thursday afternoon. He'd plugged the device up to one of the power chargers set up under a giant tent in the college's parking lot for residents without power to use.

"With an elderly person, you just sit with them and keep them calm. They need routine," Janssens said, "and this is totally not routine."

These are just two examples of how PG&E's intentional shutoff that stretched throughout much of last week created worrisome consequences for some people with chronic medical conditions.

ADVERTISEMENT

Ad

Student Debt? Not for long.



 SoFi Lending NMLS#1121636

Shasta County has one of the highest percentages of households in California enrolled in PG&E's Medical Baseline Program, which helps customers with special energy needs tied to specific medical conditions to pay their power bills.

At least 1,146 PG&E customers in Shasta County have some sort of life support need, Shasta County Health and Human Services Agency spokesman Tim Mapes said.

"I have no doubt that there's probably folks going to the emergency room that have been compromised in some way as this thing drags out," Dean Germano, chief executive officer of the Shasta Community Health Center in Redding, said late last week, as the power remained down in many communities.

By Saturday afternoon, the power had been restored throughout Shasta and Tehama counties, alleviating worries for many medically needy people and their providers.

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https://cm.redding.com/specialoffer?gps-source=ADDTHEMOE&utm_source=dot&utm_medium=house&utm_campaign=PGEpowerwind&utm_content=embed&utm_term=P

[\).](#)

No power at some patients' homes

When the shutdown began, companies like Interim HealthCare in Redding had been busy serving patients needing home health services or end-of-life care.

Some affected patients typically use electric scooters, electricity-powered wound-care devices, or CPAP and other specialized machines that help people with chronic lung conditions breathe, said Interim HealthCare Administrator Cindy Seawright.

"We just had to triage all our patients," Seawright said. "We had to call them, see if they had generators, if they had backup O2 tanks."

ADVERTISEMENT

Ad

Student Debt? Not for long.



 SoFi Lending NMLS#1121636

Some people who'd been using an electrical device to manage chronic wounds had to be switched to conventional dressings, she said.

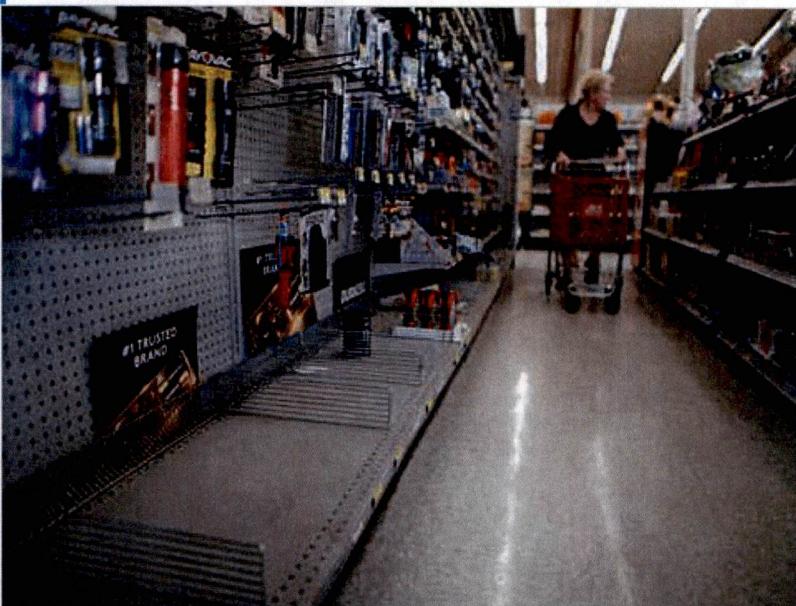
MORE: [Generators, batteries, ice selling fast as PG&E outage lingers on](#) (/story/news/local/2019/10/10/generators-batteries-ice-selling-fast-pg-e-outage-lingers/3926713002/)

And since land phone lines don't work if there's no power — and not all their patients have mobile phones — "we make visits and check on them to make sure that they're OK or call family members to see if they've heard from them," Seawright said.

About 20 to 30 of Interim's patients who live in Red Bluff, Anderson and Cottonwood had been affected by the outage.

DIG DEEPER

California power shutdown



- [PG&E power outage: California residents react to #PGEpowershutdown with humor, frustration](https://www.redding.com/story/news/2019/10/09/pge-power-outage-california-pacific-gas-electric-reactions/3918254002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
(https://www.redding.com/story/news/2019/10/09/pge-power-outage-california-pacific-gas-electric-reactions/3918254002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
- [Here's how the PG&E blackout is affecting sports in Shasta County](https://www.redding.com/story/sports/2019/10/09/pg-e-blackout-shasta-county-sports-anderson-west-valley-redding-christian/3918795002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
(https://www.redding.com/story/sports/2019/10/09/pg-e-blackout-shasta-county-sports-anderson-west-valley-redding-christian/3918795002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
- [PG&E power outage: New website coming soon; PG&E says its equipment alone isn't to blame](https://www.redding.com/story/news/local/2019/10/09/pg-e-power-shutoffs-what-know-wednesday/3913992002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
(https://www.redding.com/story/news/local/2019/10/09/pg-e-power-shutoffs-what-know-wednesday/3913992002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
- [PG&E power shutdown map: See who's impacted by California's Public Safety Power Shutoffs](https://www.redding.com/story/news/2019/10/08/california-power-outage-map-how-pg-e-power-shutoffs-impact-you/3915297002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
(https://www.redding.com/story/news/2019/10/08/california-power-outage-map-how-pg-e-power-shutoffs-impact-you/3915297002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
- [PG&E says it's making efforts to notify customers, especially those with critical needs](https://www.redding.com/story/news/local/2019/10/09/pg-e-says-its-making-efforts-notify-customers-especially-those-critical-needs/3913805002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)
(https://www.redding.com/story/news/local/2019/10/09/pg-e-says-its-making-efforts-notify-customers-especially-those-critical-needs/3913805002/?utm_source=oembed&utm_medium=onsite&utm_campaign=storylines&utm_content=news&utm_term=3918089002)

No power at some clinics

Germano, of the Shasta Community Health Center, said on Friday that the group's clinic in Anderson has been closed since PG&E turned the power off about 9 a.m. Wednesday.

Patients, as well as the Anderson center's seven physicians, nurse practitioners, physician assistants and dentists, were temporarily re-routed to the center's offices in Redding, 12 miles away.

Usually 50 to 75 medical and dental patients are seen in Anderson daily. Only half of them made it to Redding, Germano said, likely because of issues finding transportation or child care.

PG&E power outage: [California residents react to #PGEoutage with humor, frustration](https://www.redding.com/story/news/2019/10/09/pge-power-outage-california-pacific-gas-electric-reactions/3918254002/) ([/story/news/2019/10/09/pge-power-outage-california-pacific-gas-electric-reactions/3918254002/](https://www.redding.com/story/news/2019/10/09/pge-power-outage-california-pacific-gas-electric-reactions/3918254002/))

One patient who came to be seen in Redding has a chronic lung disease but hadn't been able to use her nebulizer, an electric-powered device that delivers medication in an inhaled mist.

"She was exhibiting pretty severe wheezing on exam, and we had to arrange for treatment here and trying to connect her with someplace with power so she could actually be able to use her nebulizer," Germano said.

In another case, a woman needing a power-assist chair after hip surgery was "stranded" as her family scrambled to figure out what to do before finally getting a generator so she could use the chair.

Germano said he was left thinking "how many folks are out there that are on their own or don't have the means to go out and buy or find a generator." Those are the people most likely to suffer health ills from not having power, he said."As this thing progresses, certainly I think there's a disproportional impact on lower-income people trying to find work-arounds," Germano said.

PG&E power outage: [In one town hit, residents take care of business and each other](#) ([/story/news/local/2019/10/10/one-town-hit-pg-es-power-outage-residents-take-care-business-and-each-other/3915572002/](#))

With the power back on, immunizations needing refrigeration must be moved from Redding, where they'd been taken temporarily, taken back down to Anderson.

That could result in further delays for patients.

"It's been very disruptive for us," Germano said.

Charlotte Haisch, director of home health and hospice for Dignity Health Redding, said staff began calling patients as soon as they learned of PG&E's plans to turn off electricity to many households.

About 150 of the service's 275 patient in Shasta and Tehama counties have lost electricity due to the PG&E outages.

The service identified patients who rely on medical devices requiring electricity and people who must ensure medications are properly refrigerated. They devised alternatives such as ice chests or pre-filled backup oxygen tanks to carry medically vulnerable people through until their power is restored.

The first morning after the shutdown, Mercy's staff was back in touch via telephone or in person to see if there were any issues.

"It's going very well for our patients," said Haisch. "They were quite well prepared."

Medical workers and facilities prepare for such electricity outages, which local Dignity officials say occur with surprising frequency.

Haisch said her office receives alerts between one to four times a month about power outages that could affect patients.

"What the community doesn't realize is how many times this happens to us, not to the extent of 800,000 people in California," Haisch said.

"There are constantly power lines going out," she said. "Cars hit power lines and a whole neighborhood will go out."

MORE: [Here's how the PG&E blackout is affecting sports in Shasta County](#) ([/story/sports/2019/10/09/pg-e-blackout-shasta-county-sports-anderson-west-valley-redding-christian/3918795002/](#))

Michele Chandler covers city government and housing issues (<https://www.redding.com/search/michele%20chandler/>) for the Redding Record Searchlight (<https://www.redding.com/>)/USA Today Network. Follow her on Twitter at [@MChandler_RS](#) (https://twitter.com/MChandler_RS), call her at 530-225-8344 or email her at michele.chandler@redding.com. Please support our entire newsroom's commitment to public service journalism by [subscribing today](#), (https://offers.redding.com/specialoffer?gps-source=CPNEWS&utm_medium=onsite&utm_source=news&utm_campaign=NEWSROOM&utm_content=michelechandler).

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Tom Micheletti
Windsor Jensen Land Company, LLC
256 West MacArthur Street
Sonoma, CA 95476

Mr. Ken MacNab
City Manager
Town of Windsor
9291 Old Redwood Highway
Windsor, California 95492

September 3, 2019

Re: Town Ordinance Adopting All-Electric Reach Code

Dear Mr. MacNab:

As members of the building industry and citizens of the State of California, we are concerned that the Town of Windsor's implementation of an All-Electric code will result in significant negative impacts to the environment and result in added threats to the health and safety of the community.

In addition, the implementation of the code will have substantial negative impacts to the economic viability constructing new homes which will further exacerbate the current housing crisis.

Accordingly, we do not believe this ordinance is exempt under Section 15308 of the CEQA Guidelines and requires further review and study.

Negative Impacts to the Environment and a Threat to Public Safety

People looking to move to Windsor do so with the foremost intention of creating a safe home for their family. Second, they envision turning their homes into a welcoming space to gather and entertain, which in many instances, will include sharing a meal together that, weather permitting, can be prepared on an outdoor grill.

Needless to say, denying new residents of Windsor with the ability to connect their grills to natural gas will not dissuade these families from gathering and cooking outdoors on an open flame. Therefore, as a direct result of the implementation of the all-electric code, families will be forced to turn to less safe and higher CO₂ emitting fuel sources such as wood, charcoal and propane.

According to the Environmental Protection Agency, the pounds of CO₂ emitted per million British thermal unit of energy (the "CO₂ Factor") for natural gas is 53.06 (US Environmental Protection Agency, 2018). By comparison, the CO₂ Factor for Wood and Wood Residuals is 93.80 (77% higher than natural gas), and the CO₂ factor for Propane Gas is 61.46 (16% higher than natural gas).

Furthermore, Propane grills pose a substantially higher risk of causing home fires. According to the National Fire Protection Association (Ahrens, 2019), annually there are 10,200 home fires caused by grilling of which 7,500 (74%) involve grills fueled by liquid propane gas. By comparison, only 1,000 home

fires (9%) involve grills fueled by natural gas. Propane tanks also pose a safety risk to fire fighters as the tanks can leak or rupture during a wildfire and result in explosions.

In addition to outdoor cooking, many families seek to enjoy outdoor living by including either an outdoor fireplace and/or an outdoor fire pit in their backyard landscaping. With an all-electric code, the environmentally superior option of a natural gas fixture will be eliminated, leaving homeowners with the choice of a wood burning fireplace or firepit. According to the EPA one, wood burning stove can emit as much air pollution as five diesel trucks. The United Nations also recently issued a report that concluded that the two biggest culprits in the developed world in generating black carbon are wood burning and diesel vehicles. Black carbon is a problem because it absorbs heat, which, repeated on a global scale, is a major cause of short-term climate change.

Finally, reliance on a single energy source puts the health and safety of families at risk in the event of a wildfire, earthquake or other natural disaster. PG & E has stated that electricity may be shut off, for several days, when gusty winds and dry conditions, combined with heightened fire risk, are forecasted. Accordingly, families in an all-electric home may be denied access to heat or method to purify water during a natural disaster. In addition, families without power will be reliant on gasoline or diesel powered generators, a significant source of GHG emissions, whose impacts to the environment should also be reviewed.

Practical Impact to the Environment

According to the EPA (US Environmental Protection Agency, 2017), 5.2% of GHG emitted in 2017 by the United States was from the residential sectors of which 89.0% of GHG was emitted from the burning of fossil fuels, primarily for heating. There are 127,590,000 households in the United States, in 2018 permits were issued for 1,328,800 new housing units (or 1.03% of the existing households).

If all new homes built in the United States in 2018 were all-electric, the total estimated reduction in the US Annual GHG emission would only be 0.0536%.

However, we must also consider that the vast majority of residential GHG emissions from fossil fuels in the United States is due to the combustion of heating oil and propane in cold weather states. Due to its Mediterranean climate, the use of fossil fuels to heat homes in Windsor is a fraction of that of States with cold winters.

Therefore, the reduction of GHG through the implementation of an all-electric code, even if it were applied to all municipalities in the United States with mild winters, will have an extremely limited positive impact, if any at all, to climate change. After factoring in the unintended consequences, an all-electric code might actually increase greenhouse gas emissions.

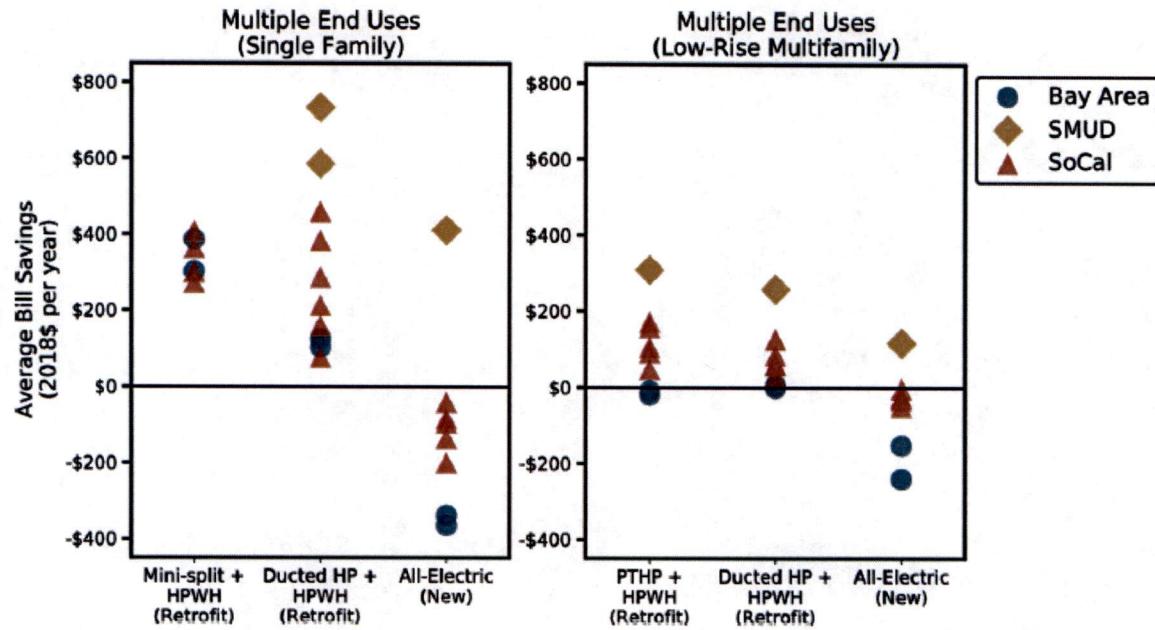
Economic Justification: Consumer Bill Impacts and Lifecycle Costs and Savings

Frontier Energy, Inc., the co-author of the “2019 Cost-effectiveness Study: Low-Rise residential New Construction” (the “July 2019 Study”), also authored and published a study on their website in April 2019 entitled “Residential Building Electrification in California” (the “April 2019 Study”).

Although, the July 2019 Study indicated a cost savings with respect to consumer bills and lifecycle costs, the April 2019 Study clearly shows an increase in costs for “Bay Area” consumers purchasing new homes (see tables below).

"Residential Building Electrification in California" (April 2019)

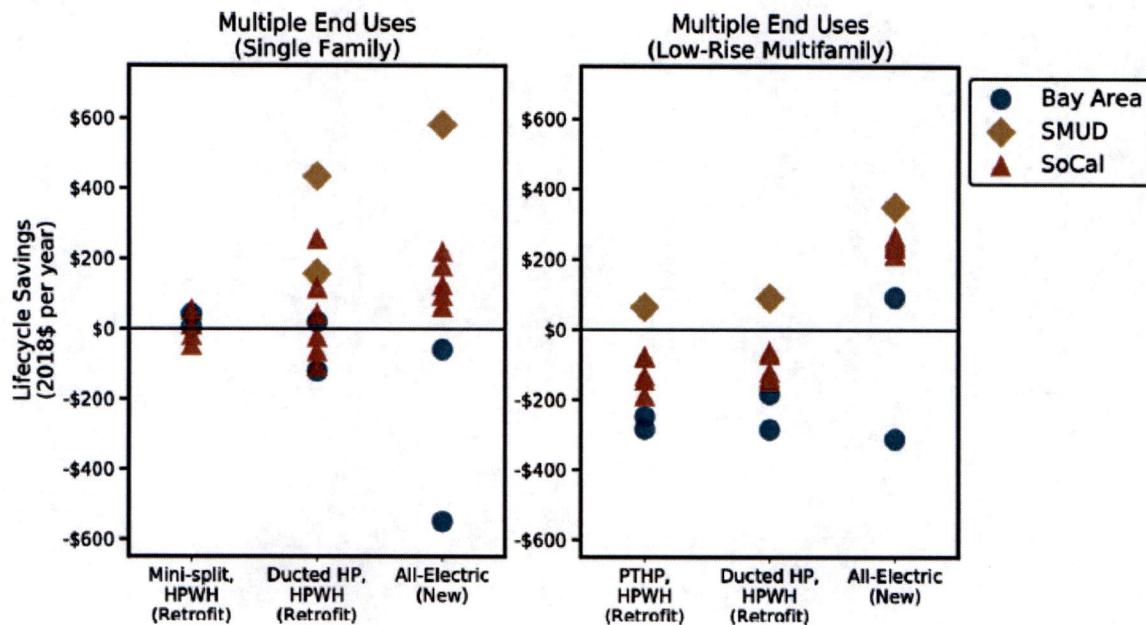
Figure 3-19. Average consumer bill impacts of electrifying multiple end uses, electric rate sensitivity



The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to gas end uses. For retrofit homes, bill impacts reflect electrifying both HVAC and water heating systems. For new construction homes, bill impacts of electrifying an entire home are shown including electric air source heat pump, heat pump water heater, cookstove and clothes dryer.

"Residential Building Electrification in California" (April 2019)

Figure 3-28. Lifecycle savings of electrifying multiple end uses, electric rate sensitivity



The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Electrification of HVAC and water heating only is assumed for retrofit homes, and electrification of all end uses is assumed for new construction homes. Savings are relative to gas alternatives. Single family new construction homes have electric induction stoves and electric heat pump clothes dryers in addition to HVAC heat pumps and HPWHs. LRMF new construction homes have electric resistance cookstoves and electric resistance clothes dryers in addition to HVAC heat pumps and HPWHs. Positive values represent savings in both capital and operating costs throughout the lifetime of all appliances over the gas counterpart; negative values indicate lifecycle costs. Heat pump technologies here are the same as modeled for individual appliances above. The new construction blue dot (Bay Area) is an outlier here because in the gas baseline there is no air conditioning assumed.

Further, Frontier also states in the April 2019 study that:

"PG&E's electric rates are assumed to increase faster than the natural gas rates due to wildfire risk and liability, while SCE's, SMUD and LADWP's rates are assumed to increase at the same pace at the gas utility in their service territory."

However, the July 2019 Study assumed a "Statewide Electric Residential Average Rate" of 2% per year from 2020 to 2025 and 1% thereafter. It appears that Frontier used a lower rate escalation in their July 2019 Study versus their own, publicly available April 2019 Study. Therefore, we believe the positive cost benefits of the implementation of an all-electric code in Windsor are misstated.

Table 24: Real Utility Rate Escalation Rate Assumptions

	Statewide Electric Residential Average Rate (%/year, real)	Natural Gas Residential Core Rate (%/yr escalation, real)		
		PG&E	SoCalGas	SDG&E
2020	2.0%	1.48%	6.37%	5.00%
2021	2.0%	5.69%	4.12%	3.14%
2022	2.0%	1.11%	4.12%	2.94%
2023	2.0%	4.0%	4.0%	4.0%
2024	2.0%	4.0%	4.0%	4.0%
2025	2.0%	4.0%	4.0%	4.0%
2026	1.0%	1.0%	1.0%	1.0%
2027	1.0%	1.0%	1.0%	1.0%
2028	1.0%	1.0%	1.0%	1.0%
2029	1.0%	1.0%	1.0%	1.0%
2030	1.0%	1.0%	1.0%	1.0%
2031	1.0%	1.0%	1.0%	1.0%

Marketability of New Homes

Based on surveys conducted by the California Building Industry Association (California Building Industry Association, 2018):

- less than 10% of voters would choose an all-electric home;
- 80% of voters prefer homes with both electricity and gas, especially for cooking;
- 80% of voters oppose prohibiting the use of gas appliance; and
- 66% of voters oppose eliminating natural gas.

The idea of entertaining and cooking on a gas range or on a grill in the backyard is a critical part of the vision and emotional draw families have when looking to purchase a home. Eliminating a family's option to use gas creates a significant marketing disadvantage against resale homes, accordingly home builders will be substantially disincentivized from building new, for sale homes.

Closing

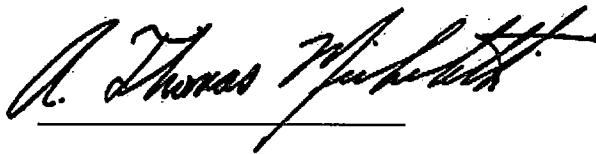
Climate change is a real threat to our society, and we all need to do our part to combat global warming. However, the solutions to climate change are multi-faceted and complex, and we all have to carefully consider and study whether some of the proposed solutions, such as an all-electric code, will have any long-term effect on climate change or may even have a negative impact on the environment. If the goal is to provide the greatest reduction in greenhouse gas emissions, then there are better ways of achieving

such a goal as it relates to new home development. For example, building a more energy efficient home, with a tighter building envelope, increased insulation, better performing windows/doors and/or ultra-efficient appliances will do far more to reduce greenhouse gas emissions than replacing a tankless natural gas water heater and cooktop with electric versions.

Meanwhile, we cannot ignore the other problems we face as a society such as delivering quality health care to our residents, ending homelessness, and addressing the housing crisis. Implementation of the all-electric code is, at best, a marginal positive impact against climate change, while a substantially negative impediment to delivering new homes to families and keeping home prices affordable for future generations.

Regards,

WINDSOR-JENSEN LAND COMPANY, LLC

A handwritten signature in black ink, appearing to read "T. Thomas Micheletti".

Tom Micheletti, Managing Member

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ES Executive Summary and Recommendations

Study Overview

Greenhouse gas (GHG) emissions attributable to buildings in California currently represent about a quarter (25%) of the state's total emissions.¹ In order to achieve California's climate goal of an economy-wide 40% GHG reduction by 2030, greenhouse gas emissions from buildings will need to fall by 40% or more over the next decade.² Furthermore, to reach California's carbon neutrality goal by 2045, high levels of building electrification are likely to be required.³

In 2018, E3 evaluated several long-term energy and climate scenarios for the California Energy Commission (CEC), assessing how California could achieve its 2050 climate goals. That analysis suggested that electrification of buildings is likely to be a lower-cost GHG mitigation strategy over the long-term than a heavy reliance on renewable natural gas (RNG), given current trends in the industry. The 2018 study suggested that building electrification could be a lower cost carbon mitigation option than other alternatives. However, the study did not include a detailed assessment of the customer economics of building electrification, or of the market barriers and opportunities for electrification. This study addresses these issues.

¹ E3 estimate based on data from the California Greenhouse Gas Emission Inventory and the California PATHWAYS model.

² See Mahone et al. (2018)

³ The 2018 Intergovernmental Panel on Climate Change report shows a dramatic increase in the levels of building electrification between 2030 and 2050 in the scenarios that are consistent with California's carbon neutral climate goal (limiting global warming to 1.5 degrees Celsius). See Figure 2.22 in Rogelj et al. (2018)

HRMF	High-Rise Multifamily
HSPF	Heating Seasonal Performance Factor
HVAC	Heating, Ventilation, and Air Conditioning
IOU	Investor-Owned Utility
kWh	Kilowatt hour
LADWP	Los Angeles Department of Water and Power
LPG	Liquefied Petroleum Gas
LRMF	Low-Rise Multifamily
LSE	Load Serving Entity
MMBtu	Million BTU
MSHP	Mini Split Heat Pump
NGO	Non-Governmental Organization
NREL	National Renewable Energy Laboratory
PG&E	Pacific Gas and Electric
PTHP	Packaged Terminal Heat Pump
RASS	Residential Appliance Saturation Survey
RNG	Renewable Natural Gas
RPS	Renewable Portfolio Standard
SB	Senate Bill
SCE	Southern California Edison
SCG	Southern California Gas Company
SEER	Seasonal Energy Efficiency Ratio
SF	Single Family
SMUD	Sacramento Municipal Utility District
TOU	Time-Of-Use
UEF	Uniform Energy Factor
VRF	Variable Refrigerant Flow
ZEV	Zero-Emissions Vehicle

Acronyms

AEO	Annual Energy Outlook
AFUE	Annual Fuel Utilization Efficiency
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
ASHP	Air-Source Heat Pump
CAISO	California Independent System Operator
CARB	California Air Resources Board
CCA	Community Choice Aggregator
CEC	California Energy Commission
CFC	Chlorofluorocarbon
CO₂	Carbon Dioxide
CO₂eq	Carbon Dioxide Equivalent
COP	Coefficient of Performance
CPUC	California Public Utilities Commission
DHW	Domestic Hot Water
DOE	Department of Energy
DOF	Department of Finance
DSHP	Ducted Split Heat Pump
EE	Energy Efficiency
EER	Energy Efficiency Ratio
EF	Energy Factor
GHG	Greenhouse Gas
GRC	General Rate Case
GWh	Gigawatt-hour
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HPWH	Heat Pump Water Heater

Abstract

This study evaluates the consumer economics, greenhouse gas savings and grid impacts of electrification in residential low-rise buildings across six representative homes type in six climate zones in California. Consumer economics are evaluated in three ways, by comparing: 1) upfront installed capital costs, 2) energy bills, and 3) lifecycle savings between gas-fired and electric technologies.

Prior research has suggested that electrification of buildings is likely to be a lower-cost greenhouse gas (GHG) mitigation strategy over the long-term than a heavy reliance on renewable natural gas. This study takes a closer look at the near-term consumer economics of building electrification than prior work, considering both commonly available and best-in-class electric equipment options, as well as expected near-term increases in electric and natural gas.

We confirm that the electrification of buildings represents an important opportunity to reduce greenhouse gas emissions from buildings both in the near term and long term, and can lead to consumer capital cost savings, bills savings, and lifecycle savings in many circumstances. The most promising near-term opportunities for consumer cost savings among low-rise residential building electrification options can be found in all-electric new construction, and high efficiency air source heat pumps in homes where air conditioning can be replaced with heat pumps.

However, for electrification retrofits to succeed at scale, the market for building electrification technologies should be further developed in California. Ensuring contractors understand best-practices during scoping and installation of heat pump equipment will be critical to the long-term success of an electrification market in California. Likewise, international markets in Europe and Japan offer a wider range of high-efficiency electric technologies to choose from than are available in the United States. Finally, California should encourage the development of “retrofit ready” heat pump water heaters and HVAC systems to provide consumers with more low-cost and high efficiency electric choices.

This report is available to download at: https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf

Acknowledgements

The authors of this study would like to acknowledge the contributions of the staff of Southern California Edison, Sacramento Municipal Utility District and Los Angeles Department of Water and Power who have helped to inform and shape the study assumptions. Any errors or omissions are the authors' own.

Conventions

All costs reported in this study are reported in real 2018 dollars. All references to quantities of greenhouse gas emissions are reported using units of metric tons (or tonnes), using a carbon dioxide equivalent metric with a 100-year global warming potential.

4.1	Building Electrification Consumer Economics for Individual Appliances and Electrification Packages	86
4.2	Understanding Drivers of Differences in Consumer Economics	89
4.3	Market adoption barriers	90
4.4	Further Research Needs.....	91
5	References	93
6	Appendix A: Technology Characterization and Screening	98
6.2	Overview of Technology Selection and Efficiencies	106
7	Appendix B: Building Simulation Descriptions	113
	Thermostat Schedules as Modeled	113
8	Appendix C: Additional Methods Detail	122
8.1	Fossil emissions from electricity	122
8.2	Methodology for methane and refrigerant leakage calculations.....	124
9	Appendix D: Market Adoption Barriers and Potential Solutions.....	126
10	Appendix E: Additional Results.....	131
10.1	Electricity load shapes for individual homes simulated	131
10.2	Site energy savings.....	132

Table of Contents

Abstract	ii
ES Executive Summary and Recommendations	i
1 Introduction	1
1.1 Study motivation	1
1.2 Building electrification market overview.....	7
1.3 Report contents.....	10
2 Modeling Approach	11
2.1 Methods Overview.....	11
2.2 California Housing Stock and Market Potential	12
2.3 Building Simulations and End Use Technologies	18
2.4 Upfront equipment costs and efficiencies.....	23
2.5 Customer Costs and Savings.....	36
2.6 Greenhouse Gas Emissions.....	41
2.7 Grid Impacts	45
3 Results	47
3.1 Greenhouse gas emissions.....	47
3.2 Capital Cost Comparisons	49
3.3 Consumer bill impacts	56
3.4 Lifecycle costs and savings.....	69
3.5 Grid Impacts	81
4 Discussion	86

Residential Building Electrification in California

Consumer economics, greenhouse gases and grid impacts

April 2019

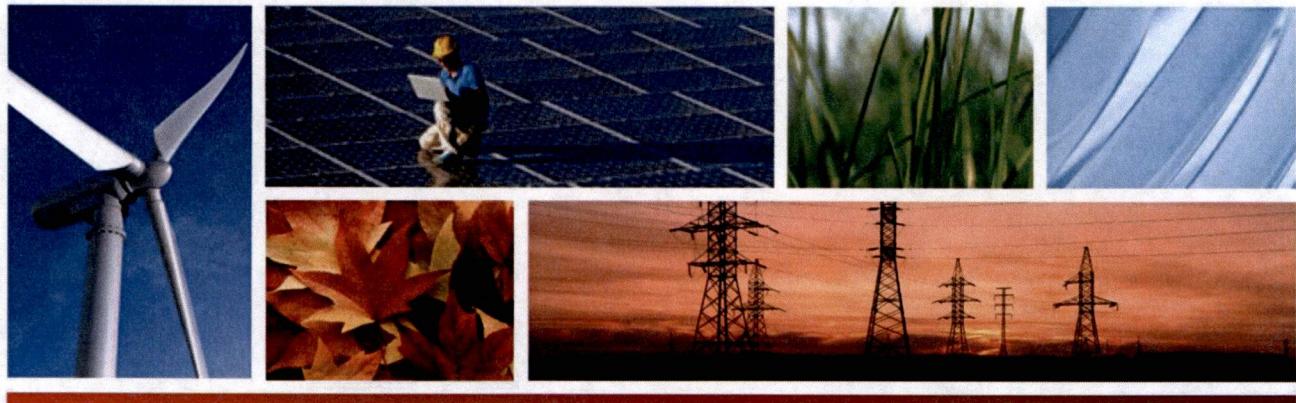
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Residential Building Electrification in California

**Consumer economics, greenhouse gases
and grid impacts**

April 2019



Energy+Environmental Economics

Attachment 1

Study: "Residential Building Electrification in California" dated April 2019

"2019 Cost-effectiveness Study: Low-rise Residential Construction" (July 17, 2019)

Table 24: Real Utility Rate Escalation Rate Assumptions

	Statewide Electric Residential Average Rate (%/year, real)	Natural Gas Residential Core Rate (%/yr escalation, real)		
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2025	2.0%	4.0%	4.0%	4.0%
2026	1.0%	1.0%	1.0%	1.0%
2027	1.0%	1.0%	1.0%	1.0%
2028	1.0%	1.0%	1.0%	1.0%
2029	1.0%	1.0%	1.0%	1.0%
2030	1.0%	1.0%	1.0%	1.0%
2031	1.0%	1.0%	1.0%	1.0%

In closing, in addition to the above concerns, we reiterate our concerns expressed in our previous letter dated August 21, 2019 (Attachment 2), and we are also in agreement with the letter from Miller Starr Regalia in re: Proposal by Town of Windsor to Adopt All-Electric Residential Reach Code/Natural Gas Ban dated September 4, 2019 (Attachment 3).

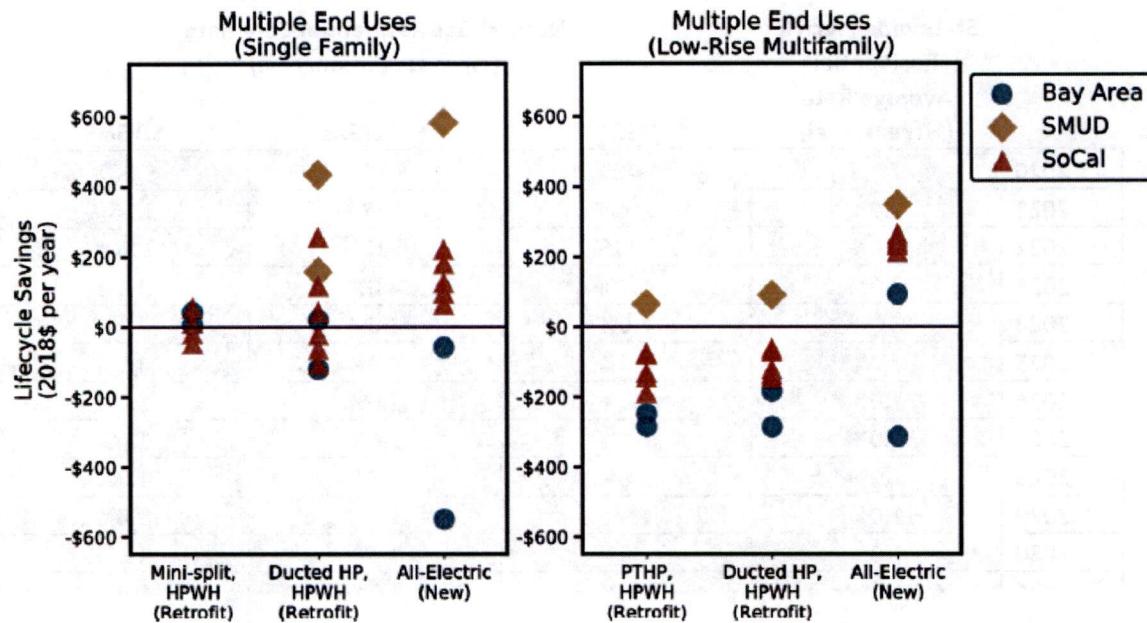
Respectfully, we request that the City Council not adopt the Ordinance approving the All-Electric Code and instead work collaboratively with the relevant stakeholders to develop alternative means to achieve the common goals of reducing emissions and related environmental impacts without sacrificing critically-needed housing stock. At the very least, the City Council must evaluate and disclose all potentially significant environmental impacts before moving forward with this action, as is its duty under CEQA and reflects its obligation to the community at large.

Regards,



Tom Micheletti

Figure 3-28. Lifecycle savings of electrifying multiple end uses, electric rate sensitivity



The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Electrification of HVAC and water heating only is assumed for retrofit homes, and electrification of all end uses is assumed for new construction homes. Savings are relative to gas alternatives. Single family new construction homes have electric induction stoves and electric heat pump clothes dryers in addition to HVAC heat pumps and HPWHs. LRMF new construction homes have electric resistance cookstoves and electric resistance clothes dryers in addition to HVAC heat pumps and HPWHs. Positive values represent savings in both capital and operating costs throughout the lifetime of all appliances over the gas counterpart; negative values indicate lifecycle costs. Heat pump technologies here are the same as modeled for individual appliances above. The new construction blue dot (Bay Area) is an outlier here because in the gas baseline there is no air conditioning assumed.

Further, Frontier also states in the April 2019 study that:

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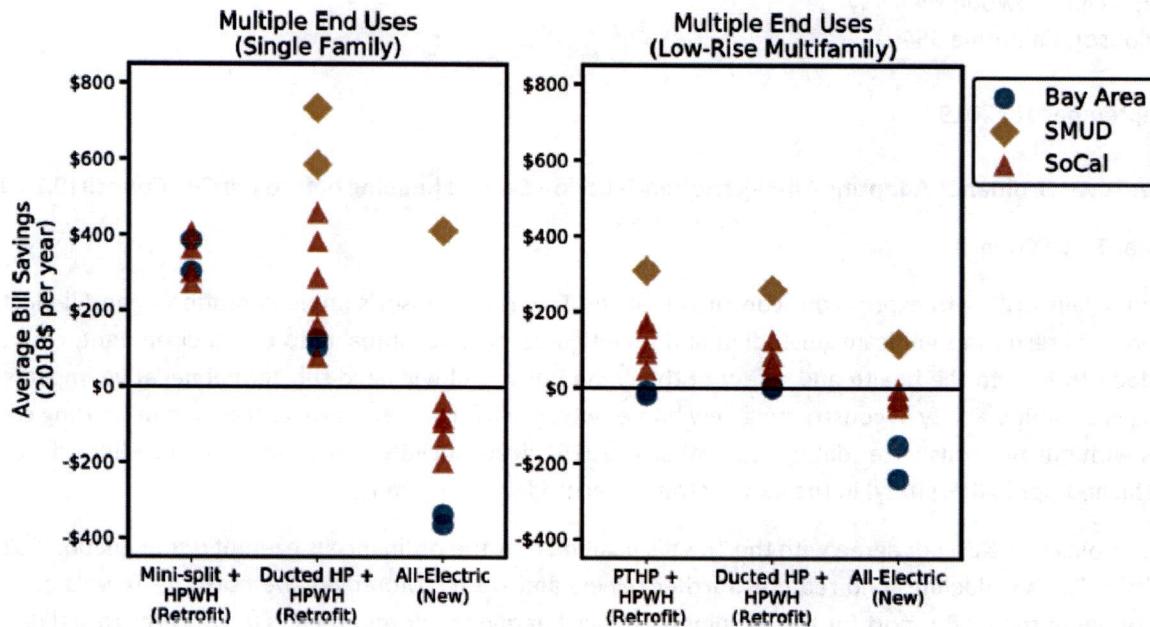
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a study on that can be found on Frontier's website entitled "Residential Building Electrification in California" and dated April 2019 (the "April 2019 Study"; Attachment 1).

Although, the July 2019 Study indicated a cost savings with respect to consumer bills and lifecycle costs, the April 2019 Study clearly shows an increase in costs for "Bay Area" consumers purchasing new homes (see tables below).

"Residential Building Electrification in California" (April 2019)

Figure 3-19. Average consumer bill impacts of electrifying multiple end uses, electric rate sensitivity



The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to gas end uses. For retrofit homes, bill impacts reflect electrifying both HVAC and water heating systems. For new construction homes, bill impacts of electrifying an entire home are shown including electric air source heat pump, heat pump water heater, cookstove and clothes dryer.

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Town of Windsor Town Council
Town Civic Center
9291 Old Redwood Highway
Windsor, California 95492

September 18, 2019

Re: Town Ordinance Adopting All-Electric Reach Code – Second Reading before the City Council (9.18.19)

Dear Town Council:

I am again writing to express our concerns that the Town of Windsor's implementation of an All-Electric code will result in significant unstudied and unmitigated negative impacts to the environment, result in added threats to the health and safety of the community, and will have substantial negative impacts to the economic viability of constructing new homes which will further exacerbate the current housing crisis. As with our previous letter dated September 4, 2019, please include this correspondence (including the attached April 2019 study) in the administrative record for this matter.

Accordingly, we do not agree with the Town's position that the ordinance is exempt under Section 15308 of the CEQA Guidelines and requires further review and study. Moreover, we note the Town's cursory attempt in the staff report for this evening's Council hearing to address the CEQA concerns raised during this process does not substantively respond to these significant issues. To the contrary, the Town's continued insistence on exempting the All-Electric Code from consideration of potential environmental impacts under CEQA impairs its fundamental purpose of facilitating thoughtful decision making after full disclosure of such impacts.

Furthermore, approval of the All-Electric Reach Code may have significant negative financial impacts to the Town as it is apparent that many individuals and companies within the real estate development community will oppose its implementation, and thus the Town is at risk of substantial potential legal exposure and all costs associated therewith. These significant, negative financial impacts can be avoided if the Town would not proceed at this time with adopting the All-Electric Code and instead work collaboratively with the relevant stakeholders (including developers and the broader community) to design alternative solutions that can achieve the Town's goals with respect to energy efficiency, GHG reduction and climate change adaptation without substantially impacting the development communities ability to construct new homes for future Windsor families.

Finally, we would like to again point out that Frontier Energy, Inc.'s ("Frontier) findings contained within the "2019 Cost-effectiveness Study: Low-Rise residential New Construction" (the "July 2019 Study"), which the Town had relied on to justify the all-electric code as "cost effective", appear to be contradicted within

The study was jointly funded by Southern California Edison (SCE), Sacramento Municipal Utility District (SMUD), and the Los Angeles Department of Water and Power (LADWP). Energy and Environmental Economics, Inc. (E3) is the lead author of the study and completed the economic analysis. Frontier Energy developed the electrification technology specifications and performed the building simulations of the electric- and natural gas-fueled homes. AECOM developed the installed capital cost estimates for the natural gas and electrification technologies in each home type, including the costs of building retrofits, labor and other installation costs. Point Energy Innovations served as an advisor to the study and helped evaluate the current market for electric heat pump technologies.

Methodology & Assumptions

This study evaluates the consumer costs and benefits of several types of electric air source heat pumps for space heating and cooling (HVAC), heat pump water heaters, electric and induction stoves, as well as electric and heat pump clothes dryers. Each of these electric technologies are compared individually to a natural gas alternative. In addition, all-electric new construction is evaluated relative to a mixed-fuel new construction home, as well as a “retrofit package”, where the gas furnace, gas water heater and air conditioner are replaced with electric heat pump options.

The study evaluates electrification in two building types: single family homes and low-rise multifamily homes. It considers three vintages for each home type: pre-1978 vintage homes that are assumed to require electric panel upgrades, 1990s vintage homes, and new construction complying with California’s 2019 Title 24 building code. New construction homes are assumed to install the same size rooftop solar panel in both the gas baseline and all-electric home, and as a result the rooftop solar has a relatively minor impact on the relative bill savings between these two options. In the retrofit homes, we sought to compare comparable levels of thermal comfort in both the gas and electric HVAC alternatives. As a result, the existing gas-fired homes evaluated in the study are assumed to either already have, or be retrofitted to

include, air conditioning to provide a like-for-like comparison to the heat pumps, which also provide both heating and air conditioning.

Building simulations used NREL's BeOpt software and the DOE's EnergyPlus simulation engine. The single family and low-rise multifamily building prototypes are from the California Energy Commission's Title 24 energy code. The six building types are simulated with both a natural gas baseline and an electric option across six California climate zones. These factors combined resulted in 72 unique building simulations.

The six climate zones modeled in this study include: San Francisco (CZ3), San Jose (CZ4), Sacramento (CZ12), Coastal Los Angeles (CZ06), Downtown Los Angeles (CZ09) and Riverside (CZ10). These regions cover many of the growing population centers of the state and, combined, directly represent 51% of the state's households. Another 36% of the state's households are found in similar climate zones to those studied. The remaining 13% of the state's households are in northern, mountainous, or desert climates that are not well covered by the study area.

The installed capital costs for both gas and electric technologies were developed by an experienced building technology cost-estimator, using a combination of the cost-estimator's market experience and public sources of equipment costs. This study sought to overcome many of the shortcomings in publicly available electrification technology datasets by creating an internally consistent and detailed cost build-up, reflecting regionally-specific labor costs and contractor mark-ups, as well as the installation and permitting costs of retrofits and new construction for both gas-fired and electric end uses.

The bill savings analysis is based on a forecast of residential natural gas and electric retail rates under a "current policy" or "reference" forecast. The upfront capital cost estimates and the future bill savings are used to calculate the lifecycle savings of electric options, over the expected useful lifetime of the equipment or the building. For more details on the study methodology, see Chapter 2.

This study does not assume any incentives for gas or electric equipment, nor do we assume any market transformation of the California building electrification market. As such, this analysis represents our best guess at the “current market” conditions for low-rise residential electrification. In the future, capital costs or installation costs for equipment may change, higher efficiency equipment may become available, and both natural gas and electric rates may change dramatically from the “reference case” forecast estimated here. The California building market is changing rapidly, and future policies that are currently under development, such as the implementation of SB 1477, could have a large impact on the cost-effectiveness results shown here.

Key Findings

GREENHOUSE GAS SAVINGS

Electrification of buildings — switching from fossil fuels to electricity use for space heating, water heating, cooking, and clothes drying — represents an important strategy to reduce greenhouse gas emissions. In California, the electricity mix is already relatively clean and renewable, and by 2045, 100% of the state’s retail electricity sales will be met with zero-carbon resources (per SB 100)⁴. This means that using electricity to power our homes already reduces carbon emissions relative to direct-use of natural gas, and these carbon savings will increase over time as the grid become cleaner.

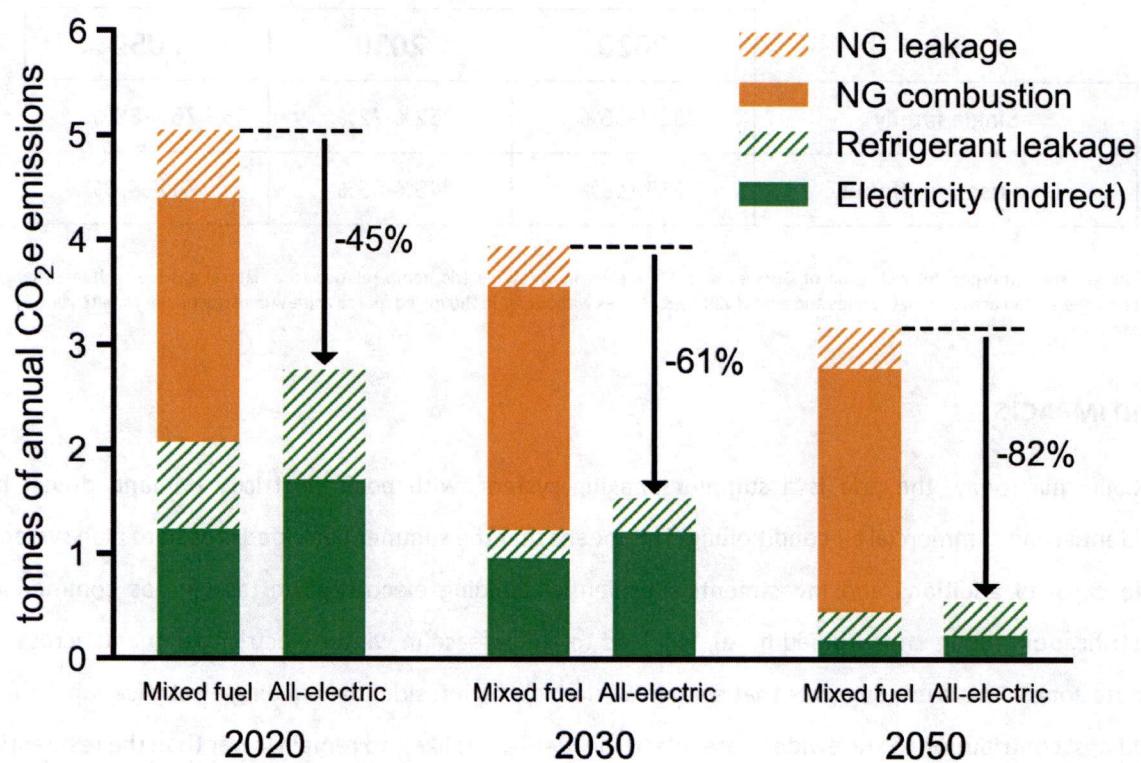
Electrification is found to reduce total greenhouse gas emissions in single family homes by ~30% – 60% in 2020, relative to a natural gas-fueled home. As the carbon intensity of the grid decreases over time, these savings are estimated to increase to ~80% – 90% by 2050, including the impacts of upstream methane leakage and refrigerant gas leakage from air conditioners and heat pumps. If the state succeeds in

⁴ The details of implementing and interpreting SB 100 have not yet been clarified by the state. In this analysis, we interpret the definition of SB 100 to require about 96% zero-carbon generation by 2050, which allows over 100% of RPS-qualifying retail sales to be met with zero-carbon generation.

achieving a completely decarbonized grid by 2045, the GHG savings would be even larger in 2050. The absolute level of greenhouse gas savings in buildings depends on the size of the home, the quality of the building shell (which is generally better in newer homes), and the climate zone where the home is located.

Figure 1-1 illustrates the expected greenhouse gas emissions savings from an all-electric single family home in Sacramento in 2020, 2030 and 2050, compared to a mixed fuel home, assuming no change in the efficiency of today's commonly available electric and natural gas end uses. The largest source of greenhouse gas savings comes from eliminating on-site combustion of natural gas. Emissions from electricity decrease over time due to the state's zero-carbon generation goals. The increase in GHG emissions from refrigerant leakage associated with heat pumps in the all-electric home is relatively small, since the mixed-fuel home uses a conventional air conditioner, which also results in GHG emissions from leaked refrigerant gases. Natural gas leakage is also assumed to decrease over time as well.

Figure 1-1: Annual GHG emissions from a mixed-fuel and all-electric 1990s vintage home in Sacramento



Electricity emissions are based on the High Electrification scenario consistent with SB 100; see the greenhouse gas methodology section for more details. The 2030 and 2050 bars assume that the next generation of low-GWP refrigerants are used in all applicable heat pump systems modeled, including air conditioners, HVAC heat pumps, heat pump water heaters, and heat pump clothes dryers. We do not estimate refrigerant leakage from refrigerators and freezers, but these fugitive emissions would be the same in both electric and natural gas homes. We assume that by 2030, fugitive methane emissions are reduced by 40%, as mandated by the CARB Short-Lived Climate Pollutant Strategy and as previously set as a goal by the Obama administration. We based our calculations of fugitive refrigerant emissions on CARB data as described further in Appendix C.

Table 1-1: Greenhouse gas savings achieved across all-vintages of the all-electric homes, annual % reduction relative to the natural gas-fueled homes

	2020	2030	2050
Single family	33%-56%	52%-72%	76%-88%
Low-rise multifamily	25%-46%	49%-65%	74%-85%

Percentages show the percent reduction of GHG emissions achieved in an all-electric home relative to a natural gas-fueled home. Ranges represent the spread across climate zones and across vintages. Homes without AC in the mixed fuel case (new construction in climate zone 3) are excluded.

GRID IMPACTS

In California today, the grid is a summer peaking system, with peak electricity demand driven by residential and commercial air conditioning. This means that the summer peak load is used to plan system-wide capacity additions and investments. Residential building electrification (as well as commercial electrification, though not studied here), will lead to an increase in winter electricity demand across all climate zones. This study suggests that even in a relatively high residential building electrification future, buildings' contribution to statewide winter electricity demand is likely to remain lower than the residential summer peak demand levels, at least under typical weather year conditions.

In general, building electrification will contribute to a better utilization (higher load factor) of the bulk power grid. The regional and distribution-level grid impacts may have more localized impacts. For example, in regions without large air conditioning loads, such as San Francisco, the addition of electric heating loads could trigger a new winter-peak demand period, necessitating local distribution grid upgrades. Grid planners will need to monitor these local trends.

BUILDING ELECTRIFICATION CONSUMER COSTS AND SAVINGS

Near-term low-rise residential building electrification opportunities

All-electric new construction is one of the most promising near-term applications for building electrification efforts. All-electric new construction is expected to be lower cost than gas-fueled new construction homes in homes that have air conditioning, resulting in lifecycle savings of \$130 - \$540/year. These findings are based on commonly available technology, without incentives or intervening policies.

Retrofits to electric air source heat pumps for space heating and cooling represent another near-term savings opportunity in existing homes that have air conditioning. High capital costs of electric heat pump retrofits in existing homes are often perceived as a barrier to electrification, but this assumption was not borne out for homes that are otherwise already upgrading the air conditioning system. While HVAC systems are highly capital-intensive in general, in most cases we found capital cost *savings* when replacing the combination of an air conditioner and a gas furnace with a standalone heat pump HVAC unit. Further, 87% of the simulated single family retrofit homes (all of which are assumed to have air conditioning) see lifecycle savings from switching from a gas furnace and air conditioner to an electric heat pump HVAC system.

Near-term electrification barriers and market transformation needs

While electrification can be lower cost in many cases, the incremental upfront capital costs can be higher for electrification when retrofitting the HVAC system in older homes that lack air conditioning. This is because air source heat pumps provide both air conditioning and space heating; when compared to just a gas furnace the cost of the heat pump is often higher. In general, Californians could benefit from having access to a broader range of high-efficiency, lower-cost heat pump options, including those available in international markets such as Japan and Europe, but which lack a UL listing in the United States.

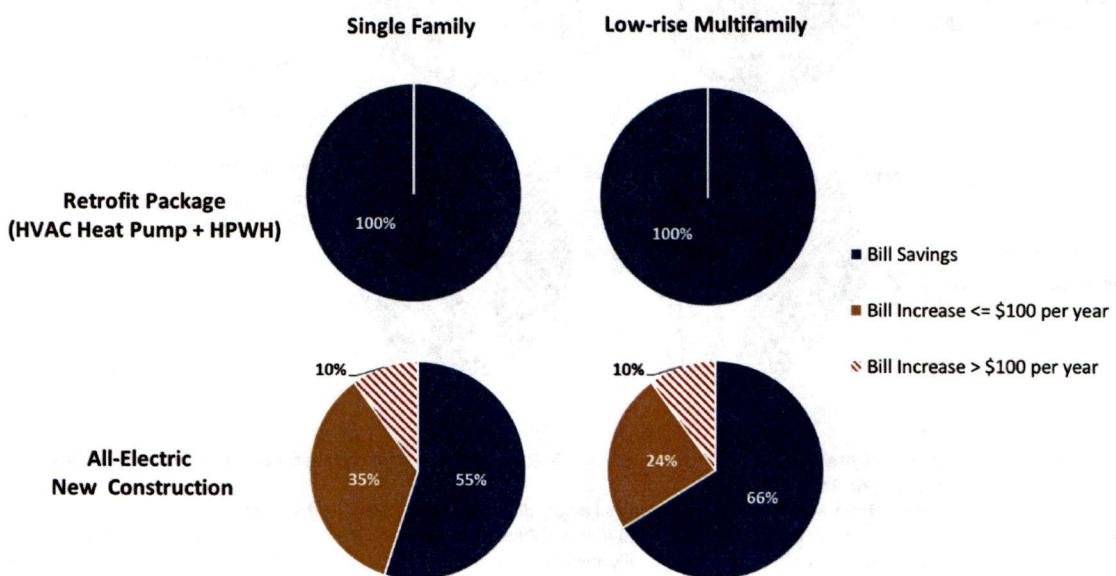
Another retrofit challenge is that older homes can require an electrical panel upgrade to support new electric loads. Electrical panel upgrades can add \$2,000 - \$4,000 in capital costs for some older homes that lack 200-amp electrical panels, although these are not expected to be required for the majority of existing homes. Furthermore, older homes that require electrical panel upgrades will represent a decreasing proportion of the housing stock over time as buildings are renovated or as panels are upgraded for other purposes, such as to add electric vehicle charging, rooftop solar or to add rooms or auxiliary dwelling units to an existing home. The development of low-amperage "retrofit ready" heat pump options, and lower cost solutions to the standard electrical panel upgrade package represent important areas for market transformation.

This study also evaluates the consumer economics of heat pump water heaters, electric stoves and electric clothes dryers. Heat pump water heaters are currently more expensive than conventional gas storage water heaters found in many existing homes but are comparable in cost to tankless gas water heaters which have become the norm in new construction and in home renovations. Heat pump water heaters have mixed results for lifecycle costs but can generate lifecycle savings when water heater retrofits are combined with heat pump HVAC retrofits. Electric stoves and clothes dryers are not found to generate lifecycle savings for customers under today's rates in most cases and represent end-uses that may benefit from different electric rate designs, or from a longer-term market transformation effort.

Figure 1-2 summarizes the bill savings results across all six climate zones for the simulated pre-1978 and 1990s vintage homes with the "retrofit package", replacing both the HVAC system and water heater with heat pumps, as well as the bill savings results for new construction single family and low-rise multifamily homes.

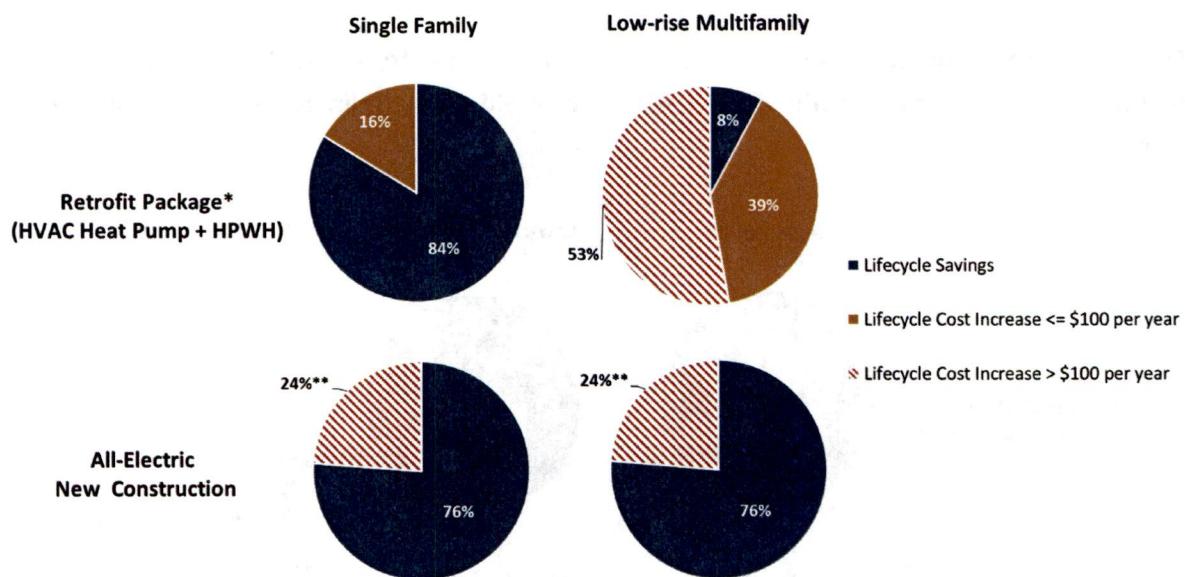
Figure 1-3 summarizes the lifecycle savings results across all six climate zones for the retrofit and new construction homes. Lifecycle savings represent the difference between the annualized capital costs and operating costs of gas equipment versus electric equipment.

Figure 1-2 Share of simulated households with bill savings from adopting electric end uses; results are weighted by the estimated share of households in each climate zone and utility service territory



The building simulation results are weighted using the share of households in each combination of climate zone and utility, as described in section 2.2.1., to create this summary figure. Average bill costs of HVAC heat pumps are compared against a combined gas furnace and air conditioner (AC) system except for a new construction home in San Francisco (Climate Zone 3) where we assume all homes do not have AC. For retrofit homes, we show the average bill impact of electrifying HVAC and water heating systems at the same time. For new construction, we look at an all-electric home with all four appliances modeled electrified.

Figure 1-3 Share of simulated households with lifecycle savings from adopting electric end uses; results are weighted by the estimated share of households in each climate zone and utility service territory



The building simulation results are weighted using the share of households in each combination of climate zone and utility, as described in section 2.2.1., to create this summary figure.

* We assume that all consumers in retrofit homes have or would install air conditioning in the mixed fuel baseline.

** This category corresponds to buildings modeled in San Francisco (Climate Zone 3) that we assumed would not install air conditioning in the gas baseline home. 100% of all-electric new construction single family and low-rise multifamily homes that include air conditioning show lifecycle savings.

Recommendations

California policymakers are already starting to evaluate policy options around building decarbonization. The Final 2018 Integrated Energy Policy Report (IEPR) Update Volume II, released by the CEC in January 2019, dedicates the first chapter of the report to building decarbonization and includes an important set

of policy recommendations.⁵ Likewise, the California Public Utilities Commission has recently opened a new rulemaking proceeding on Building Decarbonization. Without presupposing the outcome of these ongoing policy dialogues, we suggest a few broad policies to encourage higher levels of building electrification in California.

Overall, building electrification represents an important strategy for reducing greenhouse gas emissions in California. Additional strategies will need to be pursued in parallel if California is to meet its climate goals, including continued improvements in electric and natural gas energy efficiency in buildings, the development of sustainable renewable natural gas for remaining natural gas consumption in non-converted buildings and in industry, and mitigation of methane leaks and high global warming potential gases. However, given the long lifetimes of buildings and building equipment, California cannot afford to miss windows of opportunity to electrify building end uses where possible. Near-term policies are needed to encourage higher rates of building electrification, when benefits can be created for customers and for society.

Electrification can support sustainability and equity policy goals. For example, heat pump HVAC systems provide a climate *adaptation* advantage, because they provide both air conditioning and heating. Air conditioning, along with better building design and more resilient communities, can help protect public health in low-income and vulnerable communities as heat waves become more severe under climate change. Likewise, California is currently facing a historic housing affordability crisis driven largely by a housing supply shortage. In this study we found that all-electric new homes can reduce building costs. By prioritizing the construction of new and affordable housing, and ensuring that these homes are designed to be highly efficient, California has a greater chance of meeting its climate policy goals while protecting its most vulnerable residents.

⁵ See Bailey et al. (2019).

Despite the positive economic results for many homes, current heat pump market penetrations are much lower than the economic potential. The following recommendations suggest ways to address the market barriers to heat pumps, accelerating adoption so that building electrification may occur quickly enough to play a role in meeting the state's climate goals.

Our recommendations can be summarized into the following five points, which are elaborated on below:

1. Incentivize all-electric new construction and update the building code
2. Incentivize high-efficiency heat pump HVAC, particularly in areas with high air conditioning loads
3. Ensure efficient price signals are conveyed in electric and natural gas rates
4. Develop a building electrification market transformation initiative
5. Align energy efficiency goals and savings with GHG savings opportunities

1. INCENTIVIZE ALL-ELECTRIC NEW CONSTRUCTION AND UPDATE THE BUILDING CODE

- + **All-electric new construction in residential low-rise homes appears to be among the most promising near-term ways to save consumers money and reduce GHG emissions and could be incentivized in the near term to help transform the market.** It avoids the costs and hassle associated with retrofits, and in most cases, we found that all-electric new construction offered lifecycle cost savings for residents. Savings could be larger if capital costs were reduced, if higher efficiency electric technologies were available, or if the costs of gas distribution interconnection were more directly reflected in the cost of new construction.
- + **Align building standards with GHG savings opportunities.** In California's building code, the current approach to assessing cost effectiveness (Time Dependent Valuation [TDV]) does not fully measure or fully value GHG emissions savings. The CEC is working to update the TDV metric in the next code cycle to allow the emissions benefits of building electrification to be appropriately valued and considered in new construction design decisions. In addition, the building code could include a GHG emissions performance standard for new buildings. The estimated GHG emissions

from a building would be calculated based on the efficiency and simulated performance of the building, combined with a long-term forecast of emissions from electricity and pipeline gas, using policy goals or verifiable commitments from utilities. The GHG performance standard could become stricter in each code cycle, as the state's climate goals become more stringent. A GHG emissions performance standard is a technology-neutral way to encourage the decarbonization of buildings.

- + **New construction homes should be designed to be “electrification-ready”, with sufficient electrical amperage and circuitry in the right places for future electric HVAC, water heating, cooking, and clothes drying equipment, as well as for electric vehicles (EVs) where possible.** Given the long lifetime of buildings and heating equipment and the cost of upgrading electrical infrastructure in existing buildings, new construction is the ideal time to design buildings to be prepared for an all-electric future. In retrofit homes, electrical panel upgrades to accommodate room additions, electric vehicles, and rooftop solar panels can be specified to ensure that there is sufficient electric panel capacity for electric HVAC, water heating, cooking and clothes drying.
- + **Factor fugitive emissions from high-GWP refrigerants and natural gas leakage into GHG metrics.** Future building standards metrics should incorporate the emissions from high-GWP refrigerant leakage as well as methane leakage in the gas distribution system and within houses. This will yield a balanced and comprehensive perspective on emissions from gas and electric technologies and encourage best practices for using lower-GWP refrigerants and reducing methane leakage.

2. INCENTIVIZE HIGH-EFFICIENCY HEAT PUMP HVAC, PARTICULARLY IN AREAS WITH HIGH AIR CONDITIONING LOADS

California should consider developing programs to incentivize:

- + **Heat pump HVAC systems in residential low-rise retrofit homes, where central air conditioning is needed/wanted. Higher efficiency heat pumps should be encouraged above existing code minimums.** Heat pumps provide both space heating and space cooling and are found to be cost-effective in homes where they can serve both these purposes. While the 2015 federal code minimum for heat pump HVAC systems encourages high efficiency heat pump installations, higher efficiency heat pump HVAC products are readily available in the market and provide customer

- benefits. Heat pump HVAC systems with higher efficiencies (Heating Seasonal Performance Factor [HSPF] of 10 or higher) create lifecycle savings for residential customers in homes that require air conditioning.
- + **HVAC heat pumps to replace space heating currently provided by propane, distillate, or electric resistance heat.** The economic benefits of replacing high cost fuels with electric HVAC heat pumps have been demonstrated in other studies. Replacing high cost heating fuels, including propane, distillate, and electric resistance heat with high efficiency HVAC heat pumps represents “low-hanging fruit” when it comes to savings customers money and reducing GHG emissions..
- + **Encourage the installation of high efficiency HVAC heat pumps rather than standalone central AC units whenever possible.** The capital cost analysis found that HVAC heat pumps are generally cheaper than the combined cost of a new gas furnace and standalone central air conditioner, and bill savings are seen in most home types as well. Incentives could take advantage of these cost savings to encourage consumers to install an HVAC heat pump when replacing an air conditioner whenever it makes sense for that building. This will give the home the option to use gas heating or electric heating (with the option to not replace the gas furnace upon failure), while providing high efficiency air conditioning during the summer.
- + **Consider early replacement programs for older gas furnaces and gas water heaters.** These programs would be designed to avoid the practical challenges around “emergency” replacement of equipment upon failure, when there is less time to retrofit a home to electric technologies. Early replacement programs could also target the oldest, least efficient equipment, thereby maximizing bill savings and GHG savings.
- + **Target incentives and low-cost financing to landlords and low-income consumers to overcome capital cost barriers and ensure that clean energy benefits are enjoyed by all communities.** Upfront capital cost barriers will prevent many consumers from investing in new equipment unless they absolutely have to when their existing equipment fails. This is particularly true for low-income customers. The CPUC could call for proposals or pilots for innovative business models, such as ConEdison’s proposal for financing small to medium commercial HVAC heat pumps and

developing a utility-owned ground-source heat pump program⁶. Other financing options to explore include on-bill financing programs like the “Pay As You Save (PAYS®)” programs. Furthermore, incentives targeting landlords would allow renters to take advantage of bill savings from efficient heat pumps.

3. ENSURE EFFICIENT PRICE SIGNALS ARE CONVEYED IN ELECTRIC AND NATURAL GAS RATES

- + **Design more efficient electricity rates.** Today’s electricity rates are largely designed based on volumetric charges (i.e. \$/kWh of use). However, many costs on the electric grid do not vary with the quantity of electricity used, but are rather based on system-wide, and distribution level costs. More efficient, cost-based electric rates would remove disincentives for electrification and could better align customer choices with socially beneficial outcomes. While electric rates do not need to be designed to preferentially encourage building electrification, they should at least be evaluated to ensure that they do not discourage electrification. For example, electric rates could collect more of the “fixed costs” via fixed charges rather than volumetric rates, which tend to penalize electrification. In addition, in regions with time-of-use (TOU) rates, the TOU periods should be aligned with system costs as well as GHG emissions on the grid.
- + **Higher carbon prices, or complementary policies aimed at reducing the GHG emissions from natural gas, would better align customer’s economic incentives with the state’s climate goals.** This study finds that electrification of water heating and HVAC results in substantial GHG savings in all cases at today’s emission rates. Moreover, the electricity system is required by SB 100 to reduce emissions to near zero by 2045. No comparable policy exists for the natural gas system to reduce GHG emissions. Yet, carbon prices in California, ranging between \$12 and \$22/tonne as of early 2019, have been too small to effectively signal to customers the GHG benefits associated with fuel-switching to electricity. In 2016 the US Environmental Protection Agency (EPA) calculated a mid-range “social cost of carbon” representing the global harms of incremental CO₂

⁶ Petition of Consolidated Edison Company of New York Inc. for Approval of the Smart Solutions for Natural Gas Customers Program, Case 17-G-0606, December 20th, 2018.

emissions of \$42/tonne for emissions occurring in 2020, with a more recent study estimating an *order of magnitude* larger value represented a mid-range estimate (Ricke et al. 2018).

- + **Consider requiring builders, rather than ratepayers, to pay for the full cost of new gas distribution hookups.** Currently, utilities cover a portion of the cost of new gas hookups to buildings, anticipating that these costs will be recovered from ratepayers through future revenues. These discounts can be up to 50% of the total estimated installed costs to complete a distribution main extension.⁷ However, continued natural gas distribution revenue growth is not guaranteed in a carbon-constrained future, and these gas distribution fixed costs may become shared among a shrinking base of natural gas customers. Ensuring that new gas hook-ups are paid for by the builder at the point of construction could mitigate future cost increases for existing gas customers.

4. DEVELOP A RESIDENTIAL BUILDING ELECTRIFICATION MARKET TRANSFORMATION INITIATIVE

Market transformation can mean many things to many people. In this context, we mean that the residential building electrification market would benefit from having access to a wider range of high efficiency and “retrofit” ready products, including some that are already available in international markets, as well as a better trained workforce to ensure experienced installers and service providers are readily available and operating competitively across the state, and more information available to consumers about electrification options, costs and benefits. A few recommendations describing what such a market transformation initiative could include are described below:

- + **Encourage the development of retrofit-ready electrification technology options for older homes.** In general, 200-amp electrical service is needed to serve a home with both a heat pump HVAC system and heat pump water heater. While most newer homes have 200-amp service, many

⁷ See for example PG&E’s Gas Rule No. 15 for gas main extensions:
<https://www.pge.com/tariffs/assets/pdf/tariffbook/GAS RULES 15.pdf>

older homes in California do not (data is not readily available on the share of homes in each category). In this study, the electrical panel upgrade costs triggered by the adoption of heat pump HVAC and heat pump water heating units together were large enough to create net costs instead of net savings for some of the low-rise multifamily homes that were modeled (the panel upgrade costs were applied to pre-1978 vintage single family homes in this situation). An area for on-going market transformation is in developing more “retrofit-ready” heat pump options, that are small enough to fit in existing spaces and require lower current, to avoid the need for an electrical panel upgrade in these older, retrofit homes.

- + **Educate consumers about building electrification options.** Consumers may have preconceptions about electric technologies, based on earlier generations of electric heat pumps and electric resistance stoves. Some consumers are entirely unfamiliar with heat pump technologies; others are unaware of newer options like ductless heat pumps and induction stoves. Many consumers are not aware of the non-economic advantages of new electric technologies, such as the option for multi-zone temperature control with ductless heat pumps, or the health, safety and performance advantages of induction stoves over conventional gas stove. Customers should also be aware of other differences between electric and gas options, such as the potential for noise or vibrations from an electric heat pump condenser/compressor. Consumers generally want to know about real-world experiences from a trusted source before they make important decisions a new electric technology in their home. Ideally, they should have this information before their existing equipment fails.
- + **Workforce training and certification for electrification in buildings.** Currently, few building contractors and HVAC professionals are well-versed in building electrification technologies. Poorly installed heat pumps could create a customer backlash against the technology. Workforce training, combined with a voluntary certification program for building electrification, could provide quality assurance to customers interested in making the switch to electric HVAC or water heating. Similarly, with CPUC guidance, utilities could consider direct utility install programs to ensure electrification technologies are readily available on the truck, and that high-quality installations can be ensured. Quality control is needed for proper sizing and installation of the right heat pump equipment for each customer’s needs.

- + Coordinate with manufacturers to bring emerging technologies to the US market, including very efficient heat pumps, ultra-low global warming potential refrigerants, and retrofit-ready or low-voltage options. Many high efficiency heat pump products available in other countries are not available in the U.S., and manufacturers may be reluctant to invest in market expansion on their own given the relatively small size of the U.S. market today. State and local governments and utilities could commit to purchasing initial tranches of equipment for use in buildings they own and operate to help bring new heat pump technologies to the U.S. market.
- + Encourage lower global warming potential gases to be used in heat pumps and encourage heat pump innovation over time. Higher incentives could be made available for appliances featuring low-Global Warming Potential (GWP) refrigerants.

5. ALIGN ENERGY EFFICIENCY GOALS AND PROGRAMS WITH GHG SAVINGS OPPORTUNITIES

- + Energy efficiency incentives should be aligned with GHG savings opportunities. Historically, energy efficiency programs have been designed with separate goals for reducing natural gas and electricity consumption. These programs focus on cost-effective kWh and therm energy savings rather than cost-effective carbon savings. Energy efficiency programs for fuel substitution, (e.g. switching from natural gas to electric end uses), have been effectively prohibited by the current interpretation of the CPUC's "three-prong test".⁸ The CPUC should update the three-prong test to directly consider carbon savings and allow incentive programs for electrification where cost-effective energy and carbon savings can be achieved. Furthermore, California should pursue a combined, all-fuels approach to cost-effectively reduce carbon emissions from buildings, reducing silos between natural gas and electrical efficiency programs.

⁸ The CPUC developed a standard to known as the "three-prong test" in the 1990s to determine whether energy efficiency program funding could be used for projects involving fuel switching. The broad objectives of the three-prong test, which are to ensure that energy efficiency programs: 1) save energy, 2) are cost-effective, and 3) not harm the environment, are valid. However, the definitions and application of the test have become outdated, and so in practice, the three-prong test has become a hurdle, preventing utilities from using energy efficiency funds to incentivize electric end uses over the direct use of natural gas. The CPUC has issued a ruling (R-13-11-005) seeking comments on possible revisions to the definition and implementation of the three-prong test, but no decision has been reached. For more information on the three-prong test, see the California Public Utilities Commission, 2013 Energy Efficiency Policy Manual, R.09-11-014, Version 5, July 5, 2013, pages 24-25: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_Electricity_and_Natural_Gas/EEPolicyManualV5PDF.pdf.

In summary, many low-rise residential building owners and residents could already see cost and GHG savings from electrifying space heating and water heating, even in the absence of incentives or programs. However, in order to increase adoption rates of low-rise residential building electrification options in California, the state will need to develop new policies and programs such as those described above, educate and train both contractors and consumers about building electrification technologies, and encourage market transformation for building electrification technologies.

1 Introduction

1.1 Study motivation

1.1.1 CALIFORNIA'S CLIMATE GOALS

California has established itself as a global leader in reducing greenhouse gas emissions (GHGs). The state has set ambitious targets to reduce emissions 40% below 1990 levels by 2030 (40x30; Senate Bill 32 of 2016) and to achieve carbon neutrality by 2045 (Executive Order B-55-18 of 2018). Recent analysis has indicated that to meet these goals, California will need to significantly reduce emissions from direct fossil fuel combustion in buildings, which currently represent ~10% of total statewide GHG emissions⁹.

Greenhouse gas emissions from electricity use in buildings are already on the decline, thanks to the state's renewable portfolio standard and energy efficiency efforts. However, GHG emissions from natural gas use in buildings has remained flat in recent decades. California Assembly Bill 3232 (2018) calls for the California Energy Commission to assess how to achieve a 40% reduction in GHG emissions by 2030 within the state's residential and commercial buildings. Achieving this goal in buildings in 2030, while remaining on the path to carbon neutrality by 2045, will require a major transformation of the existing building stock, and new construction, in California.

⁹ See Mahone et al. (2018).

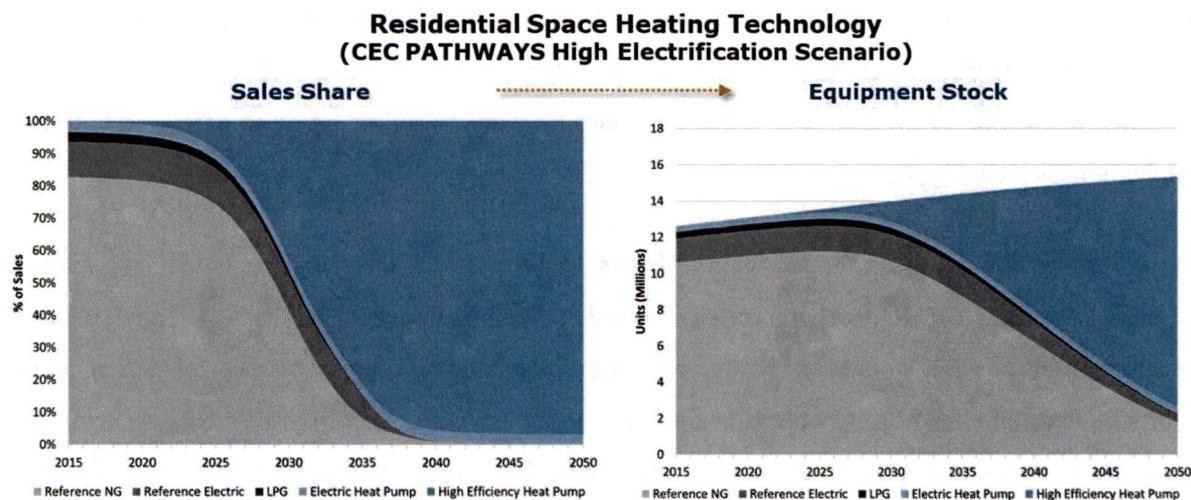
1.1.2 BUILDING ELECTRIFICATION IN THE CONTEXT OF CALIFORNIA'S GREENHOUSE GAS REDUCTION GOALS

There are two primary strategies to mitigate direct GHG emissions from buildings: 1) natural gas energy efficiency combined with extensive use of renewable natural gas (RNG), and 2) electrification of fossil fuel end uses in buildings. Neither one of these strategies have seen wide adoption to date, and both face implementation challenges.

In the near-term, progress is needed on both fronts. In the long-run, electrification in buildings appears to be a lower-cost GHG mitigation strategy from a societal perspective, particularly if the supply of renewable natural gas is limited, and limited progress is made on the commercialization of carbon neutral synthetic fuels and power-to-gas technologies. That was a key conclusion from E3's 2018 evaluation of several long-term energy and climate scenarios for the California Energy Commission (CEC), assessing how California could achieve its 2050 climate goals. The High Electrification scenario was one of those scenarios, and was among the lower cost, and lower risk scenarios evaluated.

In the High Electrification scenario, the sales share of electric heat pumps for residential space heating and water heating ramps up quickly, from less than 10% at present, to about 50% in 2030, and to 100% of all new sales in 2040 (Figure 1-1.). In this scenario, heat pumps for space heating and water heating saved 27 MMT CO₂e in 2050, relative to a 2050 economy-wide emissions target of 86 MMT statewide. While this scenario assumed that equipment is only replaced at the end of its useful lifetime, achieving this level of adoption of building electrification by 2050 would still require retrofitting at least half the existing residential building stock, more than 7 million homes, with electric heat pump space heating. Buildings, and the space heating and water heating equipment used in buildings, are long-lived and slow to change – which is why any effort to electrify buildings would need to begin in the early 2020s, in order to assure a reasonable pace of transitioning the state's building stock without causing disruption in people's homes.

Figure 1-1. Residential Space Heating Technology Sales Share and Equipment Stock in the High Electrification Scenario



The market share trajectory shown in the figure above is based on what might be required to meet the state's climate goals, rather than a detailed assessment of consumer economics and existing market barriers.

1.1.3 PREVIOUS STUDIES OF BUILDING ELECTRIFICATION

Other regions, including the U.S. Northeast and Northwest, have begun to explore the economic and practical implementation issues around “beneficial electrification” as a greenhouse gas reduction measure (Regulatory Assistance Project, NYSERDA, Northeast Energy Efficiency Partnership). The National Renewable Energy Laboratory assessed the potential for electrification in buildings, transportation, and industry throughout the US, including reviewing the likelihood for future heat pump innovation.¹⁰

¹⁰ See Mai et al. (2018).

However, California has unique climate, building stock, and energy prices compared with the rest of the US. Several recent studies have focused on the economics of electrification in California. The Rocky Mountain Institute analyzed case studies for four national locations, including Oakland, and highlighted three situations when building electrification is generally expected to be cost-effective: 1) when replacing oil or propane, 2) in new construction, and 3) when replacing both an air conditioner and a furnace.¹¹ A recent study from the Natural Resources Defense Council, performed by Synapse Energy Economics, also found the potential for both capital cost savings and bill savings from electrification in California, and identified a set of next steps to encourage building electrification in the state.¹² This study confirms many of the high-level findings of these previous studies, while taking a more detailed look at the consumer economics of residential electrification across more heat pump technologies, climate zones, and building types within California (Section 1.1.5).

1.1.4 HISTORICAL POLICY BARRIERS TO BUILDING ELECTRIFICATION & WHAT'S CHANGED

Historically, the California Public Utilities Commission (CPUC) and CEC enacted energy efficiency policies to reduce electricity consumption and encourage on-site use of natural gas over electric heating. This made sense, because electricity was largely generated from fossil fuels, in relatively inefficient powerplants, separated from the customer by transmission and distribution losses which further wasted energy. Meanwhile, on-site combustion of natural gas for heating was encouraged because it was more efficient than conventional electric resistance heating fueled by a fossil power plant.

It was in this context that the CPUC developed a standard known as the “three-prong test” in the 1990s to determine whether energy efficiency program funding could be used for projects involving fuel

¹¹ See Billimoria et al. (2018).

¹² Hopkins, Asa, K. Takahashi, D. Glick, M. Whited, “Decarbonization of Heating Energy Use in California Buildings,” Synapse Energy Economics, October 2018.

switching.¹³ The broad objectives of the three-prong test, which are to ensure that energy efficiency programs: 1) save energy, 2) are cost-effective, and 3) not harm the environment, are valid. However, the definitions and application of the test have become outdated, and so in practice, the three-prong test has become a hurdle, preventing utilities from using energy efficiency funds to incentivize electric end uses over the direct use of natural gas. The CPUC has issued a ruling (R-13-11-005) seeking comments on possible revisions to the definition and implementation of the three-prong test, but no decision has been reached.

California's energy efficiency programs, including the standards in the three-prong test, must be updated to reflect current requirements for low-carbon electricity on the grid, and to reflect the state's long-term climate goals. Today, California's electricity grid is relatively clean, with about 50% from renewable or zero carbon generation, and almost no coal generation. The grid will only get cleaner as load-serving entities comply with Senate Bill (SB) 100, which requires a 60% renewable portfolio standard (RPS) by 2030 and 100% of retail sales to be served by zero carbon electricity by 2045.

Meanwhile, increasingly efficient electric heat pumps are available in the market. Modern air-source electric heat pumps are 3 to 4 times more efficient than electric resistance or gas heaters, especially in California's mild climate. This means that a high-efficiency electric heat pump, powered by electricity from a natural gas combined cycle power plant, will generally consume less natural gas in total than the on-site combustion of natural gas in a conventional furnace.

Energy efficiency is one key component or "pillar" of deep decarbonization, along with electrification and the use of low carbon fuels (Mahone, 2018). The challenge at hand for regulators and policymakers today is to ensure that the definitions and policies around energy efficiency in buildings and appliance standards

¹³ California Public Utilities Commission. 2013. Energy Efficiency Policy Manual, R.09-11-014, Version 5, July 5, 2013, pages 24-25: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_Electricity_and_Natural_Gas/EEPolicyManualV5PDF.pdf.

are updated to reflect the state's climate goals, including by enabling and encouraging electrification and the use of low-carbon fuels in buildings.

1.1.5 GOALS OF THIS STUDY

This report evaluates the factors affecting market adoption of electric end uses in residential buildings in California, including retrofits of existing mixed-fuel buildings, as well as new all-electric construction. The key goal of this study is to provide a more detailed set of customer-focused analyses of building electrification options than have been previously undertaken in California. Elements of this study include:

- +
- >An assessment of impacts of building electrification using detailed electric and natural gas rate structures compared to hourly electricity demands;
- +
- A detailed breakdown of electrification and natural gas equipment capital costs, labor costs, and installation costs across different regions of California;
- +
- Scenarios to assess the changing dynamics in customer costs over time, with two scenarios of how electric and natural gas rates may change over time, as well as sensitivities with improved heat pump performance and lower capital costs over time;
- +
- A disaggregation of the impacts of building electrification by end-use, focusing on HVAC, water heating, cooking and clothes drying in different building types and climate zones across the state;
- +
- An identification of priority actions and market segments for future utility or state programs to encourage building electrification.

This study focuses on the economics of electrification with current market and policy conditions and is not intended as a detailed program design assessment for building decarbonization. Likewise, previous work¹⁴ has highlighted the need for a more detailed assessment of the role of the natural gas system in the context of California's climate goals. California will need to develop a natural gas transition strategy if building electrification proves to be a successful decarbonization strategy, particularly for natural gas

¹⁴ See Mahone et al. (2018).

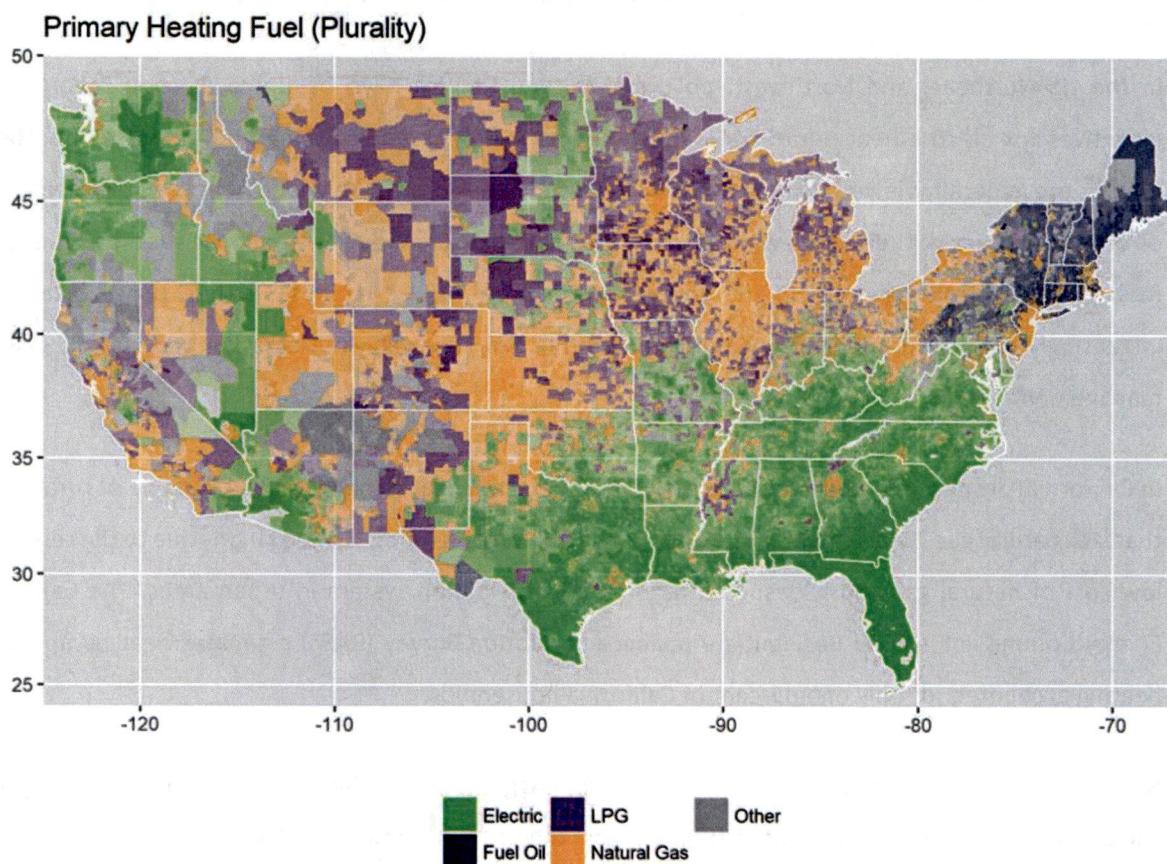
customers and distribution utilities. The potential implications of this gas transition strategy are outside the scope of this study.

1.2 Building electrification market overview

In the United States, the use of electric space heating is highest in the South and Pacific Northwest. These regions are characterized by mild winters and historically, cheap electricity and limited natural gas distribution (Figure 1-2.). Historically, these regions have relied on lower efficiency electric resistance heat and older technology heat pumps. However, as heat pump technology has improved, electric heat pumps are becoming an increasingly attractive option even in very cold climates. Electric heat pump adoption has grown in the Northern US, particularly in states like Maine and Vermont, largely displacing higher cost heating fuels like fuel oil, wood, coal, and propane¹⁵.

¹⁵ See Lapsa et al. (2017)

Figure 1-2. Residential Electric Space Heat Market Share in the United States



Data from the American Community Survey (2016).

While modern, higher efficiency heat pumps still represent a relatively small share of most segments of the US heating market, they represent a growing share of HVAC deployments in new homes, particularly in the Southern US. The Energy Information Administration's latest Residential Energy Consumption Survey (RECS) estimates 12 million American households (10% of total households) currently use electric

heat pumps as their primary space heating equipment, with 40 million households using electricity as their primary heat source. Over 70% of households relying primarily on heat pumps are in the South¹⁶.

In the US Northeast and Northwest, policymakers and utilities have begun to develop rebates and incentives for electric heat pump adoption, including in New York, Washington, and Vermont. These policies are generally viewed in the context of energy efficiency, with the added benefit of displacing fuel oil or other expensive fuels; however, using electric heat pumps to reduce greenhouse gas emissions from fossil fuels is increasingly part of the policy conversation in these regions. Further, policymakers are increasingly interested in electric heating as a method for renewables integration and electric system management¹⁷.

In California, despite its moderate climate, the use of electric heat remains limited, outside of rural areas that lack natural gas. Electric heat pump adoption in California remains limited largely due to the relatively low cost of natural gas and widespread natural gas distribution system in urban areas. The California Energy Commission's 2009 Residential Appliance Saturation Survey (RASS) estimates heat pump space heating accounted for only one percent of California households.

Many municipal utilities and Community Choice Aggregators (CCAs) in California, including the Sacramento Municipal Utility District (SMUD), Los Angeles Department of Water and Power (LADWP), Marin Clean Energy, and Sonoma Clean Power have begun to offer incentives and programs for electric heat pumps as a cost-saving and greenhouse-gas saving measure. Some of these programs focus on incentivizing electrification in new homes.¹⁸

¹⁶ From the EIA Residential Energy Consumption Survey: <https://www.eia.gov/consumption/residential/data/2015/hc/php/hc6.8.php>

¹⁷ See Billimoria et al. (2018).

¹⁸ For a recent summary of policies and programs for building electrification, see, "Meja Cunningham, A. Ralston, M. and Wu, K., "Strategies and Approaches for Building Decarbonization," Transcendent Energy for the Building Decarbonization Coalition, 2018.

1.3 Report contents

The remainder of this report is organized as follows:

- + **Section 2** describes the modeling approach applied in this analysis, including assumptions about the California housing stock and heating fuel mix, building energy simulations, customer economics, greenhouse gas impacts, and grid impacts.
- + **Section 3** presents the results of the analysis.
- + **Section 4** identifies barriers to electrification and potential solutions.
- + **Section 5** concludes with recommendations and additional research needs.

Additionally, several appendices with additional technical details are included:

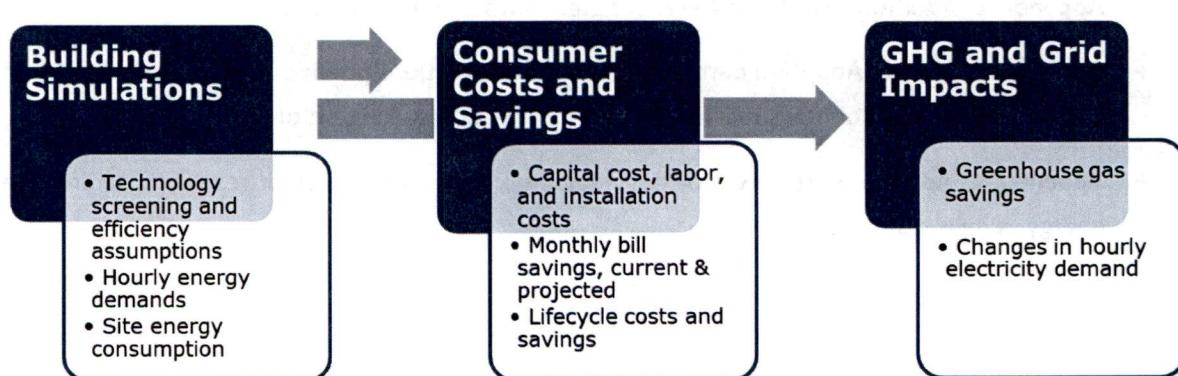
- + **Appendix A: Technology Characterization and Screening** describes the criteria for selecting the appliances modeled.
- + **Appendix B: Building Simulation Descriptions** describes the modeling of building energy demands.
- + **Appendix C: Additional Methods Detail** for greenhouse gas calculations
- + **Appendix D: Market Adoption Barriers and Potential Solutions** provides a more complete list of market barriers and solutions than the key examples discussed in Section 5.
- + **Appendix E: Additional Results** provides additional charts and tables of results, including site energy savings results.

2 Modeling Approach

2.1 Methods Overview

This section describes the methods and modeling approach used in this study. At a high level, we started with data on the existing housing and appliance stock. Building simulations were used to develop estimates of hourly energy demands. This information was used to estimate the bill impacts of building electrification, which combined with estimates of the capital costs of building electrification, allowed us to calculate lifecycle costs and savings. The building simulation data was also used to evaluate the greenhouse gas savings of building electrification and changes in hourly electricity demand that could be associated with high levels of building electrification in California. Each of these steps are described in more detail below.

Figure 2-1. Analysis steps schematic

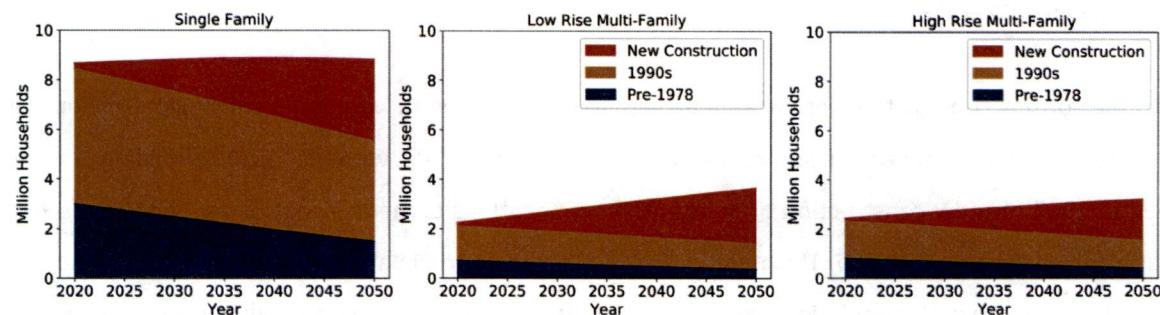


2.2 California Housing Stock and Market Potential

2.2.1 HOUSING STOCK

In 2014, California's population of 39 million resided in 13 million households, which the California Department of Finance (DOF) forecasts will grow to 50 million people by 2050, in approximately 16 million households.¹⁹ The majority of households live in single family dwellings, although multifamily housing comprises the majority of new construction.²⁰ California also includes about 0.6 million mobile homes, which are not pictured, and are not studied here, but which are included in the California PATHWAYS model. The characteristics of the building stock over time determine the characteristics of the market for new appliances and the potential for electrification.

Figure 2-2: Projected residential housing stock for single family, low-rise multifamily and high-rise multifamily



Source: Based on 2019 data from the E3 California PATHWAYS model, residential building stock-rollover assuming a 75-yr mean life and that new housing keeps up with population growth

The California PATHWAYS model (Mahone et al. 2018) simulates the state building stock using historical and projected county-level population based on the DOF forecast. It assumes a stock-rollover of housing units, treating substantial building shell upgrades and retrofits as new buildings for the purposes of

¹⁹ See <http://www.dof.ca.gov/Forecasting/Demographics/projections/> (version available in 2016 was used; more recent data is now available)

²⁰ See http://www.dof.ca.gov/Forecasting/Economics/Indicators/Construction_Permits/

modeling building energy demands (Figure 2-2). A 75-yr mean lifetime is assumed for turnover and shell upgrades. The proportion of existing appliances is determined from the Residential Appliance Saturation Survey (RASS)²¹.

The rate of new construction relative to existing homes is a key metric for assessing the potential for electrification, as logistical barriers to electrification are generally much lower for new construction than for retrofitting existing housing. New buildings naturally provide a decision point for installing an efficient technology, whereas retrofits may require cumbersome or costly adjustments to features such as ducts, electrical wiring, and appliance placement. All-electric new buildings can avoid the costs inherent in supporting dual fuel capability. Previous studies have identified new buildings as a priority for building electrification.²² Following the assumptions in PATHWAYS, new construction is expected to represent about one half of the building stock by 2050; this means that meeting the adoption rates in the High Electrification Scenario (Section 1.1.2) will require retrofitting at least half the existing residential building stock, more than 7 million homes.

California housing construction has not kept up with population growth, with a current shortfall estimated at more than 3 million homes.²³ This is reflected in building permit data, with the 117,000 building permits issued in 2017 for new construction or substantial modifications exceeding that of any year in the last decade, which averaged 74,000. This number is short of the approximately 100,000 annual new homes required to keep up with population growth at constant household size, with no allowance for turnover of the existing housing stock. In this study, we assume that building turnover and new construction will eventually rise commensurate with a 75-year turnover of the existing building stock and population growth. We note that if this does not occur, even more retrofits may be needed than we estimate here to reach the state's climate goals. Conversely, housing policy reforms that facilitate new construction and

²¹ 2003 California Residential Appliance Saturation Study (KEMA-XENERGY, Itron, and RoperASW 2004).

²² See Billimoria et al. (2018) and Hopkins et al. (2018).

²³ See Woetzel et al. (2016).

faster turnover of existing buildings – many of which are currently overdue for upgrades – could potentially accelerate a transition to building electrification.

The two tables below show the share of the residential existing housing and new construction housing stock for single family detached and low-rise multifamily that are assumed to be located in each combination of climate zone and utility service territory modeled in this study (eight combinations). The tables illustrate the estimated share of housing in each region in 2020; these shares may change slightly over time as new housing is constructed in different parts of the state. These estimated shares are used to weight the results of the building simulations to come up with estimates of total impacts from residential low-rise building electrification. The data for Table 2-1 and Table 2-2 are derived from the estimated housing shares from the California PATHWAYS model (as illustrated in Figure 2-2) and a geographic mapping to climate zone and utility.

Table 2-1. Share of low-rise residential existing housing (as of 2020) assumed by climate zone and utility in the modeled study area

Climate Zone	Major City	Utility	Retrofits	
			Single Family	Low-rise Multifamily
CZ03	San Francisco	PG&E	17%	4%
CZ04	San Jose	PG&E	8%	2%
CZ12	Sacramento	SMUD	7%	2%
CZ06	Coastal LA	SCE	10%	3%
CZ06	Coastal LA	LADWP	2%	1%
CZ09	Downtown LA	SCE	12%	3%
CZ09	Downtown LA	LADWP	13%	3%
CZ10	Riverside	SCE	11%	3%
		Total	80%	20%

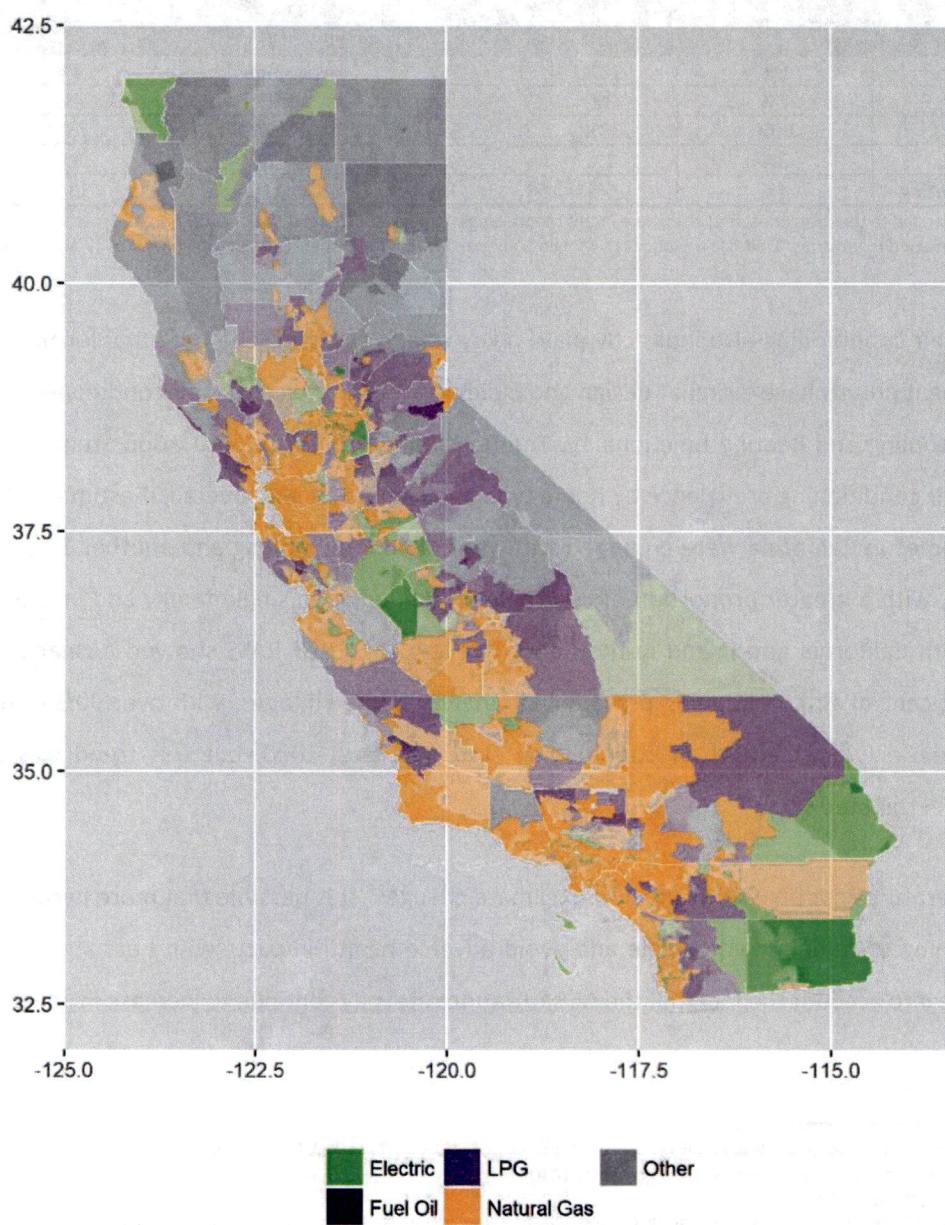
Table 2-2. Share of low-rise residential new construction housing (as of 2020) assumed by climate zone and utility in the modeled study area

Climate Zone	Major City	Utility	New Construction		
			Single Family	Low-rise	Multifamily
CZ03	San Francisco	PG&E	14%	9%	
CZ04	San Jose	PG&E	6%	4%	
CZ12	Sacramento	SMUD	6%	4%	
CZ06	Coastal LA	SCE	7%	5%	
CZ06	Coastal LA	LADWP	1%	1%	
CZ09	Downtown LA	SCE	8%	5%	
CZ09	Downtown LA	LADWP	9%	6%	
CZ10	Riverside	SCE	9%	6%	
			Total	61%	39%

2.2.2 APPLIANCE STOCK

The existing fuel mix and appliance population in California homes also provides a starting point for analysis. Most urbanized areas in California are predominantly natural gas heating, with electric heating (typically cheaper electric resistance heating) and propane (Liquefied Petroleum Gas, or LPG) in many rural areas (Figure 2-3). Overall, 86% of single family homes were estimated to use natural gas as their primary heating fuel in 2009, with a somewhat lower proportion in multifamily homes, particularly high-rise apartments (Table 2-3). This data is used to populate the 2015 PATHWAYS equipment stock and when estimating statewide impacts (except for SMUD, where utility-specific data indicated a higher prevalence of electric resistance space and water heating).

Figure 2-3: Residential Space Heating Fuel Market Share in California



Source: Authors' visualization. Data from the American Community Survey (2016). Only the plurality heating fuel is shown in each geographic region.

Table 2-3: Heating Fuel Prevalence by Housing Type in California²⁴

Fuel	Single Family Detached	Townhouse	2-4 Unit Apartment	5+ Unit Apartment	Mobile Home
Electric (Resistance)	5%	13%	19%	30%	4%
Electric (Heat Pump)	2%	3%	3%	5%	4%
Natural Gas	86%	78%	69%	53%	73%
LPG	3%	1%	1%	1%	8%
No central space heating	4%	5%	8%	11%	11%

These building types are mapped to the categories used elsewhere in this report. Single family detached are single family homes. Townhouses and 2 to 4 unit apartments are grouped together as "Low-rise Multifamily". Mobile homes and 5+ unit apartment buildings (high-rise multi-family) are not considered in this report.

The prevalence of air conditioning also indirectly plays a key role in assessing the potential for building electrification, as heat pumps have a similar design and building footprint to central air conditioners, and can provide both cooling and heating functionality. The Residential Appliance Saturation Study (RASS) provided data on air conditioning prevalence by home type and climate zone.²⁵ Overall, it estimated that 54% of low-rise homes in California were equipped with central air conditioning and another 14% with room conditioning, with a greater proportion of central air conditioning in single family and in warmer climates in Southern California and inland in the Central Valley. The 2009 RASS showed a clear trend towards increasing central air conditioning prevalence in newer home vintages, with over 90% of new single family homes including central air conditioning statewide post-2000, but this trend was not explicitly modeled in this study.²⁶

As California temperatures continue to warm due to climate change²⁷, it is possible that more people will adopt air conditioning to remain comfortable and avoid adverse health impacts with heat stress. This study does not take into account the fact that the AC saturation rate may continue to increase in California

²⁴ These data were based on the 2003 California Residential Appliance Saturation Study (RASS) (KEMA-XENERGY, Itron, and RoperASW 2004); heating fuel prevalence showed little change in the 2009 version (Palmgren et al. 2010).

²⁵ These data were from the 2003 RASS (see above).

²⁶ Data available from <https://webtools.dnvgi.com/RASS2009/Default.aspx?tabid=0>. Across all home types statewide, over 80% of new homes included central air conditioning after 2000. However, large regional variation remained, with much higher prevalence of new homes lacking central air conditioning in climate zones 3 and 5.

²⁷ See Pierce, Kalansky, and Cayan (2018).

over time, which could also make heat pump HVAC systems economically attractive to a larger number of households in the state.

2.3 Building Simulations and End Use Technologies

2.3.1 BUILDING SIMULATION TOOLS AND ASSUMPTIONS

Building simulations and hourly energy consumption

The hourly energy consumption of natural gas and electric technologies in homes was evaluated using industry-standard building simulation tools. Two building types were evaluated: single family (SF) and low-rise multifamily (LRMF). For each of these building types, a base case mixed-fuel home was modeled with natural gas providing space heating, water heating, cooking and clothes drying. This base case was compared to an upgraded all-electric home, with gas appliances converted to electric appliances.

Frontier Energy used the National Renewable Energy Laboratory's (NREL's) BEopt software and the Department of Energy's EnergyPlus simulation engine to develop the energy models. Modeling assumptions were mostly based on the 2014 Building America House Simulation Protocols²⁸, with a few exceptions. Water heater hourly draw profiles and lighting energy use reflect the most current algorithms and data incorporated in the 2016 and 2019 CBECC-Res software, which is used to demonstrate compliance with the Title 24, Part 6 energy code. This is documented in the 2016 Residential Alternative Calculation Method Reference Manual²⁹. Certain modeling capabilities desired for this analysis were not available within BEopt, and therefore the energy model input files were exported and additional edits were made using EnergyPlus before running the simulations. EnergyPlus was used directly to apply the

²⁸ See https://www.energy.gov/sites/prod/files/2014/03/f13/house_simulation_protocols_2014.pdf

²⁹ See <https://www.energy.ca.gov/2015publications/CEC-400-2015-024/CEC-400-2015-024-CMF-REV3.pdf>

California water heater draw profiles and also make adjustments to other water heating inputs that could not be done in BEopt.

In all building simulations, weather files were based on the California Energy Commission's Title 24 typical meteorological year data. The key modification from the Title 24 building specifications was a modification of the heating and cooling set-point schedules, to conform with observed California data. The Title 24 schedules include uncharacteristic setbacks. The project team settled on a heating and cooling setback schedule based on a review of relevant literature, including California Nest data. For more details about the thermostat set point assumptions and other building simulation parameters see Appendix B: Building Simulation Descriptions.

2.3.2 BUILDING TYPES AND CLIMATE ZONES MODELED

Two building types are modeled across six California climate zones (see Table 2-4 and Figure 2-4). The assumptions about each home type are described below. We designed each case as a comparison between a mixed fuel home, with natural gas space heating, water heating, cooking, and clothes drying, and an all-electric home.

We attempted to compare options with similar levels of comfort and aesthetic characteristics whenever possible in order to provide the most fair comparison. For instance, we only compared retrofit homes in which air conditioning would be found in the mixed fuel home, for comparison with an electric home containing an HVAC heat pump providing cooling services. For new construction, we excluded technology options like packaged terminal heat pumps (PTHPs) that may be inexpensive but are seen as less aesthetically desirable.

1) Single family homes are assumed to be a one- or two-story detached home, with the square footage of the home depending on the vintage. The older pre-1978 vintage homes are assumed to be constructed before the California building code went into effect and include poor levels of building insulation and

single pane windows. These homes are assumed to be single-story, two-bedroom, 1,400 square foot homes. The 1990's vintage homes are assumed to be single story, three-bedroom, 2,100 square feet homes built to comply with the 1992 building code, with minimal building insulation and double-pane windows. New construction homes are the largest homes modeled, at 2,700 square feet with two floors and four bedrooms. New construction homes are designed to meet the 2019 Title 24 building code requirements, including the requirements for new rooftop solar PV (a 3 kW solar array per home is assumed). New construction homes are assumed to install the same size rooftop solar panel in both the gas baseline and all-electric home, and as a result the rooftop solar has a relatively minor impact on the relative bill savings between these two options. The 2,100 square foot (1990's vintage) and the 2,700 square foot (new construction) homes are based on the California Energy Commission's single family prototypes used in the Title 24, Part 6 development process.

2) Low-rise multifamily (LRMF) homes are assumed to be two-story apartment buildings with six to eight units, depending on the building vintage. Like the single family homes, the LRMF new construction buildings have minimal insulation for the older vintage construction, meet the 1992 building code requirements for the 1990's vintage homes, and achieve the 2019 Title 24 building code requirements for new construction, including the use of rooftop solar PV (1.75 kW per unit is assumed). New construction homes are assumed to install the same size rooftop solar panel in both the gas baseline and all-electric home, and as a result the rooftop solar has a relatively minor impact on the relative bill savings between these two options. The pre-1978 vintage and the new construction building prototypes both include four one-bedroom, 780 square foot units, and four two-bedroom 960 square foot units. The 1990s vintage building includes six three-bedroom, 1,500 square foot units. The pre-1978 and the new construction vintage homes are based on the California Energy Commission's multifamily prototypes used in the Title 24, Part 6 development process.

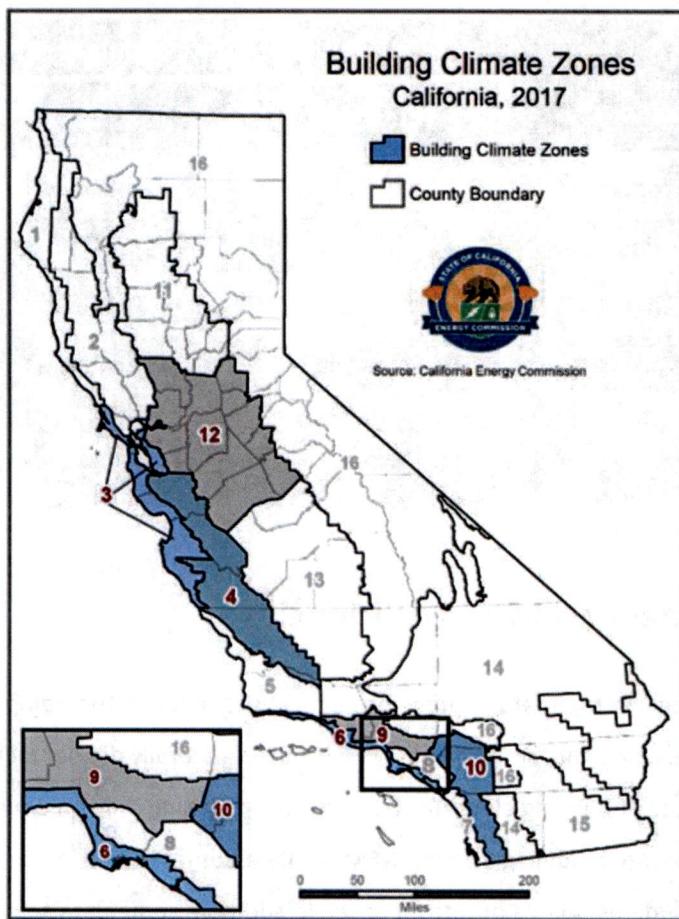
Table 2-4 Modeled building types and vintages

	 Single-Family	 Low-Rise Multifamily
Retrofit (Pre-1978) (No insulation, single pane windows)	1,400 sf	6,660 sf 8 units (780 sf/unit + 960 sf/unit)
Retrofit (1990s) (T24 building code 1992 construction)	2,100 sf	9,000 sf 6 units (1500 sf/unit)
New Construction (2019 T24 building code)	 2,700 sf	 6,660 sf 8 units (780 sf/unit + 960 sf/unit)

For each of the six building types evaluated (as described in Table 2-4 above), building simulations are performed across six California climate zones. The climate zones were selected to represent a sample of the largest population centers in California across the service territories of the participating utilities (SCE, SMUD and LADWP), with the inclusion of two Northern California climate zones in PG&E's service territory for completeness. Overall, these six climate zones represent about 50% of the state's households, covering the regions around: San Francisco, San Jose, Sacramento, Coastal Los Angeles, Downtown Los Angeles and Riverside. Data from the Residential Appliance Saturation Survey suggest that 62% of the households in the six climate zones we studied have central or room air conditioning in our study area, compared to 68% statewide, suggesting that our study area is moderately representative of the statewide air conditioning saturation rate. We estimate that the climate zones included in this study are broadly

representative of about 90% of the state's households. An assessment of building electrification for the remaining 13% of the state's households, largely rural, represents a potential area for further study.³⁰

Figure 2-4. California's Building Climate Zones, six study area climate zones evaluated are shaded in blue and grey



³⁰ Poorly covered climate zones which may be quite dissimilar to those modeled include the climate zones 1 and 2 along the northern coast, the northernmost Central Valley in climate zone 11, the mountainous climate zone 16, and the southeastern desert climate zones 14 and 15. We note that many of these climate zones include rural households that lack natural gas infrastructure and use expensive propane or electric resistance heating (Figure 2-3), so may be good candidates for heat pump retrofits as shown in previous studies.

For each climate zone, the electric and natural gas residential rates for the corresponding major utilities are evaluated in the customer bill savings calculations: PG&E, SMUD, SCE and LADWP electric rates, and PG&E and SoCalGas natural gas rates are applied, as shown in Table 2-5 below.

Table 2-5 Electric and gas utilities in the six climate zones

Building Climate Zone	Major City	Utility Rates Evaluated	
		Electric	Gas
CZ03	San Francisco	PG&E	PG&E
CZ04	San Jose	PG&E	PG&E
CZ12	Sacramento	SMUD	PG&E
CZ06	Coastal LA	SCE / LADWP	SoCalGas
CZ09	Downtown LA	SCE / LADWP	SoCalGas
CZ10	Riverside	SCE	SoCalGas

2.4 Upfront equipment costs and efficiencies

For this study, we found that existing data sources on natural gas and electric equipment costs were lacking in key respects. The existing data sources that we evaluated generally did not include estimates of the labor and installation costs of building electrification retrofits, focusing only on equipment costs. For example, the U.S. National Energy Modeling System (NEMS) data assumes a “like for like” replacement of equipment and does not include estimates of retrofit costs. In addition, some data sets did not include a comprehensive set of cost data for a range of natural gas and electric technologies.

Given the need for a comprehensive and internally-consistent set of installed equipment cost data across a range of building types and regions of California, we decided to create new estimates of installed building equipment technology costs using a professional cost estimator from AECOM. Of course, no single point cost estimate of installed building equipment will be applicable across all buildings, even if those costs are specific to a given building type and geography. Buildings are heterogeneous; in particular, retrofit and equipment installation costs vary based on many factors.

The cost-estimation approach relies on a combination of published equipment costs and market and professional experience. By creating this bottom-up estimate of installed capital costs using the same cost estimator, we hope that we have at least captured the most common sets of cost drivers in an internally consistent way.

The all-in, installed capital costs of electric equipment are compared to the cost of natural gas equipment using cost estimates. Capital costs, including installation, labor and retrofit costs were developed using California-specific information about labor rates and standard industry mark-ups. In the case of heat pump HVAC systems, which provide both heating and cooling, the costs of the electric heat pump are compared to the cost of a natural gas furnace plus an air conditioner, in regions of the state where air conditioning is prevalent. In retrofit situations, the electric heat pump HVAC system is assumed to replace a gas furnace, plus a portion of the cost of a new air conditioner. This adjustment is made to reflect the fact that there is still some useful economic life remaining in an air conditioner if it is replaced when the gas furnace fails. The guiding principle here is to minimize early retirement of equipment where possible – generally assuming only “replace-on-burnout” in retrofit situations, except for the air conditioner which is replaced upon burnout of the gas furnace.

We assume that homes that do not currently have air conditioning (primarily those in the San Francisco/Climate Zone 3, in this study), will not adopt air conditioning in gas-fueled homes. However, existing homes that currently have window AC units are assumed to upgrade to a central AC system when

they replace the HVAC system. This assumption attempts to ensure that we are comparing similar levels of thermal comfort in both the gas-fueled and electric homes in areas where air conditioning is commonly needed.

Capital costs are estimated for heat pump HVAC systems, heat pump water heaters, electric resistance and induction stoves and electric resistance and heat pump clothes dryers separately. For all-electric new construction homes, the avoided cost of natural gas infrastructure (both in-home and for interconnections to the utility) is included in our cost model. The avoided in-home natural gas piping infrastructure is reflected in the equipment capital cost estimates developed by AECOM.

An additional cost saving is applied separately based on an estimate of the avoided natural gas piping cost associated with the service and meter connection. In practice, these avoided costs will be highly site-specific and could vary widely depending on the size and location of the housing project. The estimated avoided costs of natural gas infrastructure and interconnection to the utility (outside of the avoided gas piping in the building itself) are based on estimates from the draft 2020 California Title 24 Building Reach Code³¹ and include:

- + Single family residence: \$6,000
- + LRMF: \$6,000 (cost is shared by 6-8 units, resulting in \$750 or \$1,000 per household)

Gas interconnection costs will vary greatly depending on the location of the building, making it difficult to come up with a single, central estimate. If anything, these avoided gas infrastructure costs may represent conservative estimates. However, it is important to note that in this study, the avoided gas infrastructure cost savings within the building itself are included in the equipment capital cost estimates. This study does

³¹ Based on estimates from, "PG&E Residential Building Gas Service Installation Costs" dated January 28, 2019.

not attempt to estimate the avoided societal costs of gas interconnections for new construction, which are shared among all gas ratepayers and would not be a cost or benefit to individual customers.

In retrofit homes moving from gas to electric end uses, the individual replacement of one end use or appliance is not assumed to trigger the need for a complete electrical panel upgrade. Pre-1978 vintage homes are assumed to trigger the incremental cost of a panel upgrade to 200A when both the HVAC and domestic hot water systems are electrified at the same time. The following panel upgrade costs are applied^{32,33}:

- + Single family: \$4,256
- + Low-rise multifamily: \$2,744

Hourly labor rates vary by region of the state and are estimated based on all-in costs for experienced and licensed contractors. These labor rates vary from \$65/hour to \$95/hour depending on the region. The total cost estimates also reflect a mark-up for overhead, which varies between 15% to 20% depending on the region of the state. Design and engineering costs are 10% of the project cost. Permit, testing and inspection costs are 1.25% of project costs, while contractor profit and market factors are used to reflect local market conditions in some markets and vary from 0% in Sacramento and Riverside to 8% in San Francisco.

To illustrate the categories included in the capital cost estimates for each technology, an example is provided below for a 1990s vintage single family home that retrofits a gas furnace to an electric HVAC heat pump.

³² See the City of Palo Alto 2019 Title 24 Energy Reach Code Cost Effectiveness Analysis: <https://cityofpaloalto.org/civicax/filebank/documents/66742>

³³ See the Palo Alto Electrification Final Report: <https://www.cityofpaloalto.org/civicax/filebank/documents/55069>

Figure 2-5. Example of installed equipment capital cost data developed for this analysis: Single family HVAC heat pump retrofit, 1990s vintage, Climate Zone 6

Demolition		
Remove existing furnace		
Labor		680
Disposal		500
		<hr/>
		1,180
Installation		
Furnace		
<i>Included in heat pump</i>		
New Furnace, equipment price		
<i>Heating included in split system heat pump</i>		
Miscellaneous supplies		
Labor		
Air Conditioner		
New Air Conditioner, equipment price	\$	5,400
<i>Ducted split heat pump AHU in attic,</i>	\$	-
3-ton 18 SEER/14 EER, 10 HSPF, two-	\$	
Concrete pad, precast	\$	100
Refrigerant piping and refrigerant	\$	400
Miscellaneous supplies	\$	400
Labor	\$	1,360
Controls		
Thermostat & wiring	\$	400
Gas and Electrical Supply		
New electrical circuits to equipment	\$	190
Panel and main service modification		<i>Not required</i>
Gas supply piping		<i>Not required</i>
Labor	\$	340
Ductwork modifications		
Miscellaneous supplies	\$	250
Labor	\$	680
	\$	<hr/> 9,520
Subtotal	\$	10,700
	\$	-
General Conditions and Overhead	\$	1,605
Design and Engineering	\$	1,231
Permit, testing and inspection	\$	169
Contractor Profit/Market Factor	\$	274
Recommended Budget	\$	13,979

2.4.1 TECHNOLOGIES MODELED

Existing mechanical system types are selected to represent typical construction practices for each building type and vintage. In the building models used in this study, appliances are replaced at the end of their useful life (“replace on burnout”) and replaced with either a comparable electric technology or a comparable gas technology. The electric upgrade case applies the electric technology that best complements the existing conditions while considering cost, technical feasibility, market feasibility, and occupant acceptance. In most cases, the gas upgrade assumes replacement with the same type of equipment as is existing. All applicable building codes are assumed to be met in both the electric and gas upgrade cases.

2.4.1.1 *Heating, Ventilation and Air Conditioning (HVAC) Systems*

In the gas-fueled homes modeled, the HVAC system consists of a natural gas furnace and an air conditioning unit. The size and type of the gas furnace and air conditioner vary based on the home type and the climate zone. The natural gas baseline home is assumed to meet the code minimum requirements for HVAC equipment in 2018. Homes with window air conditioning are assumed to be retrofitted to central air conditioning in order to ensure a comparable level of home comfort with the electric heat pump alternative. Overall, the building simulations suggest that in the California climate zones modeled here, HVAC heat pumps may perform better than their rated efficiencies, due to the relatively mild climate compared to the efficiency rating test conditions. Below we present the rated efficiencies of the equipment modeled; the “achieved” efficiencies vary by home type and climate zone and are generally higher.

Three types of electric air source heat pump HVAC systems are evaluated:

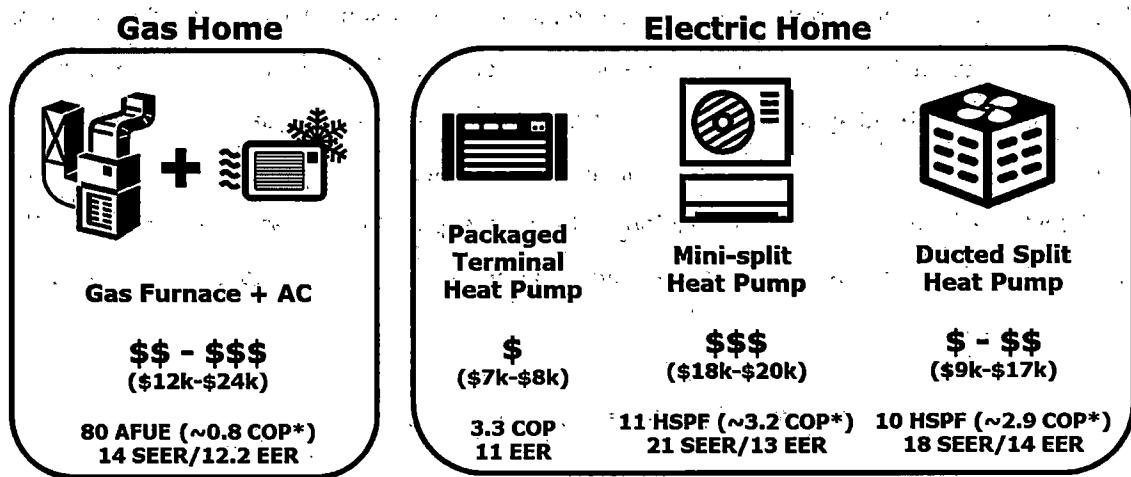
- + **Packaged terminal heat pumps:** These are self-conditioned units which can provide both space heating and cooling. They are often found in hotels but are increasingly considered as low-cost

options for small apartments and condos. Packaged terminal heat pumps (PTHPs) are generally only appropriate for smaller homes and are modeled here with a COP of 3.3.

- + **Mini-split heat pumps:** These heat pumps have an outdoor compressor/condenser and one or more indoor fan coil units. Ductless mini-split heat pumps can be installed in homes without ducts, which can make them good options for some retrofit situations. Mini-split heat pumps utilize a variable speed compressor and can achieve very high efficiencies. The base case modeled efficiency in this study is an HSPF of 11 (or a rated COP of 3.2; although actual performance will vary by climate and use patterns).
- + **Ducted split heat pumps:** A ducted split heat pump also has an outdoor compressor/condenser, but only one indoor air handling unit which pushes air throughout the home via ducts, in the same way that a central air conditioning system and furnace would. The base case modeled efficiency in this study is an HSPF of 10 (or a rated COP of 2.9, although actual performance will vary by climate and use patterns).

The various HVAC systems used in the homes modeled are summarized in Figure 2-6.

Figure 2-6 Modeled gas and electric HVAC systems: technology, price range and efficiency



Ranges reflect the range of prices across climate zones as a result of labor cost differences.

In addition to the “common high-efficiency” products modeled in the base case, we also evaluate the performance of a “best-in-class” product and an “emerging technology” product for the ducted split HVAC heat pumps and mini-split HVAC heat pumps. The Best-In-Class product represents the highest efficiency available in today’s California marketplace. The Emerging Technology product represents expected technology advances in future products.

Table 2-6, and Table 2-7: Low-rise describe the rated efficiencies applied in this analysis to HVAC equipment for the standard product as well as the two higher-efficiency tiers.

Table 2-6. Single family HVAC New Construction Efficiencies

Ducted split air source heat pump	# Speeds	Seasonal AHRI Ratings		
		SEER	EER	HSPF
Common High Eff Product	2	18	14	10
Best-In-Class Product	variable	21	15	13
Emerging Tech Product	variable	25	18	16

Table 2-7: Low-rise Multifamily HVAC New Construction Efficiencies

Mini-split heat pump	# Speeds	Seasonal AHRI Ratings		
		SEER	EER	HSPF
Common High Eff Product	variable	21	13	11
Best-In-Class Product	variable	30	15	14
Emerging Tech Product	variable	36	18	17

Best-In-Class performance assumptions are based on products in the Air-Conditioning, Heating, & Refrigeration Institute's (AHRI's) certification directory³⁴ and are selected either to match those products with the highest available HSPF or go slightly beyond. For the Emerging Technology option, the project team researched trends in system performance and technology.

An IEA study from 2011³⁵ stated that heat pump COP performance (for both cooling and heating) is expected to increase by 20% in 2020 and 50% in 2030. Assuming the 2020 target has been met, this translates to an additional 25% increase moving to 2030. For this analysis the Emerging Technology performance was assumed to be 20% better than the Best-In-Class, applying a slightly more conservative improvement factor than the IEA study to better represent the next 5 years.

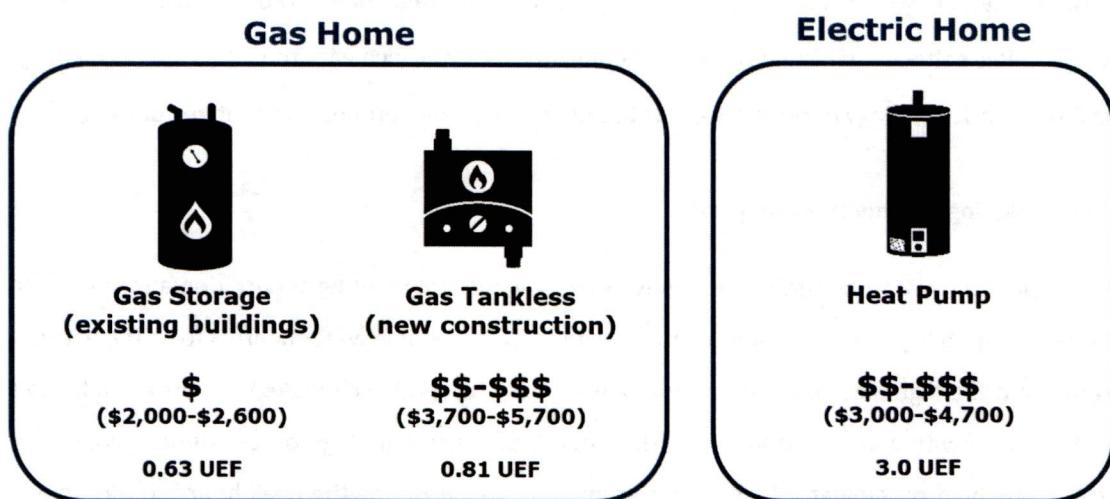
2.4.1.2 Domestic Hot Water (DHW)

In existing, natural gas-fueled homes, the base case domestic hot water system is assumed to be a code-minimum gas storage water heater with a uniform energy factor (UEF) of 0.63. In new construction gas-fueled homes, consistent with the requirements of the California Title 24 building code, gas tankless water heaters are assumed, with efficiencies of UEF 0.81. In the electric retrofit and electric new construction alternatives, heat pump water heaters are evaluated, with a base case efficiency of UEF 3.0.

³⁴ See <https://www.ahridirectory.org>

³⁵ See <https://webstore.iea.org/technology-roadmap-energy-efficient-buildings-heating-and-cooling-equipment>

Figure 2-7 Modeled gas and electric water heating systems: technology, price range and efficiency



Ranges reflect the range of prices across climate zones as a result of labor cost differences.

Higher efficiency heat pump water heaters are evaluated in a sensitivity analysis, using a “best-in-class” efficiency of 3.4 UEF, and an “emerging technology” UEF of 4.1. Table 2-8. describes the rated efficiencies applied in this analysis to water heaters for the standard product as well as the two higher-efficiency tiers.

Table 2-8. Heat Pump Water Heater Efficiencies

Technology Class	Rated Efficiencies	
	UEF	COP
Common High Efficiency Product	3.0	3.5
Best-In-Class Product	3.4	4.3
Emerging Tech Product	4.1	5.0

Best-In-Class performance was based on the Sanden heat pump water heater.³⁶ For this performance category, the Sanden COP was reduced by 15% relative to the rated value of 5.0 to better align with results from the CBECC-Res software, which was used to demonstrate compliance with the Title 24, Part 6 energy code. The Emerging Technology performance was based on the Sanden product without any derating.

Flexible water heating sensitivity assumptions

Water heater production can be optimized to save energy while still meeting service demand, thanks to the heat storage capability of water. Smart control technology can enable water heaters to shift electricity demands to avoid the high electric rates under a time-of-use (TOU) rate schedule. We perform a flexible water heating sensitivity analysis to evaluate the impact of this technology on consumer economics, assuming that the heat pump water heater runs at minimal power during the peak hours, and is able to shift all heating demands to hours before the highest priced TOU period. For the purposes of this sensitivity we assume that energy demands are shifted prior to the peak TOU period rather than after the peak TOU period – however, since off-peak TOU rates are generally symmetrical before and after the peak TOU rate, this assumption does not affect the consumer cost results. Other research has demonstrated that the use of flexible heat pump water heaters is a feasible technology option, and can provide customers with benefits in the context of Title 24 building code compliance.³⁷

2.4.1.3 Cooking

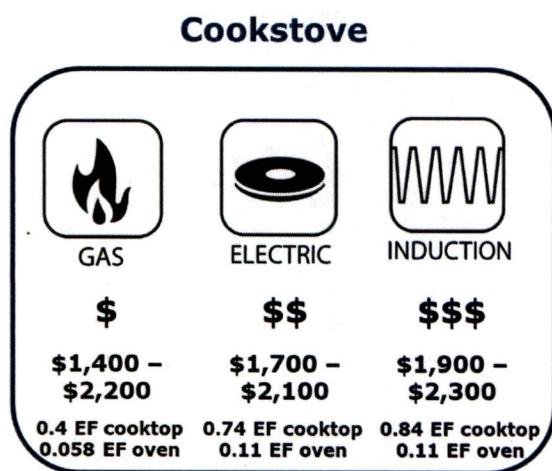
Natural gas stoves are compared on a cost and efficiency basis to electric resistance stoves, which are assumed in low-rise multifamily homes, and electric induction stoves, which are assumed for single family homes. In practice, an induction or electric resistance stove could be installed in any type of home. These

³⁶ See <https://www.sandenwaterheater.com/products/>

³⁷ See Grant and Huestis (2018).

assumptions reflect the fact that electric resistance stoves are generally considered a less high-end product than induction stoves.

Figure 2-8 Modeled gas, electric and induction cookstoves: price range and efficiency

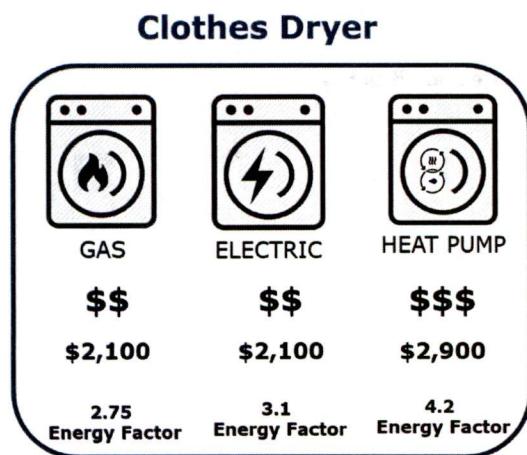


Ranges reflect the range of prices across climate zones as a result of labor cost differences.

2.4.1.4 Clothes Drying

The cost and performance of natural gas clothes dryers are compared to electric resistance clothes dryers in low-rise multifamily homes, and to electric heat pump clothes dryers in single family homes. In practice, an electric resistance or heat pump clothes dryer could be installed in any type of home, but this assumption is applied because heat pump clothes dryers are generally a higher cost product, and so are more likely to be found in the single family homes modeled.

Figure 2-9 Modeled gas, electric and heat pump clothes dryers: price range and efficiency



2.4.1.5 All-electric New Construction

For all-electric new construction homes, the avoided cost of natural gas infrastructure (both in-home and for interconnections to the utility) is included in our cost model.

In all-electric homes, regardless of whether the home is new construction or retrofit, the customer bill savings are also adjusted, to reflect the fact that the customer is no longer obligated to pay any of the fixed fees associated with the natural gas rates. The fixed fees on the natural gas rate schedules are not avoided for homes that continue to have one or more natural gas appliances or end uses.

2.5 Customer Costs and Savings

2.5.1 ELECTRICITY AND NATURAL GAS RETAIL RATES: CURRENT AND FUTURE RATE ASSUMPTIONS

To calculate the consumer bill impacts of electrification, we use the hourly energy consumption data from the building simulation results and apply the gas and electric rates appropriate for each utility service area to come up with an estimated cost of consumer utility bills. Both categories of rates are assumed to start at the 2018 rate schedules and escalate over time, using the best information about near-term rate escalation. Escalation of natural gas rates between 2019 and 2022 is based on the currently filed General Rate Cases (GRCs) for PG&E and SCG. The GRC for SCG, if approved in full, implies a cumulative 32% real increase in residential gas rates between 2018 and 2022.³⁸ During this same time period, PG&E rates would likely increase by a cumulative 6% real based on its filed GRC.³⁹ From 2023 through 2025, gas rates are assumed to escalate at 4% real per year, corresponding to historical rate increases between 2013 and 2018.⁴⁰ Escalation of electricity rates from 2019 through 2025 is assumed to be 2% per year above inflation, based on estimates provided by the electric utilities participating in this study, reflecting the need for transmission and distribution upgrades as well as compliance with SB 100.

After 2025, both natural gas and electric rates are assumed to escalate a more conservative 1% real escalation for long-term rate trajectories beginning in 2026 - 2050. This 1% escalation is based on the Handy-Whitman Index for construction between 1971 and 2016 and does not presuppose specific new

³⁸ See https://www.socalgas.com/documents/regulatory/bill-inserts/FINAL_Printer_Proof_SCGC_GRC_Reg.pdf for the SCG 2019 GRC, and Ex. 46 table ISC-03 and Ex. 44 "Summary". We assumed no changes in cost allocation from 2019 through 2022, so that the change in total revenue requirement is directly proportional to the change in residential rates.

³⁹ See https://www.pge.com/pge_global/common/pdfs/about-pge/company-information/regulation/2020-General-Rate-Case-Summary.pdf for the PG&E gas 2020 GRC, Ex. 12, Table 10-2; Ex. 11, Table 2-5; and Ex. 17, Table 17A-1. We assumed no changes in cost allocation from 2019 through 2022, so that the change in total revenue requirement is directly proportional to the change in residential rates.

⁴⁰ The historical natural gas rate increases are calculated based on the average residential retail gas price in California reported by the Energy Information Administration (EIA). <https://www.eia.gov/dnav/ng/hist/n3010ca3A.htm>

investments, changes in load and gas throughput, or other measures associated with complying with California's climate policy goals.⁴¹

In addition to the 1% per year real escalation rate, we also assume a rising carbon price trajectory through 2030. This carbon price trajectory is based on the 2017 CEC IEPR "High" price scenario⁴², reaching \$84 (in 2018\$) in 2030. The carbon price is used to determine a carbon price adder relative to today's rates, which are assumed to already reflect the current market price for carbon. We chose the CEC high carbon price scenario because of the key role of cap-and-trade policy in meeting California's 2030 climate goal, based on the adopted 2017 CARB Scoping Plan.⁴³

In this analysis, we have not attempted to forecast how the cost of wildfires may affect future electricity rates, nor have we tried to estimate how the cost of meeting the state's long-term climate goals will affect rates. Renewable natural gas and electrification are both likely to increase natural gas rates, which could lead to more favorable economics for electrification than are shown here.

To address the sensitivity of our results to higher near-term electric rate increases, we include a sensitivity analysis where electric rates increase at the same rate as natural gas rates. The rate escalation schedule from SoCalGas (showing a cumulative 32% increase above inflation from 2018 through 2022) is applied to the electric rates for SCE, PG&E, and LADWP, and the rate escalation schedule from PG&E's gas rates (showing a cumulative 6% increase above inflation from 2018 through 2022) is applied to the electric rates for SMUD. PG&E's electric rates are included in the first group due to the higher estimated potential for

⁴¹ This escalation rate is likely conservative, depending on how California implements its building decarbonization strategy. Mahone et al. (2018) showed complying with 80 x 50 requires large declines in gas throughput (i.e., from gas efficiency and building electrification), substitution of expensive renewable natural gas for fossil natural gas, or both; this would tend to exert large upwards pressure on volumetric gas rates. Furthermore, Governor Brown's recent Executive Order B-55-18, established a carbon neutrality target for 2045, which is more strict than 80 x 50. ("80 x 50" refers to the state's existing goal of an 80% reduction in GHG emissions below 1990 levels by 2050.) However, complying with SB 100 and other state policy goals may also increase electricity rates beyond that modeled here as well.

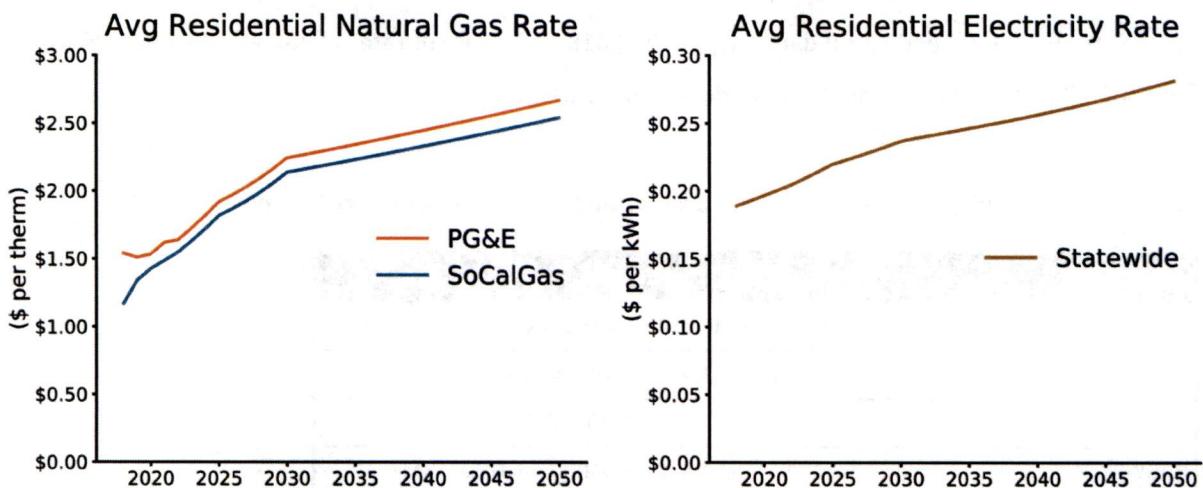
⁴² <https://efiling.energy.ca.gov/GetDocument.aspx?tn=216271>

⁴³ https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf

near-term rate increases. The results of this sensitivity analysis are presented alongside the main results in the Consumer Bill Impacts Section 3.3.5 and the Lifecycle Costs and Savings section 3.4.5.

The base case, or “reference” rate escalation assumptions applied in this study for electricity and gas are summarized in Figure 2-10.

Figure 2-10: Residential natural gas and electricity rates, reference scenario (real 2018\$)



Rates are averaged over delivered natural gas for core customers and electricity for all end uses.

The above escalation rates are applied to 2018 residential electric and gas rate schedules for each utility to come up with future rate schedules, which are summarized in Table 2-9 and Figure 2-11. We emphasize that future rate designs and cost allocation schemes could vary substantially from today's rates. For electric rates, both the SCE TOU-D-4-9 rate (filed with the 2018 GRC) and the PG&E E-TOU OPTION B rate schedule have a 4pm-9pm peak, representing the typical peak demand of the grid after residential solar generation ramps down. These two utilities' electric rates are higher than others, peaking at \$0.35-\$0.40 per kWh. SMUD 1-R-TOD has the lowest rates and a much shorter period of peak rates (5pm-8pm). LADWP R-1(A) is the only tiered and flat schedule. Depending on the monthly consumption of the consumer, the LADWP rate in most cases is higher than SMUD, but lower than PG&E and SCE. The SCE TOU-D-4-9

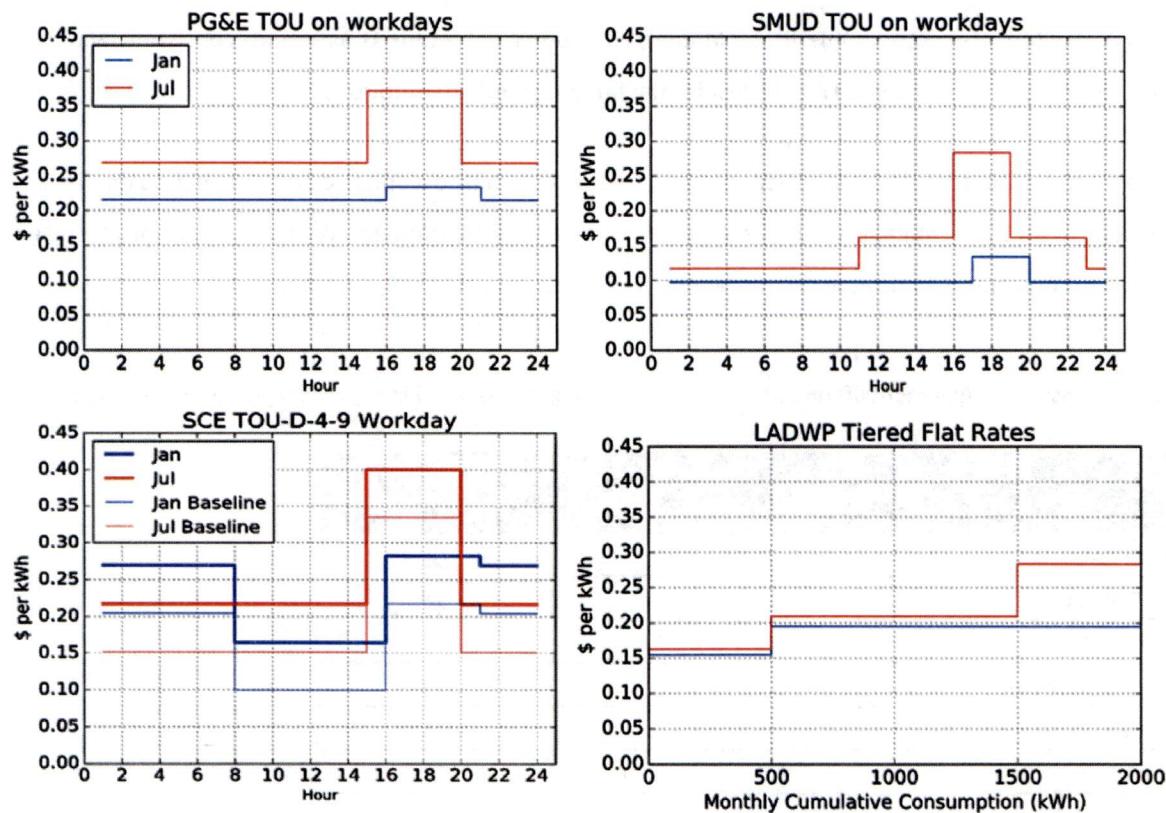
schedule is the only one that features a highly differentiated TOU structure in winter. Furthermore, on this rate schedule, SCE credits customers (on a per-kWh basis) whose consumption is below the monthly baseline, represented by the faded line in Figure 2-11.

Residential natural gas retail rates for PG&E and SoCalGas are modeled for northern California and southern California respectively. Both rates feature a tiered structure subject to daily baselines and are subject to regional and seasonal gas price variations. The 2018 PG&E G-1 residential rate averaged \$1.3 or \$1.8 per therm depending on daily usage. The 2018 SoCalGas GR rate was 30% lower than PG&E, at \$0.9 or \$1.2 per therm on average depending on daily usage.

Table 2-9: Electric and gas rate schedules applied in this study for each utility service territory.

Utility	Electricity Rate Schedule Name
SCE	TOU-D-4-9 (TIME-OF-USE DOMESTIC) (Filed)
PG&E	E-TOU (RESIDENTIAL TIME-OF-USE) OPTION B
SMUD	1-R-TOD (RESIDENTIAL TIME-OF-DAY)
LADWP	R-1(A) (RESIDENTIAL STANDARD TIERED FLAT RATE)
Utility	Gas Rate Schedule Name
PG&E	RESIDENTIAL SCHEDULE G-1
SoCal Gas	RESIDENTIAL SERVICE GR

Figure 2-11: 2018 hourly electric rates for each utility service area.



Red lines represent summer rates, and blue lines represent winter rates. Southern California Edison (SCE) gives credits (per kWh base) for customers whose consumption is below its monthly baseline, indicated by the faded line in the SCE chart. Note that time shown is based on Pacific Standard Time, so the summer peak would be one hour earlier in Pacific Daylight Time.

2.5.2 LIFECYCLE COSTS AND SAVINGS

Lifecycle costs reflect the cost of ownership of an appliance, including both capital and operating costs, spread over its lifetime (maintenance costs/savings are not estimated in this study). We calculate lifecycle cost as the monthly present value of the total capital costs and bill costs of an appliance throughout its lifetime. Lifetimes of the modeled appliances are assembled from data supporting the National Energy

Modeling System, applying the average estimated lifetime in this study (see Table 2-10). A single equipment lifetime is assumed for HVAC systems (including both the air conditioning and gas furnace systems). For the all-electric home lifecycle analysis, a 30-year lifetime is assumed, consistent with the California Energy Commission's Title 24 residential building code assumptions.

We apply a 3.35% after-tax real discount rate to the annualized capital costs and bill costs. This is equivalent to an 8% nominal discount rate that reflects a typical home equity line of credit or mortgage rate that a consumer may have access to when renovating or purchasing a home.

Table 2-10: Assumed equipment lifetimes from data supporting the National Energy Modeling System (NEMS).⁴⁴

Equipment lifetime	
Heat Pump	
Gas Fired Furnace	18
Central AC	
Gas Water Heater	13
Heat Pump Water Heater	13
Cookstove	12
Clothes Dryer	13
All-Electric Home (for bill impact calculation only)	30

2.6 Greenhouse Gas Emissions

Greenhouse gas emissions from homes include emissions from three categories: direct emissions from natural gas combustion (or other fuels, not assessed here), indirect fossil fuel combustion emissions from electricity consumption, and fugitive emissions from either methane in the natural gas system or high-

⁴⁴ See <https://www.eia.gov/analysis/studies/buildings/equipcosts/pdf/appendix-a.pdf> [Accessed on July 26th, 2018]

GWP refrigerants leaked from air conditioners, heat pumps, refrigerators and freezers. The methodology for calculating each of these is described below.

2.6.1 COMBUSTION EMISSIONS FROM NATURAL GAS

The emissions intensity of natural gas is modeled as that of fossil natural gas (0.053 tonnes/mmbTU-High Heating Value) when calculating GHGs. To achieve California's long-term climate goals, the emissions intensity of natural gas, and/or the total consumption of natural gas, will need to decline dramatically. However, as described in Section 2.5.1, we take a conservative approach and assume neither an increase in the cost of natural gas in the base scenario, nor a decrease in the emissions intensity of natural gas, to avoid a presumption about how the natural gas industry will comply with the state's climate goals.

2.6.2 INDIRECT FOSSIL FUEL COMBUSTION EMISSIONS FROM ELECTRICITY

For the 2030 timeframe, indirect fossil fuel combustion emissions from electricity are calculated based on hourly marginal electricity emissions rates. These emissions rates are based on the simulated performance of the Western Electricity Interconnect under a future in which California achieves a 60% RPS by 2030. For 2050, greenhouse gas emissions are calculated based on a long-run average emissions rate for electricity from the California PATHWAYS High Electrification scenario. This is a scenario in which California achieves the electricity sector goals of SB 100 by 2045 and sees high levels of energy efficiency and electrification across the building and transportation sectors. More details are found in Appendix C: Additional Methods Detail.

We do not attempt to quantify the upstream methane leakage emissions associated with natural gas-fired electricity generation. These emissions would not change our results significantly and will become negligible as California's grid becomes less reliant on natural gas due to compliance with SB 100.

2.6.3 FUGITIVE EMISSIONS OF METHANE

The national infrastructure for natural gas has leaks at many steps of the production and distribution process. These leaks have outsized impacts on the climate impacts of natural gas use, since methane, the chief component of natural gas, has a higher global warming potential (GWP) than natural gas.⁴⁵ This means that each 1% leakage of natural gas volume translates to a 9% increase in effective GHG emissions.⁴⁶ The rate of leakage in the national natural gas infrastructure has been widely studied. A recent widely-cited study by Alvarez et al. (2018) estimated a national average leakage rate of 2.3% of consumption across the entire national natural gas supply chain. CARB also maintains an inventory of greenhouse gas emissions in California which includes data about methane leakage, but since California imports approximately 90% of its natural gas it is more accurate to use a national average leak rate. The California Energy Commission recently estimated the behind-the-meter leakage rate for natural gas infrastructure in single family homes to be 0.5% (Fischer et al. 2018), which we add to the 2.3% figure to arrive at a total leakage rate of 2.8%.

Methane leakage is assumed to be reduced 40% by 2030, consistent with the California Air Resources Board Short-Lived Climate Pollutant Strategy and previously proposed EPA regulations on methane leakage from oil and gas wells under the Obama Administration⁴⁷. California imports ~90% of its natural gas and most fugitive methane emissions happen during production, so federal regulations, or lack

⁴⁵ While we use the 100-yr GWP in this report in accordance with CARB and other GHG inventory protocols, we note that conventional GWP metrics cannot universally equate short-lived climate pollutants like methane with long-lived GHGs like CO₂. A shorter time horizon GWP may sometimes be appropriate when considering near-term and peak warming, but even the 100-yr GWP can underestimate the primacy of CO₂ for the long-term goal of climate stabilization (Allen et al. 2016).

⁴⁶ The mass-based 100-year GWP of methane is 25 times higher than CO₂. This is based on the IPCC Fourth Assessment Report (Forster et al. 2007) and is used in the California GHG inventory, although more recent research is consistent with a somewhat higher GWP (see, e.g. Ettminan et al. (2016)). However, when calculating the GHG emissions from natural gas leakage, the molar-based GWP (not the more commonly reported mass-based metric), is the relevant GWP number, because this accounts for the difference in molar masses between CH₄ and CO₂. The molar-based GWP of methane is 9 times that of CO₂.

⁴⁷ The Obama administration previously set a goal to reduce methane emissions from the oil and gas sector to 40 to 45 percent below 2012 levels by 2025, and the EPA began instating regulations to help achieve this goal while President Obama was in office (see US EPA, 2016). Under the Trump administration, many of these regulations have been rolled back (see Tollefson, 2018).

thereof, are likely to have a big effect on fugitive methane emissions associated with natural gas use in California homes. Note that methane regulations on new oil and gas wells have been rolled back under the current administration, and no new regulations on existing wells are currently under consideration. If new federal methane regulations are not put in place by 2030, our assumption about a future 40% reduction in methane leakage may prove to be optimistic.

2.6.4 FUGITIVE EMISSIONS OF HIGH-GWP REFRIGERANT GASES

Leakage is also an issue with the refrigerants used in air conditioning units and heat pumps. The most commonly used refrigerants today still have an extremely high global warming potential. R410A, a common refrigerant currently used in new residential AC and heat pump systems including water heaters, has a 100-yr GWP of 2088. For heat pump clothes dryers, a common refrigerant is R134A (GWP 1430). In our 2020 estimates we assume that the current refrigerants listed above are used.

Efforts are currently being made in the refrigerant industry to identify lower-GWP refrigerants. The most promising replacement for R410A is R32 (GWP 675), and for R134A it is R1234yf (GWP 4)⁴⁸. In our 2030 and 2050 estimates of refrigerant leakage, we assume that this next generation of refrigerants is used.⁴⁹ For heat pump water heaters, the technology exists to use CO₂ as a refrigerant (GWP 1), and this approach can be used for hydronic HVAC heat pump systems as well, but not currently for air-to-air systems. For smaller heat pump HVAC applications, hydrocarbon refrigerants such as propane (GWP 3) are also beginning to be used in certain applications. However, these refrigerants are flammable, so at least in the near term their use will be restricted to applications that require only small volumes of refrigerant.

⁴⁸ See California Air Resources Board (2017)

⁴⁹ CARB has proposed (but not yet enacted) bans on higher-GWP refrigerants in stationary AC units as part of its efforts to meet the state's goal of reducing HFC emissions to 40% below 2013 levels by 2030.



Note that the fugitive emissions of refrigerants are much higher (as a percentage of indirect electricity emissions) than what is reported in the CARB inventory, because the CARB inventory does not include the fugitive emissions of CFCs such as HCFC-22 (GWP 1810) which are being phased out under the Montreal Protocol. As residential customers replace their older HCFC-22 equipment with newer HVAC units (regardless of whether it is a standard AC system or an HVAC heat pump), the fugitive GHG emissions caused by leakage of their equipment will not increase significantly if both their old and new refrigerants have a similar GWP, but it will increase significantly as measured by the CARB inventory since the fugitive emissions from their new system will now be counted. To estimate refrigerant leakage by technology type, we referred to CARB estimates of typical leakage rates for each technology.⁵⁰ Details are in Appendix C: Additional Methods Detail.

2.7 Grid Impacts

Electric grid impacts of electrification are estimated using the hourly electricity demand profiles from the building simulation results. The average load is calculated, weighted by the assumed share of each building type by climate zone, and the assumed technology adoption rate.

Table 2-11 below illustrates this scenario of electric end use adoption in 2020, 2030 and 2050. This electrification adoption scenario represents one plausible “high electrification” future, in a world in which heat pump adoption is based largely on consumer economics with minimal other adoption barriers. This scenario, thus, is not a forecast, but is meant to test the potential of high building electrification on the bulk grid system.

⁵⁰ Data obtained through communications with CARB staff.

Table 2-11 Projected penetration of electric equipment in 2020, 2030 and 2050

	2020 Penetration (% of stock)	2030 Penetration (% of stock)	2050 Penetration (% of stock)
Share of all-electric low-rise residential homes	0%	26%	86%

Penetration represents the share of all-electric equipment among the entire stock of all fuel types.

This approach is intended to be a rough screen of future grid impacts to test whether building electrification is likely to exacerbate peak loads, or, conversely, improve the load factor of the system (the ratio of average to peak load). An improved load factor can lead to lower electricity rates over time through more efficient utilization of electric grid infrastructure.

3 Results

3.1 Greenhouse gas emissions

We estimated greenhouse gas (GHG) emissions associated with residential buildings from both fossil fuel combustion (indirectly from electricity use and directly from natural gas use) and fugitive emissions of methane and refrigerant gases. An all-electric single family home is estimated to reduce annual GHG emissions by 33 - 56% in 2020 and by 76 – 88% in 2050 compared to a natural gas-fueled home. The ranges reflect differences based on building vintages and climate zones. Smaller homes with smaller heating and cooling demands, including low-rise multifamily homes, save less GHG emissions per home on an absolute basis, but see a similar percentage reduction in GHG emissions by 2050 (Table 3-1).

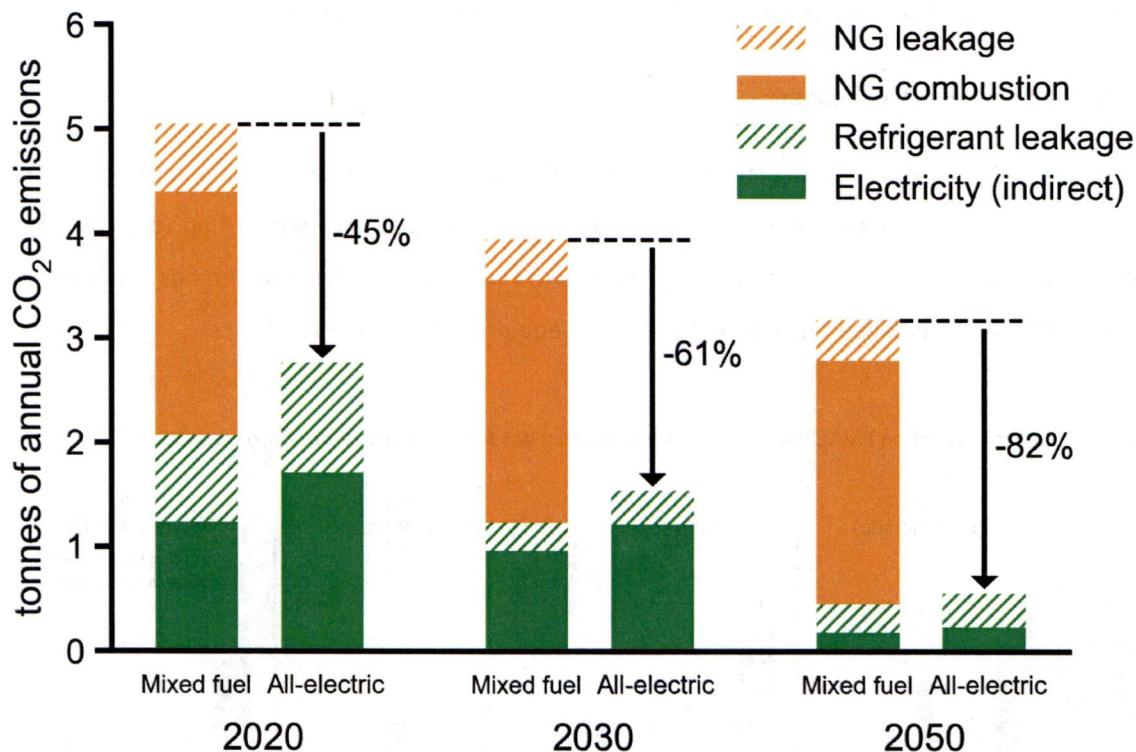
Table 3-1: Greenhouse gas savings achieved in an all-electric home relative to a natural gas-fueled home, tonnes of CO₂e annually saved, and percent reduction relative to gas

	2020	2030	2050
Single family	1.0-2.6 (33%-56%)	1.2-2.7 (52%-72%)	1.4-2.9 (76%-88%)
Low-rise multifamily	0.4-1.4 (25%-46%)	0.6-1.5 (49%-65%)	0.7-1.7 (74%-85%)

Percentages show the percent reduction of GHG emissions achieved in an all-electric home relative to a natural gas-fueled home. Ranges represent the spread across climate zones and across vintages. Homes without AC in the mixed fuel case (new construction in climate zone 3) are excluded.

Figure 3-1 illustrates this result for a 1990s vintage single family home in Sacramento. Here, emissions are reduced by 45% in 2020 and by 82% in 2050. The total magnitude of annual GHG emissions savings achieved by retrofitting to an all-electric home is about 2 tonnes of CO₂-equivalent in 2020, in this example, and closer to 3 tonnes in 2030.

Figure 3-1: Annual GHG emissions from a 1990s vintage single family home for Sacramento



Electricity emissions are based on the High Electrification scenario consistent with SB 100; see the greenhouse gas methodology section for more details. The 2030 and 2050 bars assume that the next generation of low-GWP refrigerants are used in all applicable heat pump systems modeled, including air conditioners, HVAC heat pumps, heat pump water heaters, and heat pump clothes dryers. We do not estimate refrigerant leakage from refrigerators and freezers, but these fugitive emissions would be the same in both electric and mixed fuel homes. We assume that by 2030, fugitive methane emissions are reduced by 40%, as mandated by the CARB Short-Lived Climate Pollutant Strategy and as previously set as a goal by the Obama administration. We based our calculations of fugitive refrigerant emissions on CARB data as described further in Appendix C.

The largest driver of greenhouse gas emissions savings in all-electric buildings comes from eliminating carbon dioxide emissions from natural gas combustion. In general, homes in Northern California, which require more energy for space heating and cooling, have a larger potential for emissions savings from all-electric homes than in Southern California.

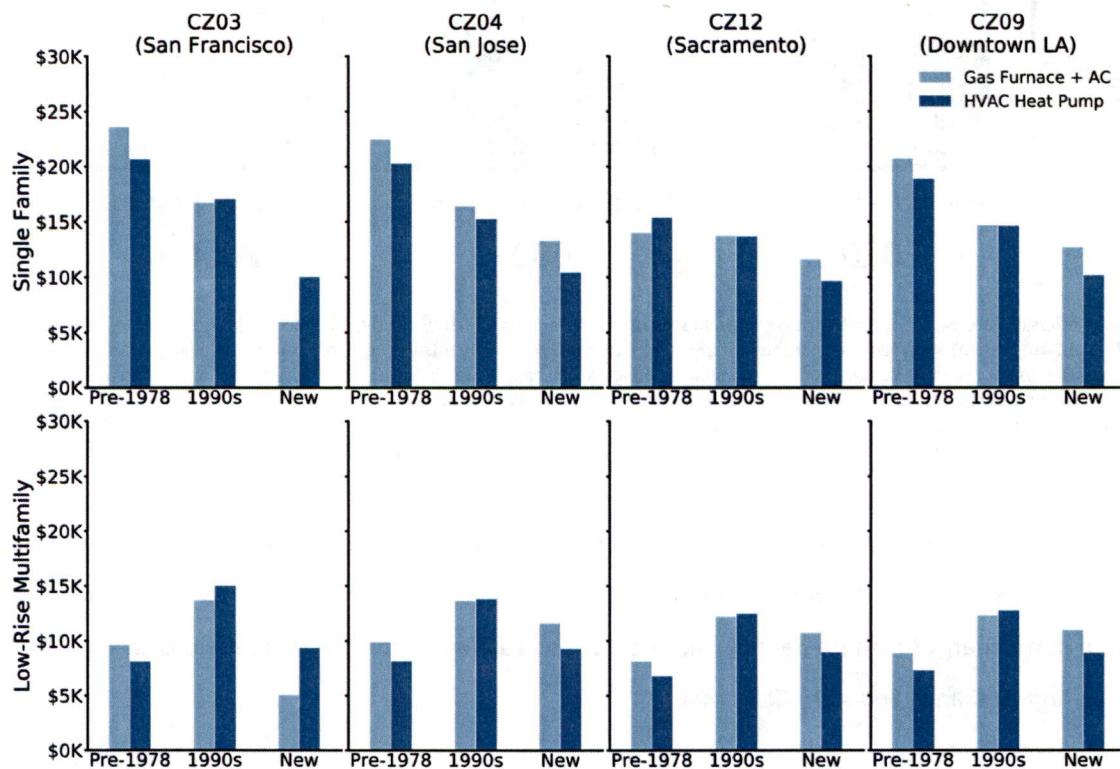
3.2 Capital Cost Comparisons

3.2.1 HEATING, VENTILATION AND AIR CONDITIONING SYSTEMS (HVAC)

Common high-efficiency equipment

Overall, we find capital cost savings from heat pump HVAC systems compared to combined gas furnace and air conditioning systems. HVAC heat pumps show a capital cost advantage of up to \$3,000 over a combined gas furnace and air conditioning system in retrofit situations for most homes modeled, even after considering the delayed replacement cost of AC equipment (Figure 3-2).

Figure 3-2: Capital cost of an HVAC heat pump compared to a gas furnace plus air conditioner system.

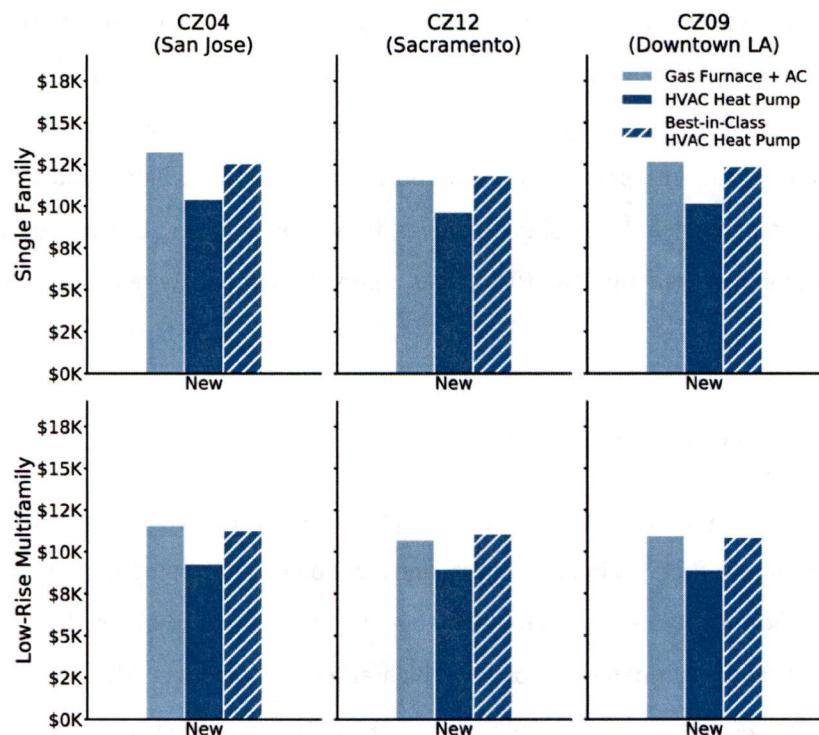


The additional electrical panel upgrade costs (adding a new 220V/30A circuit) for ducted split HVAC heat pumps diminish the cost advantage over the reference gas system in older retrofit homes using this technology. In comparison, mini-split ductless heat pumps and packaged terminal heat pumps (modeled for other retrofit homes) feature a significant cost advantage of \$1,500-\$3,000 due to the lower installation and modification costs compared to ducted heat pumps. Likewise, equipment cost savings make HVAC heat pumps more appealing in new construction homes, which avoid the demolition and modification costs associated with retrofits. However, for homes that do not have AC (modeled as new construction homes in San Francisco), an HVAC heat pump costs about twice as much as installing a gas furnace.

Best-in-class and emerging technology equipment

The additional cost of higher-performance heat pumps is assessed for new construction homes, to understand the impact of efficiency improvements and technology development. “Best-in-class products” are the highest-efficiency units that are available in the current market, featuring a 15%-40% improvement in efficiency compared to common high-efficiency products. The “emerging technology” products, which have a 40%-70% efficiency gain compared to the common high-efficiency products, were not included in the cost estimates.

Figure 3-3: Capital cost of HVAC heat pumps of two efficiency levels, compared to a combined gas furnace and air conditioner system, for new construction homes.

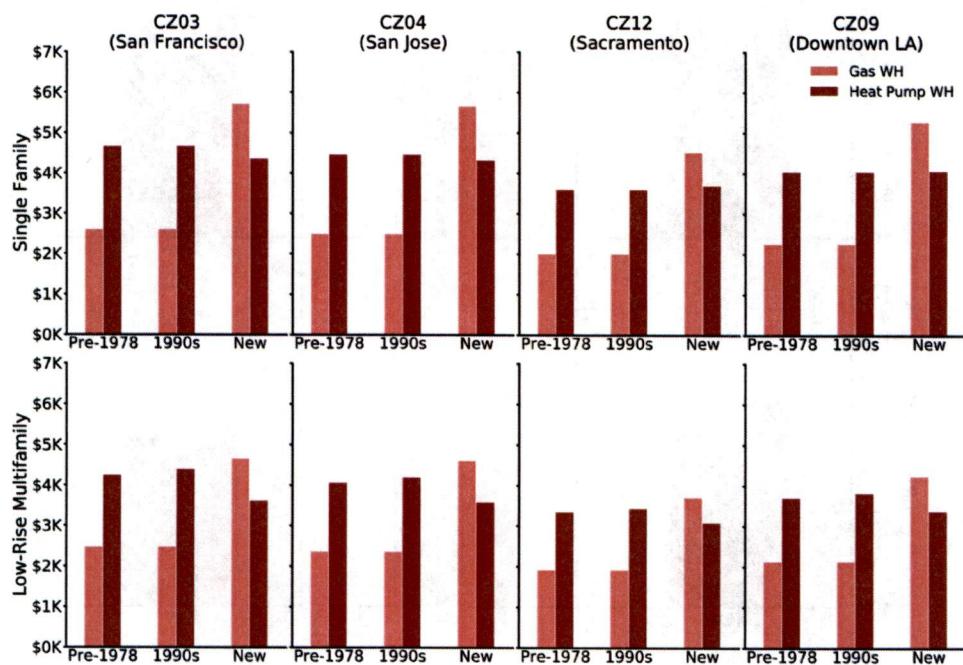


The cost premiums associated with the “Best-in-Class” HVAC heat pumps, as shown in Figure 3-3, almost erase the capital cost advantages of HVAC heat pumps over combined gas furnace and AC systems in new construction homes. The smaller best-in-class HVAC heat pump systems (modeled for San Jose, Coastal LA and Downtown LA) still maintain a slight cost advantage, whereas the higher-tonnage (more powerful) HVAC heat pumps are more costly and show a slight cost disadvantage over gas furnace plus AC systems.

3.2.2 DOMESTIC WATER HEATING

Heat pump water heaters (HPWHs) cost \$1,000-\$2,000 per household more than gas storage water heaters (modeled for all retrofit homes). However, HPWHs have a lower capital cost than gas tankless water heaters (modeled for new construction homes). The cost savings over gas tankless water heaters are driven by not having to run gas lines inside the home to connect the gas appliance.

Figure 3-4 Capital cost of an electric heat pump water heater compared to a natural gas water heater.

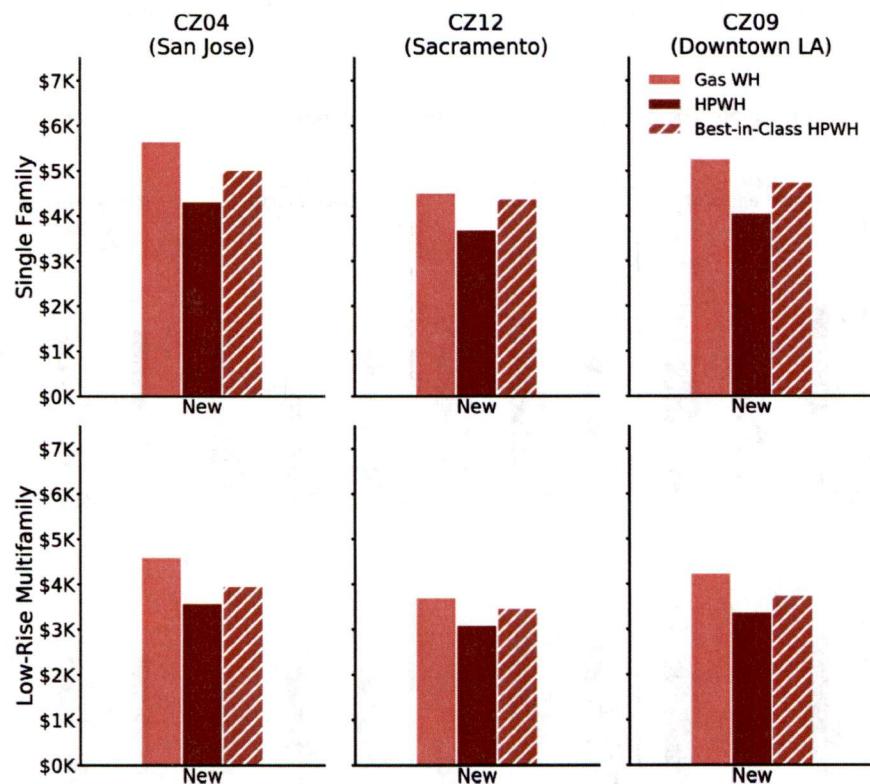


Differences between climate zones are based primarily on differences in labor costs. Costs are presented on a per-unit basis.

Similar to HVAC systems, higher-performance HPWHs are investigated. The efficiency improvement of the best-in-class product is about 10% compared to the common high-efficiency product. The emerging technology product features a 30% efficiency gain over the common high-efficiency product. For most

new construction homes, “Best-in-Class” HPWHs still deliver a capital cost advantage of ~\$500 over gas tankless water heaters.

Figure 3-5: Capital costs of heat pump water heaters of two efficiency levels, and natural gas water heaters, for new construction homes



3.2.3 COOKING AND CLOTHES DRYING

Electric induction cookstoves and heat pump clothes dryers generally have slightly higher capital costs compared to gas stoves and gas clothes dryers. Electric resistance cookstoves and electric resistance clothes dryers are similar in capital cost to their gas counterparts (Figure 3-6).

Figure 3-6).

Figure 3-6: Capital cost of cookstoves modeled. Figure on the left shows induction stoves (modeled for single family homes); figure on the right shows electric resistance stoves (modeled for low-rise multifamily homes)

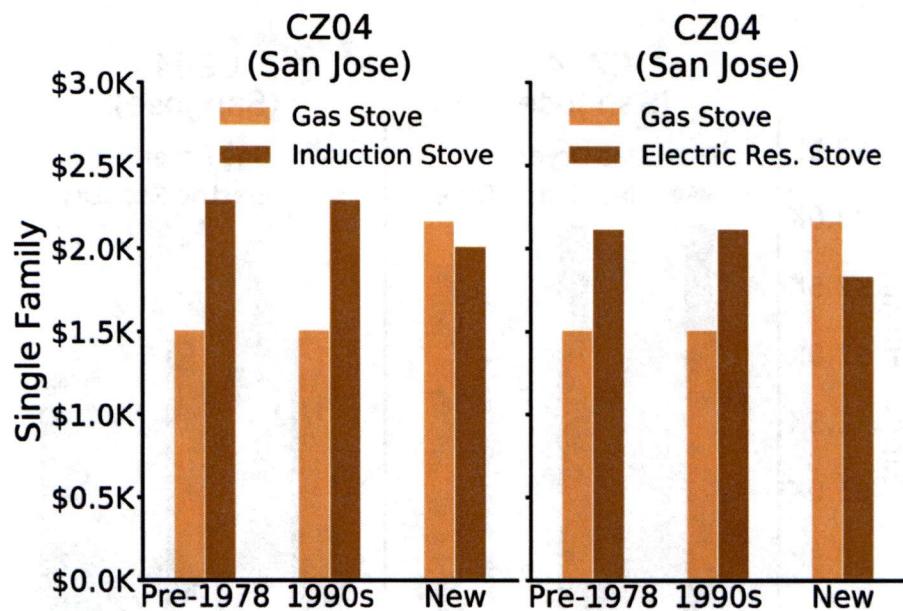


Figure 3-6 shows the capital cost of cookstoves modeled for two categories: induction stoves (modeled for single family homes) and electric resistance stoves (modeled for low-rise multifamily homes). The charts compare three models: Pre-1978, 1990s, and New. The y-axis represents capital cost in thousands of dollars, ranging from \$0.0K to \$3.0K. The x-axis categories are Pre-1978, 1990s, and New. The legend indicates that orange bars represent Gas Stoves and dark brown bars represent Induction Stoves (left chart) or Electric Res. Stoves (right chart).

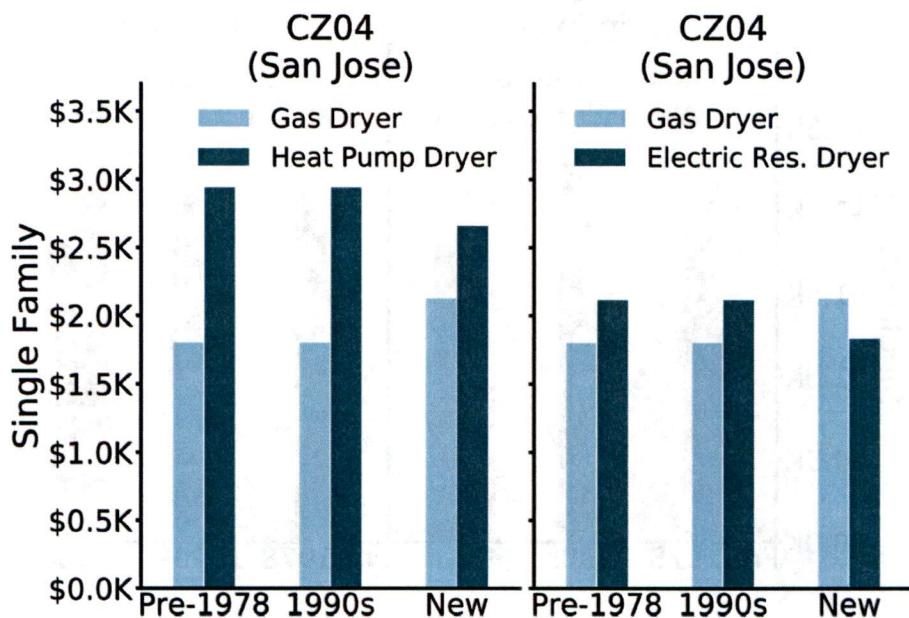
Single Family (Left Chart):

- Gas Stove:** Pre-1978: \$1.5K, 1990s: \$1.5K, New: \$2.1K
- Induction Stove:** Pre-1978: \$2.3K, 1990s: \$2.3K, New: \$2.0K

Low-Rise Multifamily (Right Chart):

- Gas Stove:** Pre-1978: \$1.5K, 1990s: \$1.5K, New: \$2.1K
- Electric Res. Stove:** Pre-1978: \$2.1K, 1990s: \$2.1K, New: \$1.8K

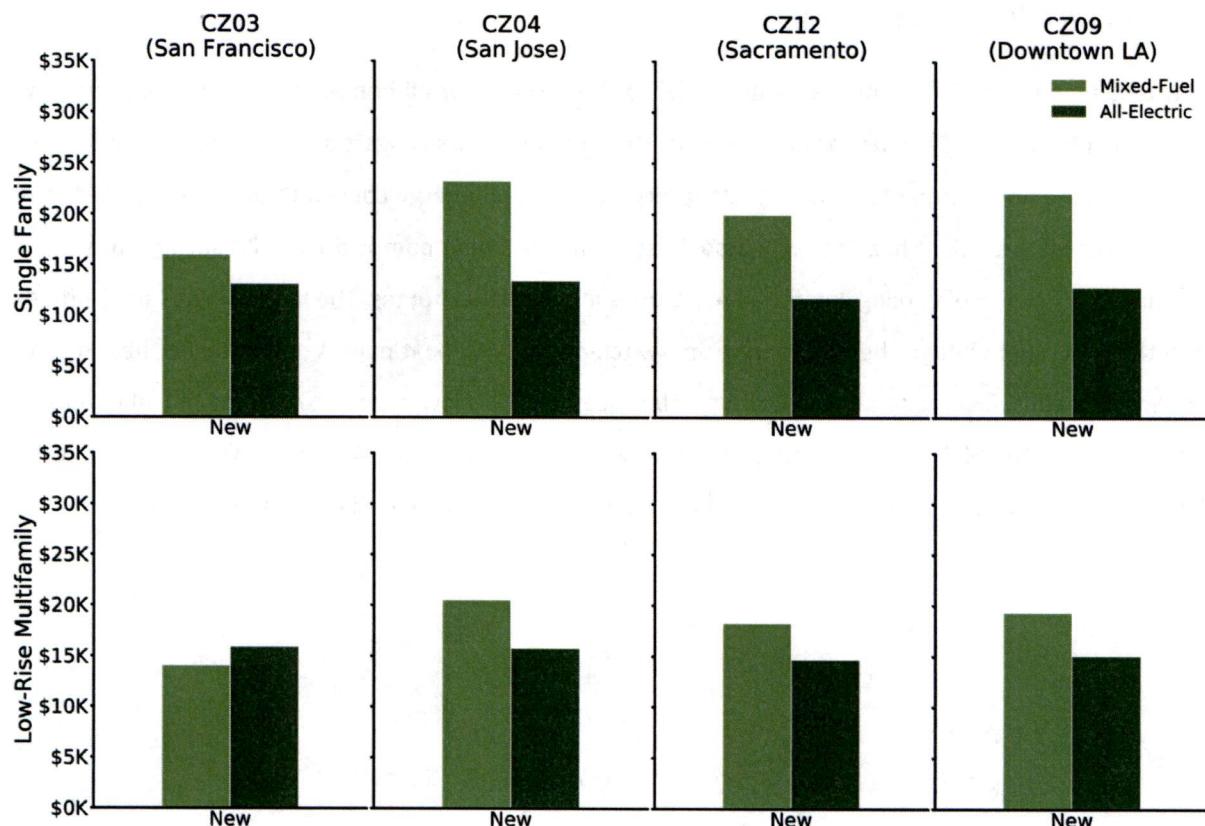
Figure 3-7: Capital cost of clothes dryers modeled. Figure on the left shows heat pump clothes dryers (modeled for single family homes); figure on the right shows electric resistance clothes dryers (modeled for low-rise multifamily homes)



3.2.4 ALL-ELECTRIC NEW CONSTRUCTION

All-electric new construction homes are likely to have a lower capital cost than their mixed-fuel counterparts. In addition to the lower capital cost of HVAC heat pumps compared to gas furnace plus AC systems, all-electric new construction homes avoid the gas infrastructure cost and gas interconnection cost needed for gas appliances. New construction homes also do not require electrical panel upgrades that can be required to retrofit existing homes to all-electric. By avoiding the aforementioned costs, an all-electric new construction home was estimated to have a capital cost advantage ranging from \$3,000 to more than \$10,000 over a mixed-fuel home, except for the low-rise multifamily home prototype in San Francisco (climate zone 3), where the mixed-fuel home was assumed to lack air conditioning.

Figure 3-8 Capital costs per unit of all appliances (HVAC, water heater, stove, and clothes dryer) and infrastructure (including gas connection costs) for new construction



3.3 Consumer bill impacts

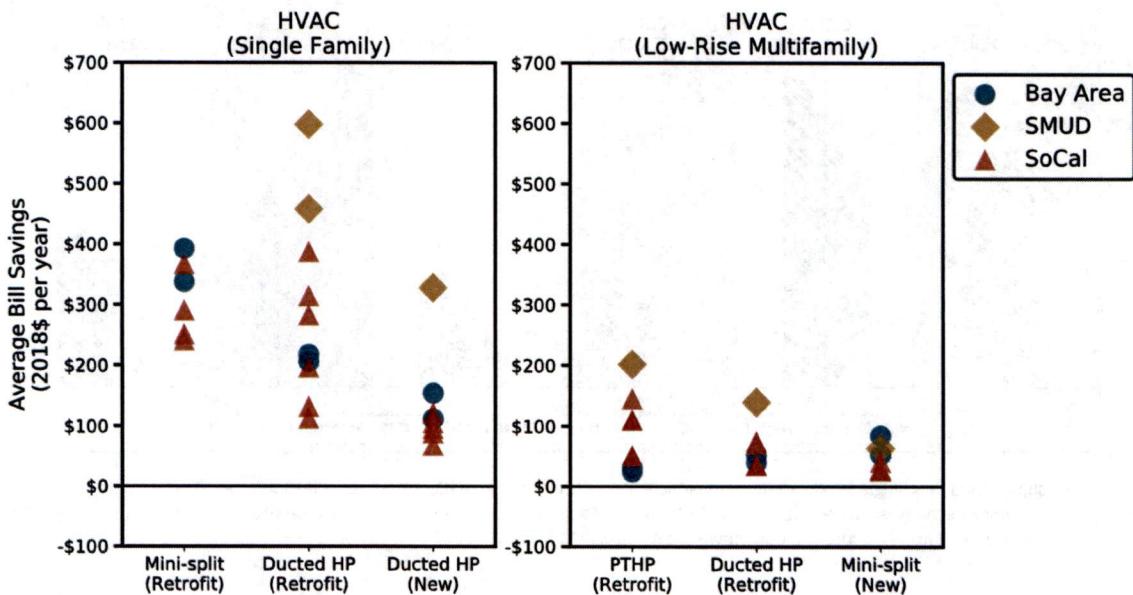
To quantify the consumer bill impacts of the electric building technologies investigated in this study, we report the average bill savings of an electric appliance over a gas counterpart. Average bill savings are presented as an annual value, amortized over the equipment lifetime. A discount rate is applied to account for the time-varying value of money.

3.3.1 HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS

Common high-efficiency equipment

Our results indicate that HVAC heat pumps deliver bill savings for all homes for both retrofit and new construction (Figure 3-9), of up to \$600 per year. The amount of bill savings is determined by the efficiency of the electric unit compared to the gas counterpart, the total energy consumption, and the electricity rates. The highly efficient heating cycle associated with HVAC heat pumps drives bills savings, as well as the higher efficiency of cooling compared to AC units in mixed-fuel homes. The larger single family homes and those of older vintages benefit more from switching to HVAC heat pumps due to higher heating and cooling demands. Electricity rates also drive differences: SMUD's low rates allow for much higher annual bill savings (up to \$600/year) than other utility service territories (up to \$400/year). Over the long term, bill savings for HVAC heat pumps could increase if gas retail rates increase faster than electric rates.

Figure 3-9 Average consumer bill savings from HVAC heat pump adoption

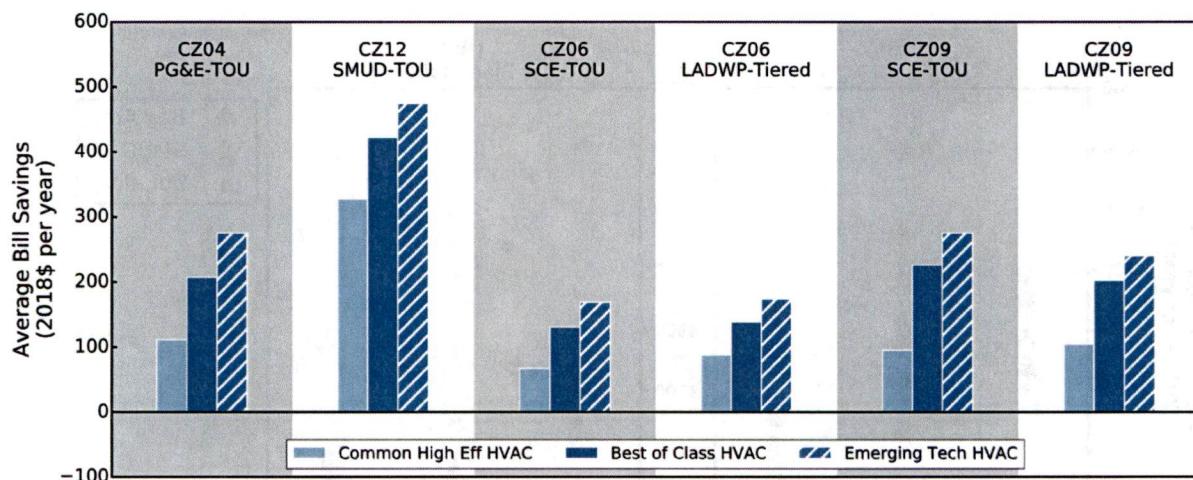


The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to combined gas furnace and air-conditioner (AC) systems (except for new construction in San Francisco where AC is not considered). Positive values represent savings in combined annual electric and gas bills. Modeled technologies include mini-split heat pumps, ducted split heat pumps, packaged terminal heat pumps (PTHPs), and central heat pump water heaters and chillers combined with hydronic radiators (HPWH + Central Chiller).

Best-in-class and emerging technology equipment

Higher-performance HVAC heat pumps can generate significant additional bill savings for consumers, more than double the savings achieved by switching to the common high-efficiency product in most regions. The advantage in bill savings is greater in regions with higher electricity rates (SCE and PG&E).

Figure 3-10 Average consumer bill savings for higher-performance HVAC heat pumps



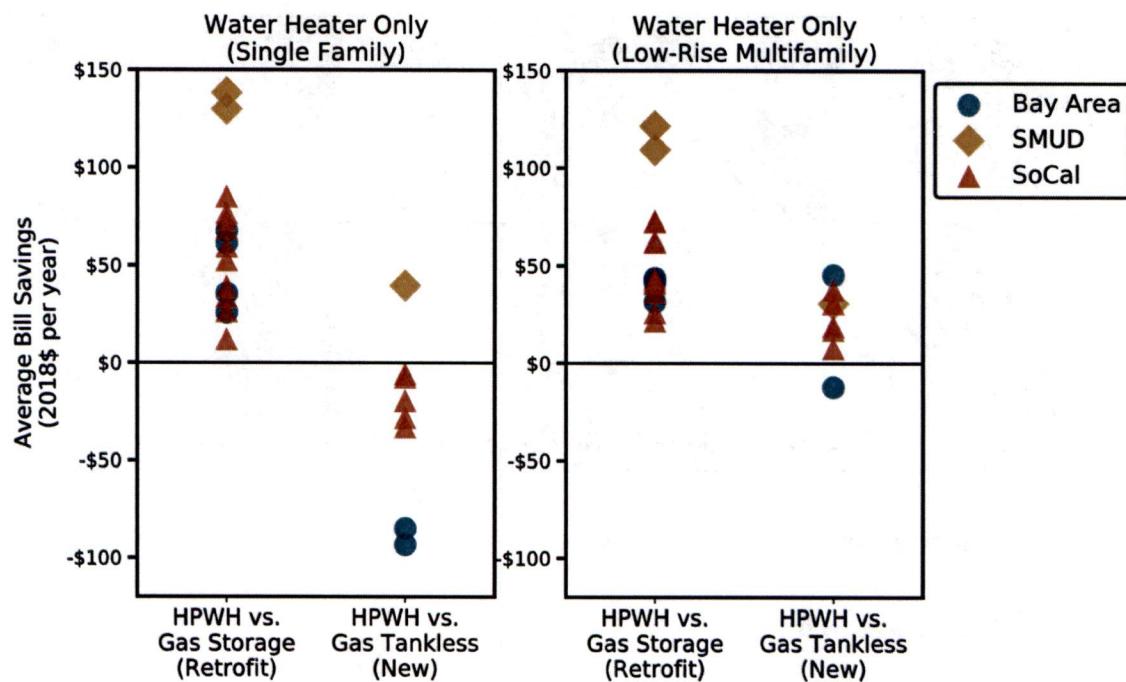
Annual bill savings shown for a new single family home, comparing a high-efficiency system (Common High-Eff HVAC), best-in-class system (Best-in-Class HVAC), and emerging technology system (Emerging-Tech HVAC). Each group represents one utility service territory in San Jose (CZ04), Sacramento (CZ12), coastal Los Angeles (CZ06) and downtown Los Angeles (CZ09).

3.3.2 WATER HEATING

Common high-efficiency equipment

Bill savings from switching to heat pump water heaters (HPWHs) do not show a clear trend across various technologies and home types. HPWHs deliver bill savings in all climate zones when compared to gas storage water heaters (modeled for retrofit homes, but not for new construction). Bill impacts are more mixed when HPWHs are compared to more efficient gas tankless water heaters for new construction homes. Electricity rates also play a role: in SMUD where electricity rates are lower, HPWHs show bill savings relative to both gas storage and gas tankless water heaters.

Figure 3-11 Average consumer bill savings from adopting heat pump water heaters (HPWHs)

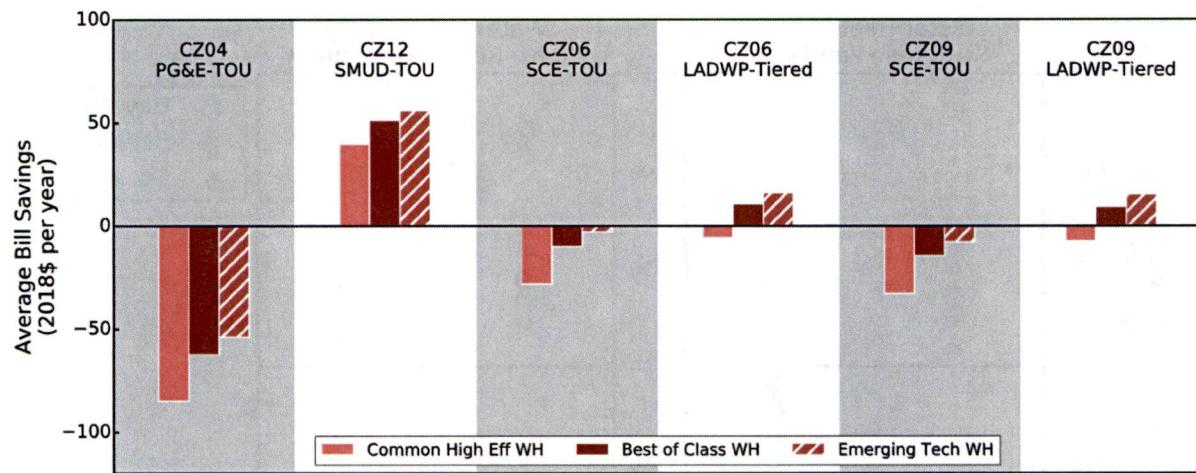


The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to natural gas water heaters. Positive values represent savings in combined annual electric and gas bills.

Best-in-class and emerging technology equipment

Higher-performance HPWHs can slightly reduce consumer bills by \$10-\$30 per year. The efficiency improvements can lead to bill savings or bring consumers close to bill parity in most areas modeled (Figure 3-12).

Figure 3-12 Average consumer bill savings from switching to higher-performance HPWHs



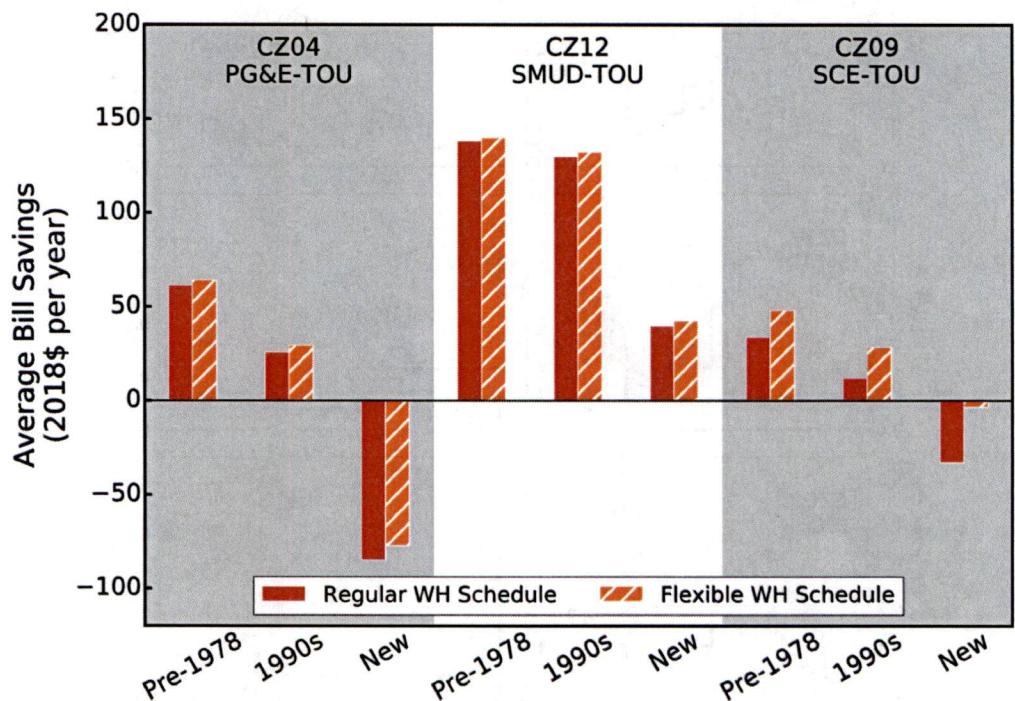
Savings are relative to a gas tankless water heater in a new construction single family home.

Flexible water heating sensitivity

We assess the impact of a flexible water heating schedule on consumer bills. We assume that the water heater runs at minimal power during the peak TOU hours and shifts the water heating to off-peak TOU hours. (We assume pre-heating; however, this is an arbitrary choice, as TOU rates are generally symmetric before and after the peak TOU period.) Energy consumption of HPWHs is higher in winter than in summer, especially during peak hours (Figure 3-14). The TOU rates investigated in this study capture the evening water heating peak demand but miss the morning water heating peak period.

Given existing rate structures, the customer benefits of flexible water heating are relatively limited. The customer benefits are highest under the SCE TOU-4-9 rate structure (Downtown Los Angeles) because of the relatively large TOU differentiation of \$0.12 per kWh in winter (Figure 3-13).

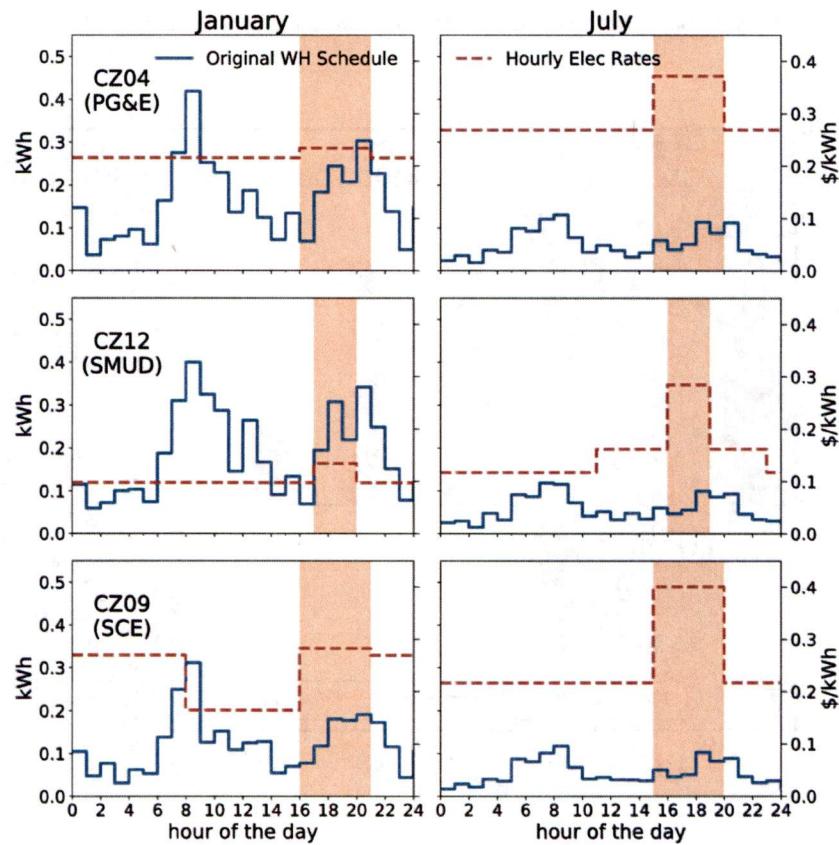
Figure 3-13 Average consumer bill savings from a flexible water heater schedule compared to a regular water heater schedule



Savings are relative to a gas tankless water in CZ04 (San Jose), CZ12 (Sacramento) and CZ09 (Downtown Los Angeles) for single family homes. The flexible schedule assumes that the water heater runs at minimal power during the peak hours and shifts the heating to hours before the highest priced TOU period.

Avoiding peak rates through flexible water heating schedules generates little bill savings under PG&E and SMUD TOU rates, because these rates feature a very small difference, less than \$0.04 per kWh, between on-peak and off-peak (Figure 2-11). In the future, new rate designs that encourage the use of flexible water heating would have larger differences in TOU periods, particularly in winter when water heating demands are higher. This could help encourage the use of flexible, smart water heater technology.

Figure 3-14: Heat pump water heater energy consumption, and corresponding electric rates, for three climate zones

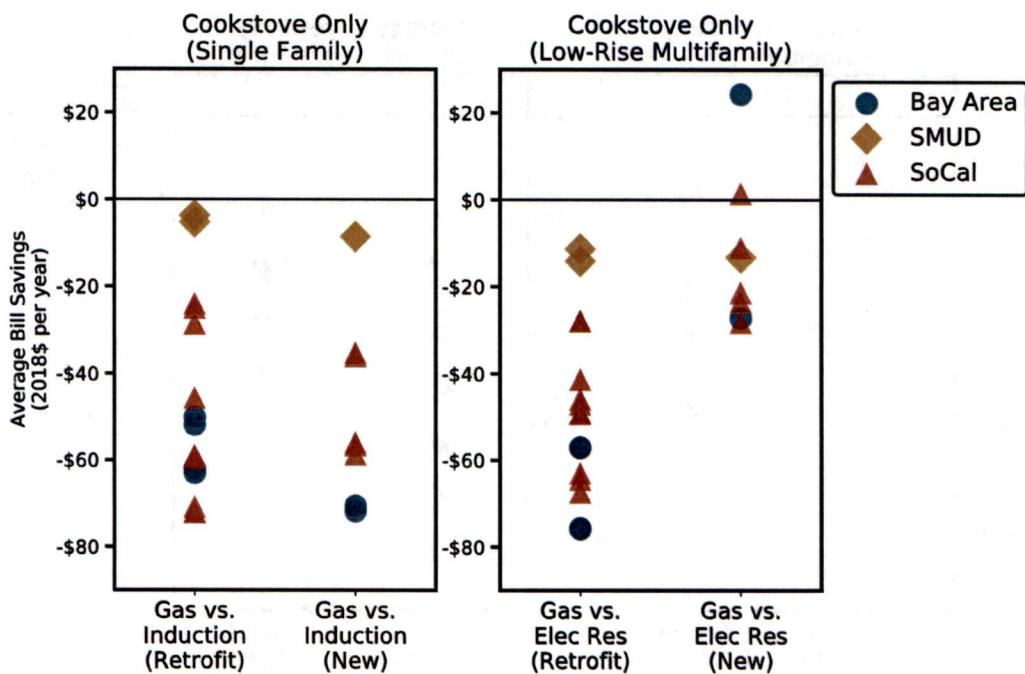


Red lines represent electricity rates. Blue lines show the water heating schedules modeled for new construction single family homes in CZ04 (San Jose), CZ12 (Sacramento) and CZ09 (downtown Los Angeles). The shade highlights the peak period under the TOU rate schedule modeled for PG&E, SMUD and SCE.

3.3.3 COOKING

Electric cookstoves, both induction and electric resistance, increase consumer bills relative to gas stoves, but the impacts are relatively low, at less than \$80/year in the highest cases. Moderate differences in bill impacts appear across utilities, climate zones, and home types due to differences in total consumption under tiered gas rates (and tiered electricity rates, for LADWP).

Figure 3-15 Average consumer bill savings from adopting electric cookstoves

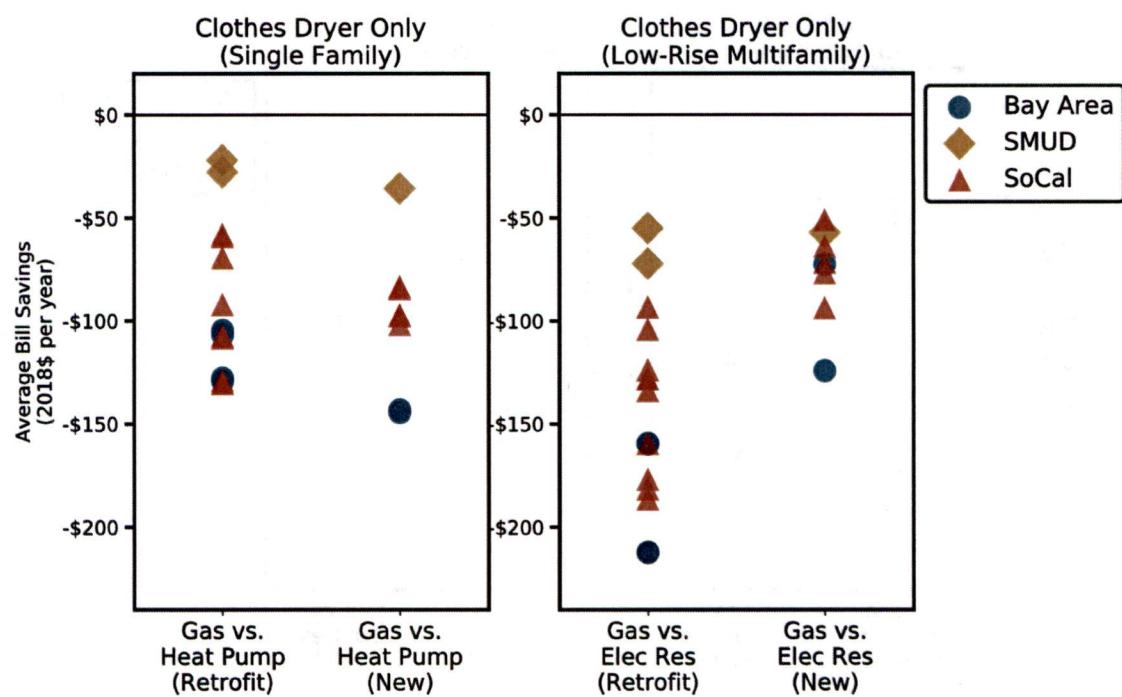


The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal).

3.3.4 CLOTHES DRYING

An electric clothes dryer, using either heat pump or electric resistance technology, increases consumer bills relative to a gas counterpart. Bill increases range from \$20/year to \$220/year, depending on the utility rates, rate structures, and the type of home.

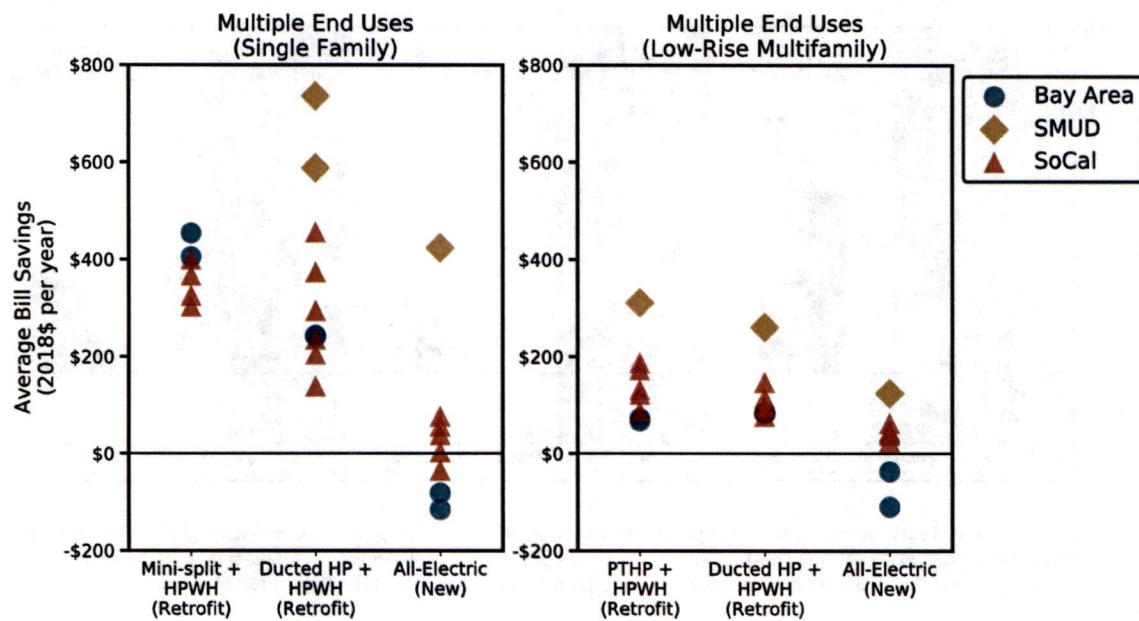
Figure 3-16 Average consumer bill savings from adopting electric clothes dryers



The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal).

3.3.5 MULTI-APPLIANCE RETROFITS AND ALL-ELECTRIC NEW CONSTRUCTION

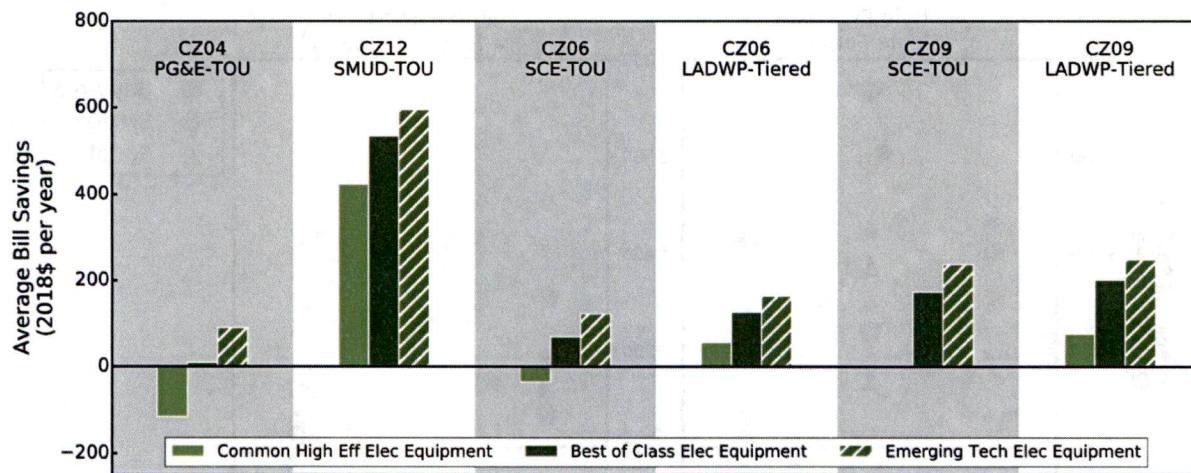
Electrifying both HVAC and water heating systems generates bill savings for all retrofit homes studied. The bill savings can be up to \$750 per year in single family homes and up to \$300 per year in low-rise multifamily homes (Figure 3-17). All-electric new construction homes also generate bill savings in many regions. Note that for this multi-appliance bill impacts analysis, we assume that only HVAC and water heating are electrified in retrofit homes, while in new construction homes, all appliances are electrified including cookstoves and clothes dryers.

Figure 3-17 Average consumer bill impacts of electrifying multiple end uses, using base case assumptions

The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to gas end uses. For retrofit homes, bill impacts reflect electrifying both HVAC and water heating systems. For new construction homes, bill impacts of electrifying an entire home are shown including electric air source heat pump, heat pump water heater, cookstove and clothes dryer.

Switching from common high-efficiency products to best-in-class or emerging-technology products would reduce average bills by \$100-\$200 per year, generating bill savings for new homes in all climate zones studied (Figure 3-18).

Figure 3-18 Average bill savings from switching to multiple higher-performance electric end uses

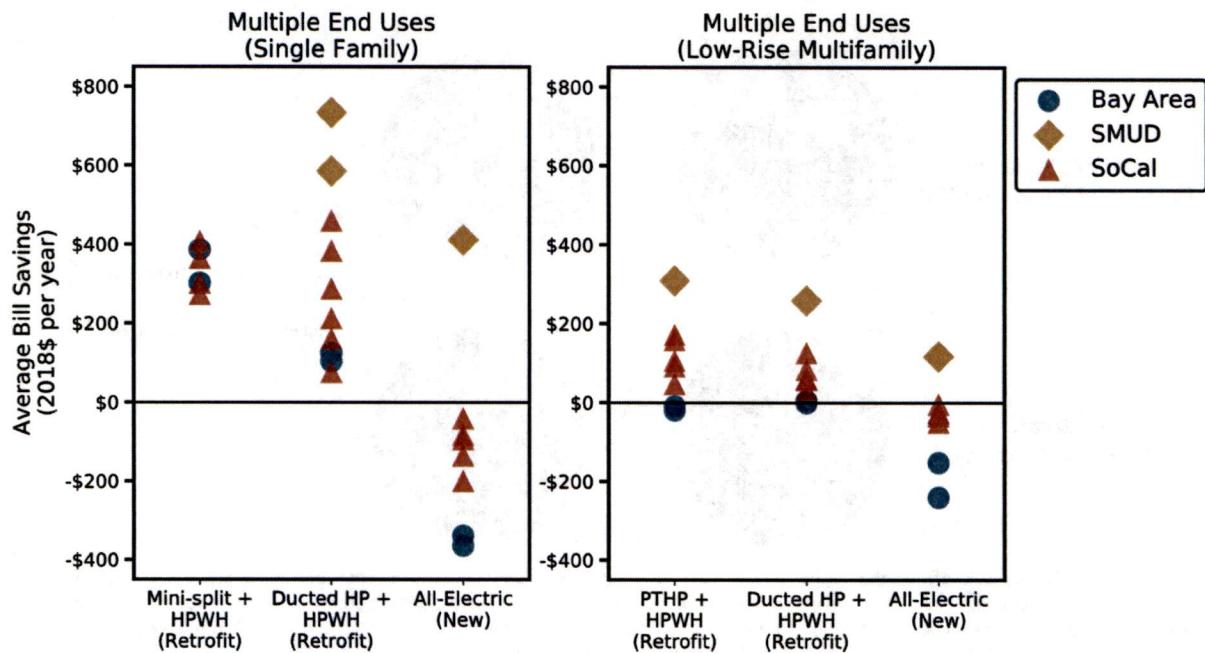


Savings are relative to gas end uses. The results are shown for a new single family all-electric home, comparing common high-efficiency, best-in-class, and emerging-technology HVAC heat pumps and heat pump water heaters. Cookstoves and clothes dryers in all three cases have the same efficiencies. Each group represents one utility service territory in San Jose (CZ04), Sacramento (CZ12), coastal Los Angeles (CZ06) and downtown Los Angeles (CZ09).

We also evaluated the impact on average consumer bills of an electric rate sensitivity, assuming that electricity and natural gas rates increase at the same annual percentage growth rate between 2019 and 2050. Electric rates for PG&E, SCE, and LADWP are assumed to increase at the same annual rate of change as SoCalGas's gas rates (including a cumulative 32% increase above inflation from 2018 through 2022), and electric rates for SMUD are assumed to increase at the same annual rate of change as PG&E's gas rates (including a cumulative 6% increase above inflation from 2018 through 2022). **In this sensitivity, PG&E's electric rates are assumed to increase faster than the natural gas rates due to wildfire risk and liability, while SCE's, SMUD and LADWP's rates are assumed to increase at the same pace at the gas utility in their service territory.** As a result, the largest difference in results between the base case assumptions and this rate sensitivity are seen in the "Bay Area" climate zones, representing PG&E's service territory.

The results of this sensitivity analysis reduce the average bill savings over the lifetime of the equipment or building relative to the base case assumptions (Figure 3-19).

Figure 3-19. Average consumer bill impacts of electrifying multiple end uses, electric rate sensitivity

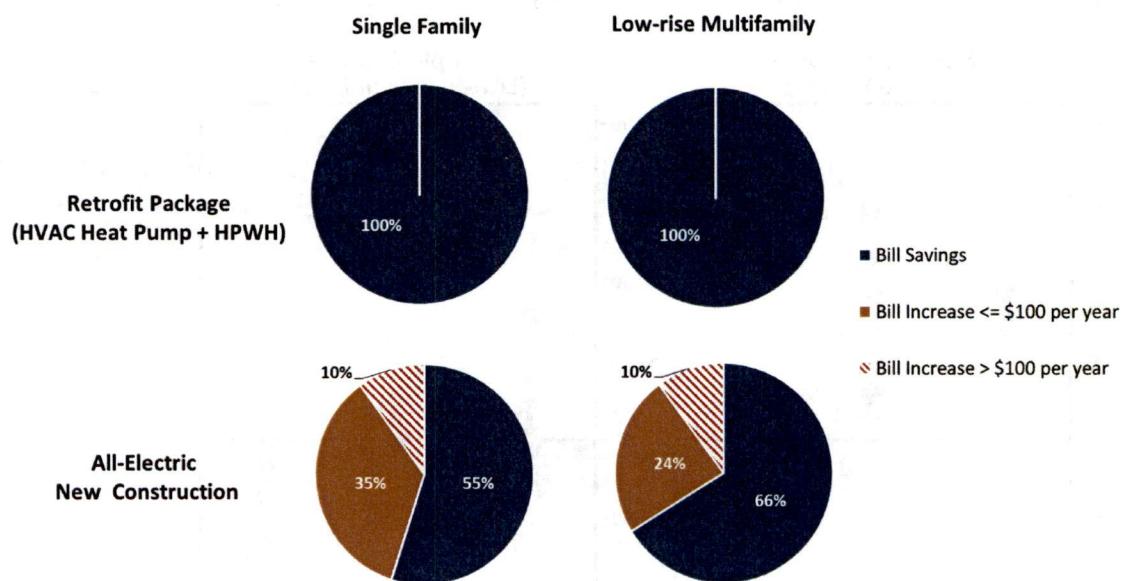


The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to gas end uses. For retrofit homes, bill impacts reflect electrifying both HVAC and water heating systems. For new construction homes, bill impacts of electrifying an entire home are shown including electric air source heat pump, heat pump water heater, cookstove and clothes dryer.

3.3.6 SUMMARY OF AVERAGE BILL IMPACTS

The pie charts below summarize the share of homes in the study area that would see bill savings, bill increases of less than \$100/year, and bill increases of more than \$100/year.

Figure 3-20 Share of simulated households with bill savings from adopting electric end uses; results are weighted by the estimated share of households in each climate zone and utility service territory



The building simulation results are weighted using the share of households in each combination of climate zone and utility, as described in section 2.2.1. to create this summary figure. Average bill costs of HVAC heat pumps are compared against a combined gas furnace and air conditioner (AC) system except for a new construction home in San Francisco (Climate Zone 3) where we assume all homes do not have AC. For retrofit homes, we show the average bill impact of electrifying HVAC and water heating systems at the same time. For new construction, we look at an all-electric home with all four appliances modeled electrified.

3.4 Lifecycle costs and savings

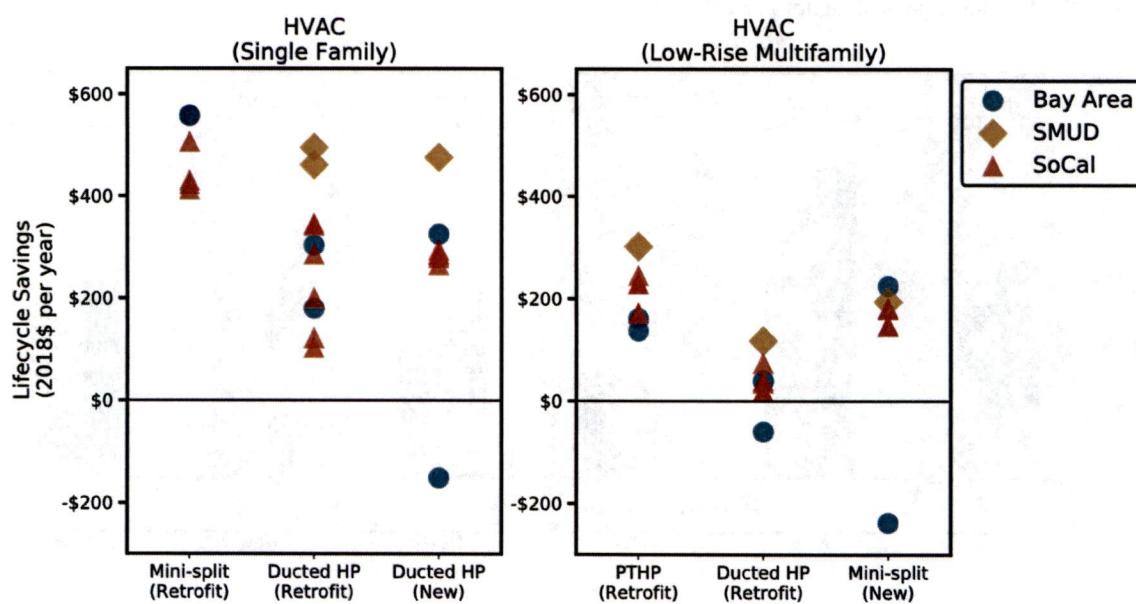
The lifecycle cost of an appliance represents the total cost of ownership, combining capital cost and bill costs. Lifecycle costs are presented in this study as an annual value, amortized over the equipment lifetime. A discount rate is used to account for the time-varying value of money. In this section, we evaluate the lifecycle costs and savings of the building technologies investigated in this study.

3.4.1 HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS

Common high-efficiency equipment

The installation of HVAC heat pumps can result in up to \$550 per year in lifecycle savings relative to a combined gas furnace plus air conditioner (AC) system (Figure 3-21). However, homes without AC incur an extra lifecycle cost of \$200 per year by switching to an HVAC heat pump.

Figure 3-21 Lifecycle savings from adopting HVAC heat pumps

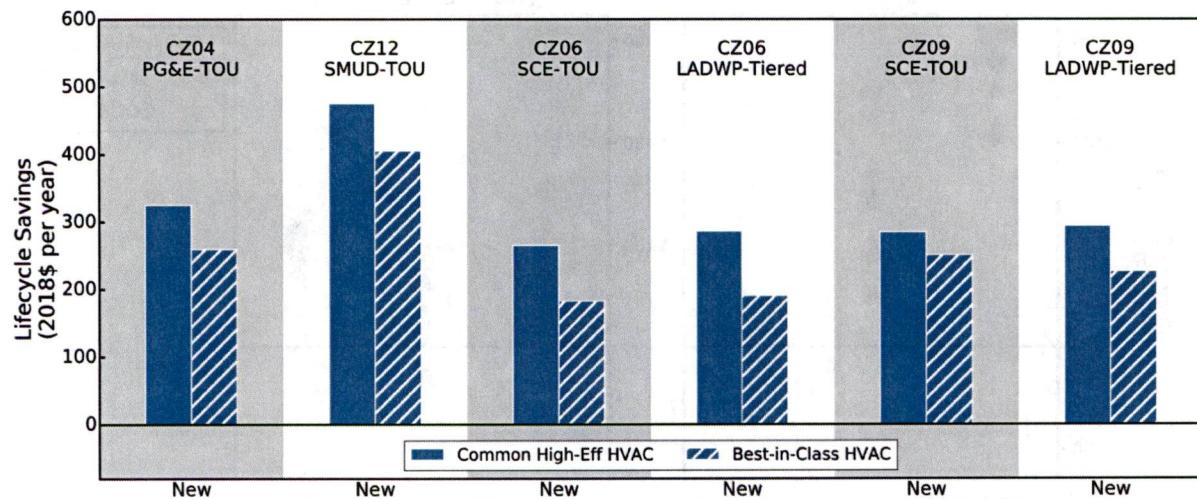


The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to a combined gas furnace and air-conditioner (AC) system (except for the new home in San Francisco where AC is not considered). Positive values represent savings in both capital and operating costs throughout the lifetime of HVAC heat pump over the gas alternative system; negative values indicate costs. Modeled technologies include mini-split heat pump (Mini-split), ducted split heat pump (Ducted HP), and packaged terminal heat pump (PTHP).

Best-in-class and emerging technology equipment

Higher-performance heat pump systems in new construction applications deliver bill savings of up to \$400 per year compared to a combined gas furnace and air conditioner (AC) system. Compared to common high-efficiency systems, higher-performance products would have higher lifecycle costs due to the increased capital costs. However, capital cost savings would still be positive relative to a combined gas furnace and air conditioner, so this might be a good target for incentives or codes to make sure consumers see both capital cost savings and bill savings, and to encourage market transformation so the costs of higher-performance units come down over time.

Figure 3-22 Lifecycle savings of higher-performance HVAC heat pumps



Savings are relative to a combined gas furnace plus air conditioner system.

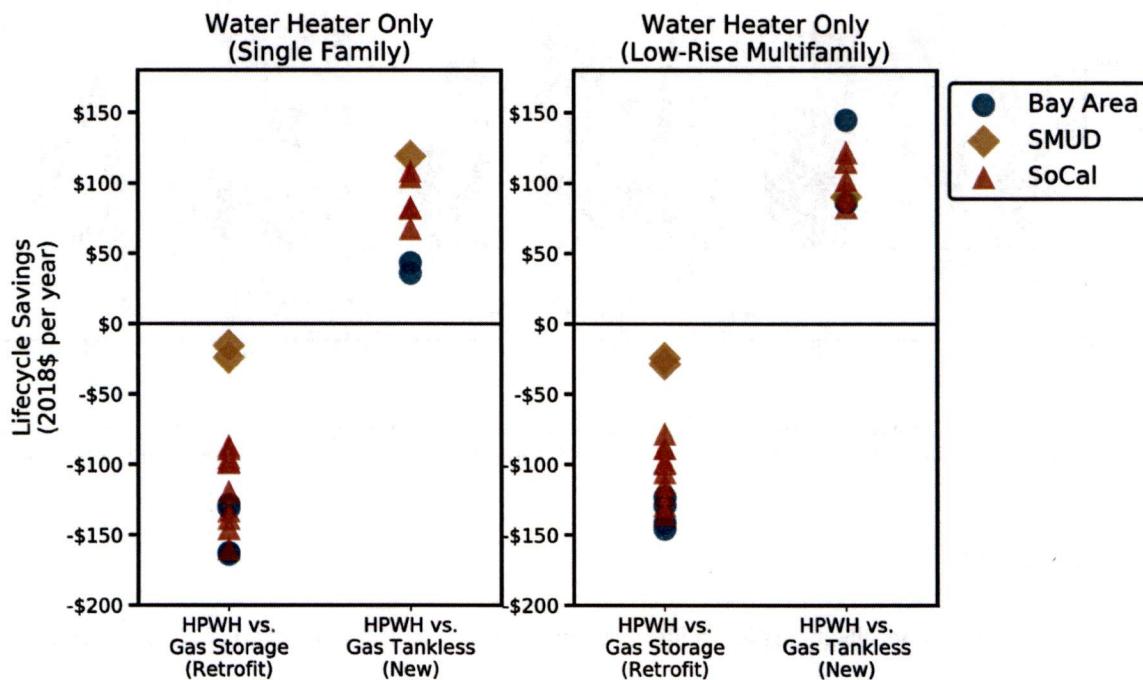
3.4.2 DOMESTIC HOT WATER (DHW)

Common high-efficiency equipment

Heat pump water heaters (HPWHs) generate lifecycle savings of up to \$150 per year over gas tankless water heaters in almost all home applications, but in retrofit homes, gas storage water heaters still appear

to be the cheapest option (Figure 3-23). The net lifecycle costs of HPWHs are driven mainly by the capital cost.

Figure 3-23 Lifecycle savings from adopting HPWHs

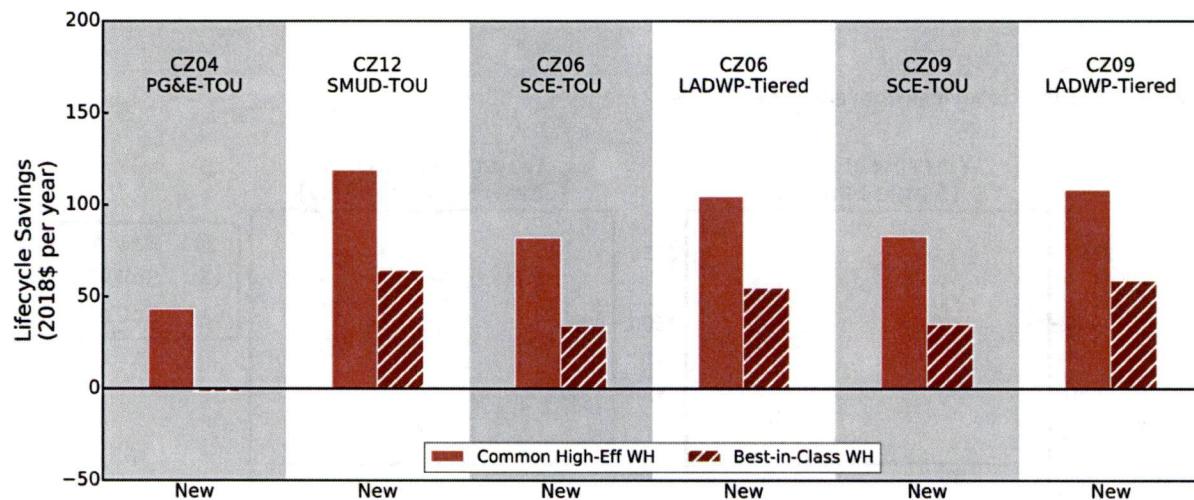


The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to gas fired water heaters. Positive values represent savings in both capital and operating costs throughout the lifetime of an HPWH over the gas water heater; negative values indicate lifecycle costs.

Best-in-class and emerging technology equipment

Higher-performance “best-in-class” HPWHs show lifecycle savings over gas tankless water heaters in most new home applications. However, similar to HVAC heat pumps, higher-performance HPWHs deliver lower lifecycle savings compared to the common high-efficiency product. The small improvement in operating costs is not enough to compensate for the capital cost premiums of the higher-performance units.

Figure 3-24 Lifecycle savings of common high-efficiency and best-in-class HPWHs

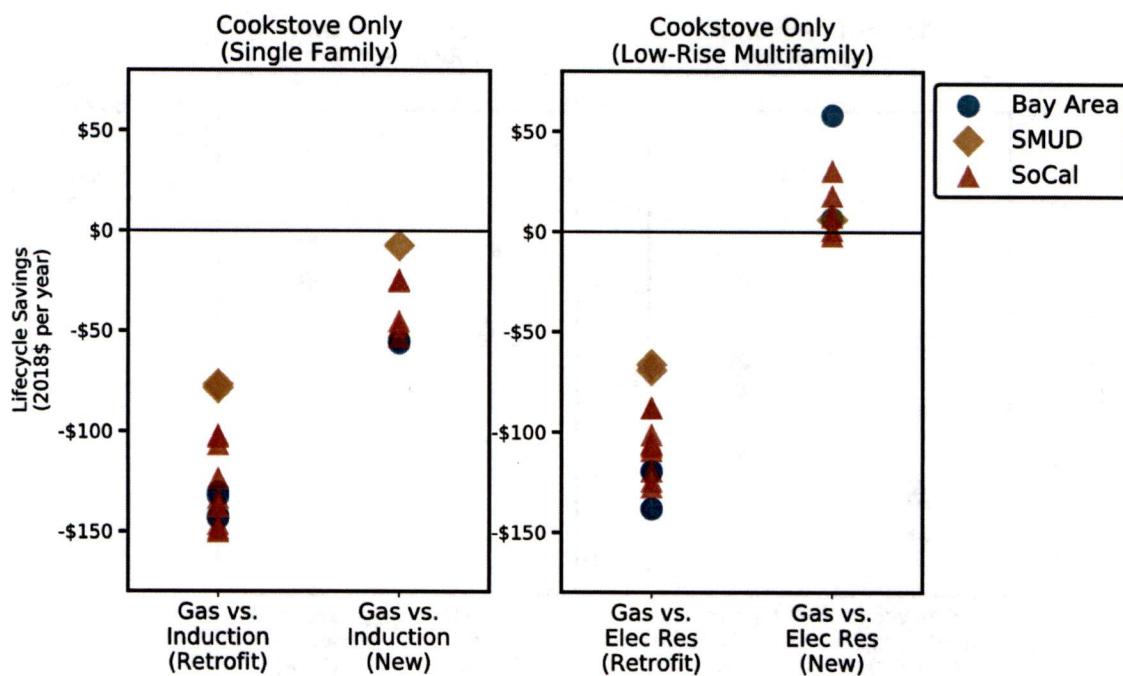


Savings are relative to a combined gas furnace plus air conditioner system. Savings are 0 for the best-in-class water heater in climate zone 4. Each climate zone compares two type of heat pump technology: a best-of-class HPWH (Best of Class WH) vs. a common high-efficiency HPWH (Common High Eff WH).

3.4.3 COOKING

Electrifying cooking generally incurs extra lifecycle costs, of up to \$150 per year, for all types of homes. Induction cookstoves have higher capital costs than both gas stoves and electric resistance stoves in the current market. Nevertheless, installing electric cookstoves in new construction homes can avoid the cost of connecting gas lines to the kitchen, which makes electric resistance stoves a lower-cost option than gas stoves in new construction.

Figure 3-25 Lifecycle savings of electrifying cooking

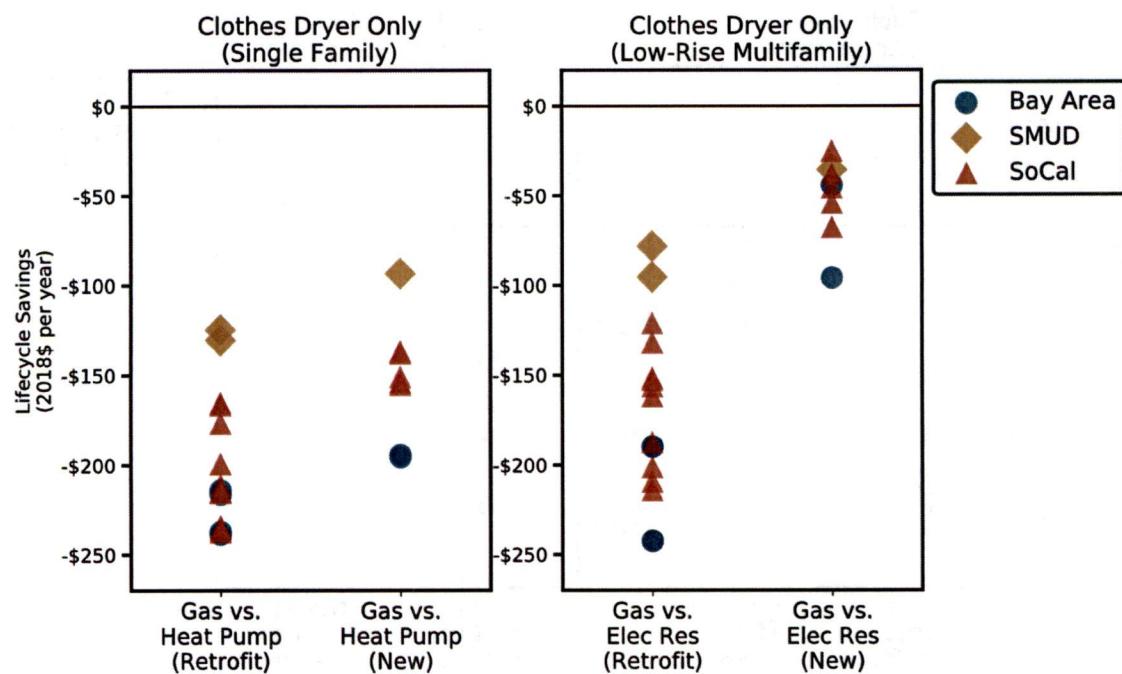


The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal).

3.4.4 CLOTHES DRYING

Electric clothes dryers are more expensive than gas dryers, costing consumers up to \$240 more per year in lifecycle costs. A heat pump clothes dryer is the most expensive option on a lifecycle basis, due to the higher capital costs. While an electric resistance clothes dryer is cheaper to install in new homes due to the avoided gas connection costs, the extra operating costs of up to \$220 per year in electric bills make it less economic than the gas dryer on a lifecycle basis.

Figure 3-26 Lifecycle savings of electrifying clothes drying



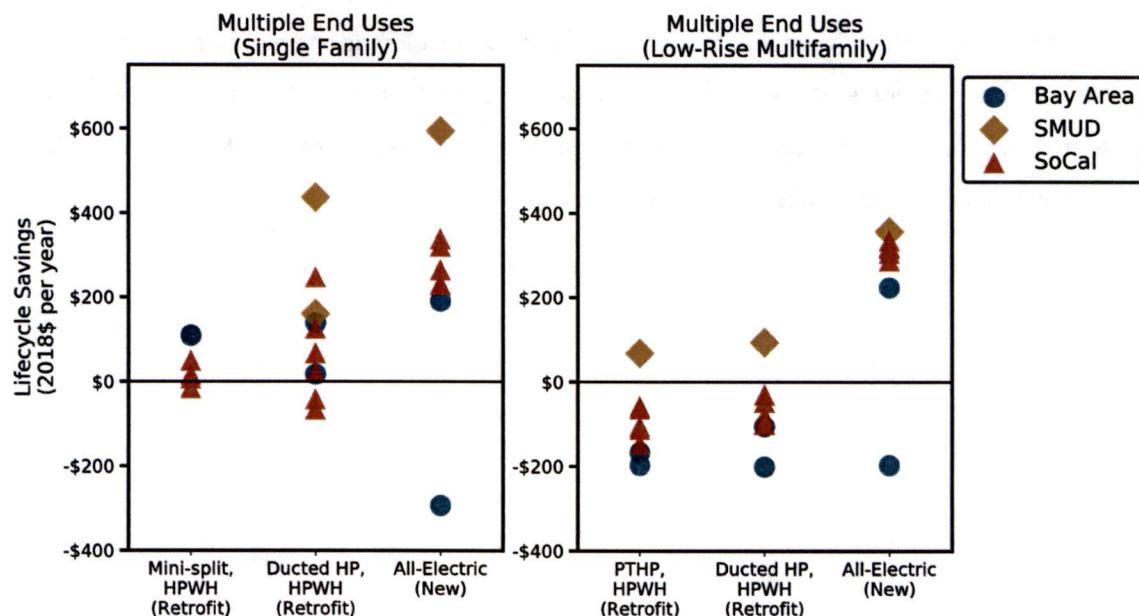
The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal).

3.4.5 MULTI-APPLIANCE RETROFITS (ELECTRIC HVAC AND HEAT PUMP WATER HEATERS) AND ALL-ELECTRIC NEW CONSTRUCTION

The lifecycle savings from electrifying both HVAC and water heating in retrofit applications are largely related to how much the appliances are used. In single family dwellings where there is a high demand for space heating, space cooling, and water heating, electrification of HVAC and water heating is more likely to deliver lifecycle savings, of up to \$420 per year. In comparison, in low-rise multifamily dwellings, electrifying both HVAC and water heating would be more likely to incur lifecycle costs.

Electrification of an entire new construction home is analyzed as a package of measures (HVAC, water heating, cooking and clothes drying). Our results indicate that all-electric new construction delivers lifecycle savings relative to a mixed-fuel home with AC. The lifecycle savings of an all-electric new construction home are driven by the capital cost difference relative to a mixed-fuel home.

Figure 3-27 Lifecycle savings of electrifying multiple end uses, base case assumptions



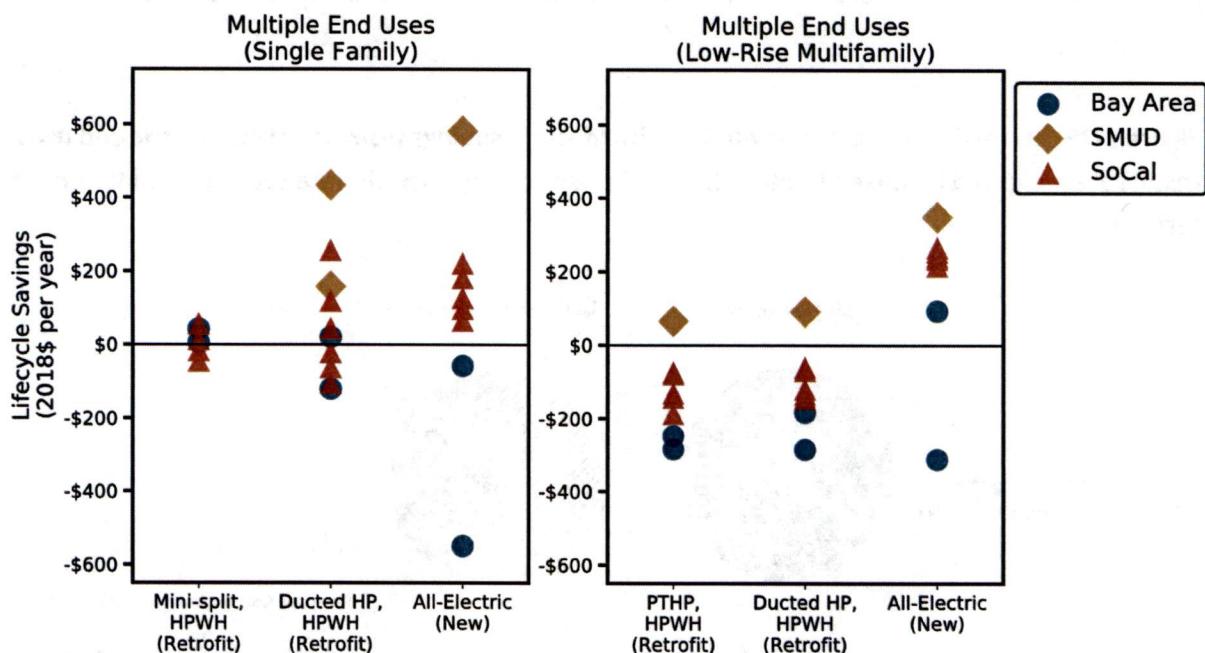
The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Electrification of HVAC and water heating only is assumed for retrofit homes, and electrification of all end uses is assumed for new construction homes. Savings are relative to gas alternatives. Single family new construction homes have electric induction stoves and electric heat pump clothes dryers in addition to HVAC heat pumps and HPWHs. LRMF new construction homes have electric resistance cookstoves and electric resistance clothes dryers in addition to HVAC heat pumps and HPWHs. Positive values represent savings in both capital and operating costs throughout the lifetime of all appliances over the gas counterpart; negative values indicate lifecycle costs. Heat pump technologies here are the same as modeled for individual appliances above. The new construction blue dot (Bay Area) is an outlier here because in the gas baseline there is no air conditioning assumed.

Figure 3-28 shows the same set of lifecycle savings for a sensitivity case where electric rates are assumed to increase at the same pace as natural gas rates. Electric rates for PG&E, SCE, and LADWP are assumed

to increase at the same annual rate of change as SoCalGas's gas rates (including a cumulative 32% increase above inflation from 2018 through 2022), and electric rates for SMUD are assumed to increase at the same annual rate of change as PG&E's gas rates (including a cumulative 6% increase above inflation from 2018 through 2022). In this sensitivity, PG&E's electric rates are assumed to increase faster than the natural gas rates due to wildfire risk and liability, while SCE's, SMUD and LADWP's rates are assumed to increase at the same pace at the gas utility in their service territory.

The lifecycle savings reflect the capital cost differences between electric and gas equipment, along with the electric rate sensitivity results as are shown in Figure 3-19. Under this electric rate sensitivity, lifecycle savings are lower overall, particularly in the PG&E (Bay Area) service territories, where the electric rates are assumed to increase more rapidly than the gas rates.

Figure 3-28. Lifecycle savings of electrifying multiple end uses, electric rate sensitivity



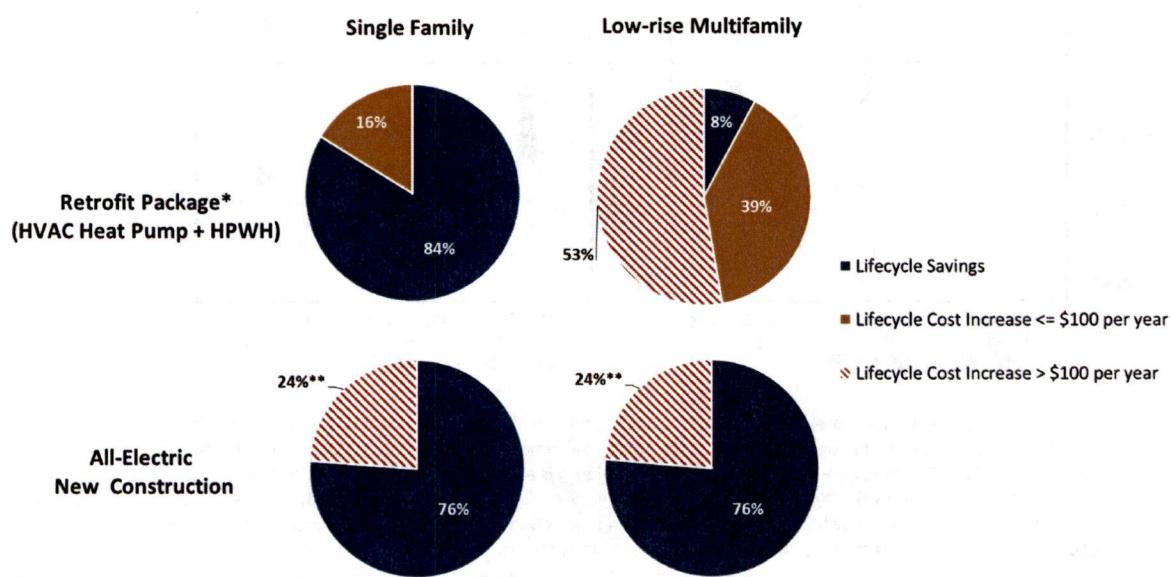
The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Electrification of HVAC and water heating only is assumed for retrofit homes, and electrification of all end uses is assumed for new construction homes. Savings are relative to gas alternatives. Single family new construction homes have electric induction stoves and electric heat pump clothes dryers in addition to HVAC heat pumps and HPWHs. LRMF new construction homes have electric resistance cookstoves and electric resistance clothes dryers in addition to HVAC heat pumps and HPWHs. Positive values represent savings in both capital and operating costs throughout the lifetime of all appliances over the gas counterpart; negative values indicate lifecycle costs. Heat pump technologies here are the same as modeled for individual appliances above. The new construction blue dot (Bay Area) is an outlier here because in the gas baseline there is no air conditioning assumed.

3.4.6 SUMMARY OF LIFECYCLE COSTS AND SAVINGS

The pie charts below summarize the key study findings, based on the share of homes in the study area that would see lifecycle savings, lifecycle cost increases of less than \$100/year, or lifecycle cost increases of more than \$100/year. By comparison, the Energy Information Agency estimates that US west coast

households spend about \$1500 per year on home energy expenditures.⁵¹ The summary results below are calculated by scaling up our results to represent the current housing stock in the six studied climate zones in California.

Figure 3-29 Share of simulated households with lifecycle savings from adopting electric end uses; results are weighted by the estimated share of households in each climate zone and utility service territory



The building simulation results are weighted using the share of households in each combination of climate zone and utility, as described in section 2.2.1. to create this summary figure.

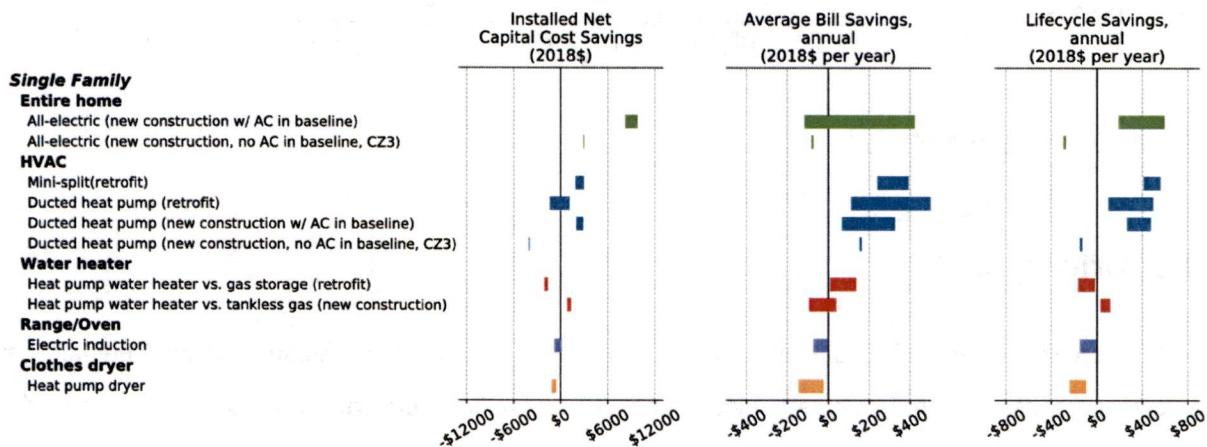
* We assume that all consumers in retrofit homes have or would install air conditioning in the mixed fuel baseline.

** This 24% of new construction that would not have lifecycle savings from electrifying the entire home correspond to buildings modeled in San Francisco (Climate Zone 3) that we assumed would not install air conditioning. For all new construction homes that include both air conditioning and space heating, electrifying all appliances shows lifecycle savings.

⁵¹ <https://www.eia.gov/consumption/residential/data/2015/c&e/pdf/ce1.5.pdf>, based on the 2015 Residential Energy Consumption Survey (RECS). These expenditures include residential electricity and on-site energy use, but not household transportation.

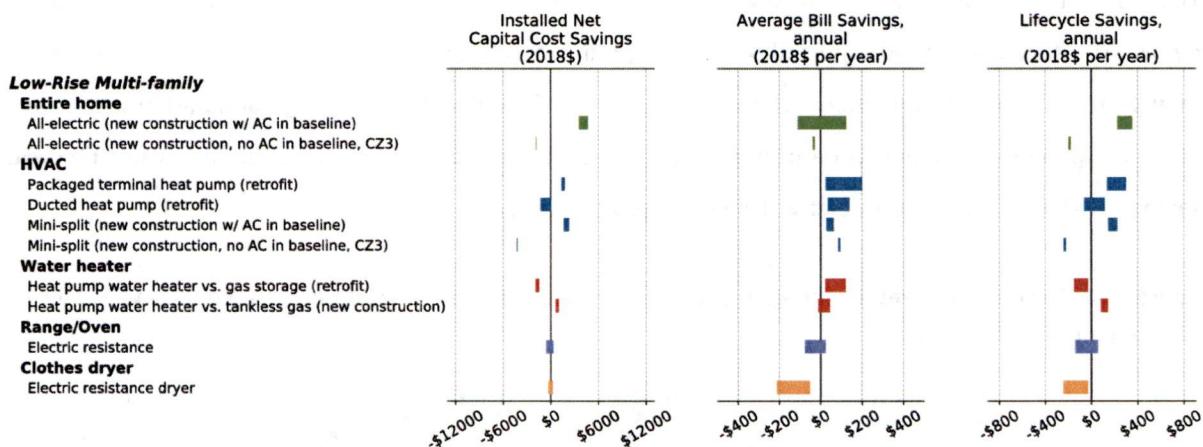
The cost results for single family and low-rise multifamily homes are summarized in each of the two figures below. The first column of results shows net capital costs or savings for installed electric equipment relative to natural gas equipment. The second column of results shows average annual bill savings for electric equipment relative to natural gas equipment. The third and final column shows net lifecycle savings of electric equipment relative to natural gas equipment.

Figure 3-30. Customer cost results for electrification in single family homes (cost ranges are due to variations by climate zone and utility rates)



Costs are relative to the gas baseline. Installed Net Capital Cost Savings are zero for the "All-electric (new construction, no AC in baseline, CZ3)" row.

Figure 3-31. Customer cost results for electrification in low-rise multifamily homes (cost ranges are due to variations by climate zone and utility rates)



Costs are relative to the gas baseline.

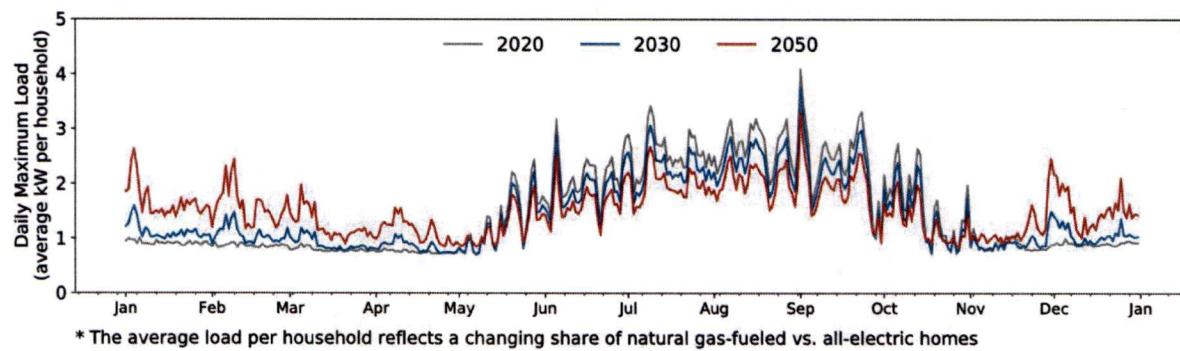
3.5 Grid Impacts

To estimate the impacts of building electrification on the electric grid, we evaluated the peak demand of an average household under increasing levels of residential building electrification adoption in the study area. Compared to the reference low-electrification scenario, the high building electrification scenario results in slightly lower summer peak loads due to greater cooling efficiency with HVAC heat pumps. Although an increase in winter electricity demand is observed across all climate zones, this increased demand remains below summer peak demand levels under “typical” weather year conditions (Figure 3-32). (The temperature and weather assumptions are based on the California Energy Commission’s Typical Meteorological Year (TMY) weather files used in the Title 24 building code.)

In California today, the grid is a summer peaking system. This means that the summer peak load is used to plan system-wide capacity additions and investments. One measure of the utilization of the electric

grid is known as the load factor, which is simply the ratio of average energy consumption to peak demand. In 2018, the load factor for residential building loads in the study area is estimated at 19% using the study's building simulation data for mixed-fuel homes. Under a high building electrification scenario (described in section 2.7) the load factor is estimated to increase to 26% in 2050. This indicates that California's bulk grid infrastructure could be more fully and better utilized under a high-electrification future. It is important to note that this study does not evaluate local distribution-level impacts of residential building electrification, an area of research that may warrant further attention.

Figure 3-32: Daily average household maximum loads from electrifying all end uses in a high building electrification scenario



* The average load per household reflects a changing share of natural gas-fueled vs. all-electric homes

The average load per household is weighted by the share of households in the home types and climate zones within the study area. Temperatures are based on the typical meteorological year data from the CEC Title 24 code.

The weather data applied in this study represent typical rather than extreme conditions. Therefore, this estimated peak load does not capture worst-case conditions that system planning may consider. The average load presented here has some representation of climate zones, home types and vintages simulated in this study. However, the system-level load is likely to show less temporal variation than what is simulated here, due to diversity of building types and behavior patterns.

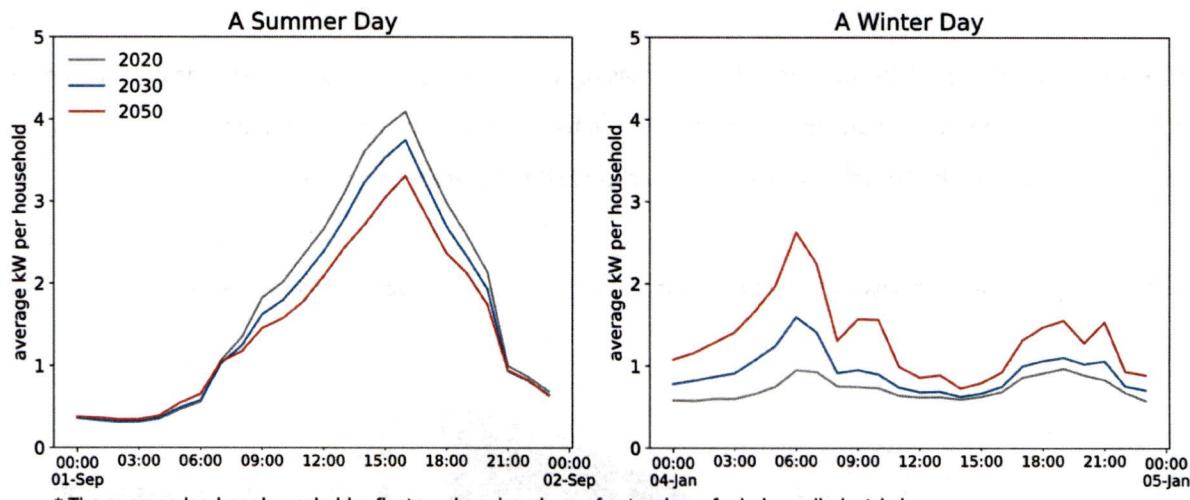
This analysis does not reflect the likely increase in air conditioning adoption due to climate change, or higher cooling demands and lower heating demands due to climate change. In general, the impacts of

climate change will tend to reduce the future likelihood that California could become a winter-peaking system even under high electrification of space heating in the state.⁵²

By further analyzing the diurnal characteristics of the average load, we find little change in load due to electrification on a hot summer day, with only a slight reduction in the peak due to more efficient cooling from high efficiency heat pumps compared to standard efficiency air conditioners (Figure 3-33). Overall, on a summer day, residential electric loads continue to be driven by space cooling needs. On a winter day in 2050, electric heating drives up the total electric load creating a morning peak and a second peak in the afternoon. However, under the typical meteorological year (TMY) weather conditions modeled here, the winter load is still smaller than the summer load both on average and on peak, even with all end uses electrified.

⁵² While research continues to investigate the possibility of changes in the patterns of winter temperature extremes due to changes in jet stream dynamics (popularly known as the “polar vortex” phenomenon), basic climate science and model projections forecast even greater increases in annual minimum temperatures than annual mean temperatures (Collins et al. 2013), and annual minimum temperatures have been trending upward in North America (Krakauer 2018).

Figure 3-33 Hourly average household residential building load in a high electrification scenario: a summer and winter day



* The average load per household reflects a changing share of natural gas-fueled vs. all-electric homes

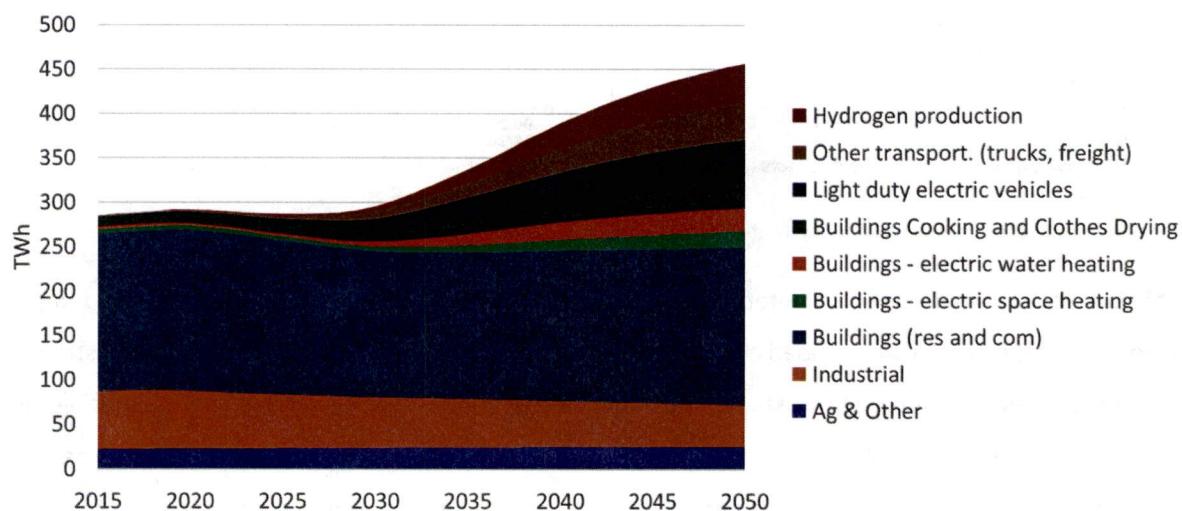
The average load per household is weighted by the share of households in the home types and climate zones within the study area.

This is a rough initial screen to determine whether electrification could exacerbate peak load impacts across the state. The impacts of load changes driven by electrification in specific locations and distribution systems were not analyzed in this study. In addition, we did not assess the difficulty of integrating these loads as the levels of variable renewable energy sources in the system increase. We would expect that summer cooling loads would be more easily integrated than winter heating loads because of their better

coincidence with solar availability. Finally, we did not include some of the coldest climate regions in the state in this study, although these represent a small portion of California's households.

In terms of total electricity consumption, increasing demands from building electrification could be significant, but the total load growth is still likely to be smaller than the impact of transportation electrification in a high electrification, deep decarbonization future (Figure 3-34).

Figure 3-34 California electricity consumption in the CEC PATHWAYS High Electrification scenario



Source: Mahone, 2018

4 Discussion

This section includes discussion of results by appliance, drivers of differences in consumer economics, market adoption barriers, and further research needs. See the Executive Summary and Recommendations for a summary of the report's key conclusions and recommendations.

4.1 Building Electrification Consumer Economics for Individual Appliances and Electrification Packages

- + All new construction homes and nearly all existing homes simulated in the study area that utilize air conditioning see lifecycle savings from an electric heat pump HVAC system. In the California climate zones evaluated in this study, electrification of space heating is favorable because mild temperatures allow heat pump space heating to average ~4 to 6 times greater efficiency than natural gas furnaces, and bill savings are also seen from more cooling due to the use of high efficiency equipment. In homes without air conditioning, for which air conditioning is not planned, heat pumps are not expected to yield lifecycle savings due to the large incremental capital costs of expanded HVAC functionality, which can require ductwork, electrical work, and new compressor placement; ductless heat pumps are one option to reduce the magnitude of this incremental capital cost.
- + Heat pump water heaters show capital cost savings for all of the new construction simulations, and bill savings for all of the simulated existing homes, yielding moderate net lifecycle savings for new construction and net costs for existing homes. Heat pump water heaters in new construction had lower capital costs than gas tankless water heaters, but also showed relatively low bill savings compared to this relatively efficient gas option. Heat pump water heaters in existing homes showed bill savings compared to gas storage water heaters, but they had significantly higher capital costs. Very high efficiency water heaters and smart appliances with

flexible schedules (especially with compatible rate design) would yield improved bill savings in new construction, while low cost, retrofit-ready models could help with existing homes. Policy should target higher efficiency and flexible water heaters for new construction along with reducing the incremental capital cost of existing equipment for existing homes via incentives and market transformation. Incentivizing the installation of heat pump water heaters along with HVAC heat pump retrofits (discussed as a “retrofit package” below) could yield cost savings from the combination, with the potential for additional soft cost savings beyond what is modeled here from reducing the number of separate installation jobs.

- + **Most homes are not expected to see lifecycle savings from electric cooking and clothes drying given current rate structures, although most lifecycle cost increases were less than \$100 per year for each appliance.** This is because of the relatively small efficiency benefits of electric cooking and clothes drying as compared with heat pumps (although they can still result in substantial GHG savings relative to natural gas cooking and clothes drying). The largest bill increases were seen for electric resistance clothes dryers; heat pump clothes dryers result in smaller bill increases but have higher capital costs and commonly available heat pump clothes dryer options in the U.S. may have inferior performance characteristics. Currently available induction stoves have higher capital costs than gas stoves in the U.S., but that is likely a function of the current market targeting induction as a high-end option. Low-cost portable induction burners are available in today’s market, and induction stoves are cheaper in other countries, such as China, where they are more common. Induction may have non-economic advantages such as more precise cooking temperatures, easier cleanup, and superior health and safety profiles, but most customers remain unfamiliar with them relative to conventional electric resistance stoves. Despite unfavorable economics as individual appliance, electric cooking and clothes drying could still be part of a cost-effective all-electric package, by helping to avoid gas infrastructure and fixed bill charges for natural gas (discussed below).
- + **All-electric new construction sees lifecycle savings in all homes that require air conditioning, based on large capital cost savings and small net changes in bills for most homes.** Capital cost savings are driven primarily by savings from the HVAC system and avoided gas infrastructure, and were found for all homes modeled as containing central air conditioning in the baseline mixed fuel home. Under current rate structures, and current equipment efficiencies, all-electric new

construction has mixed results for energy bills compared to a natural gas alternative, with bill savings from HVAC tending to be offset by bill increases for electric cooking and clothes drying.

The installation of “best of class” heat pump water heaters and heat pump HVAC systems would allow bill savings in most regions and home types, and could still yield lifecycle savings, even though they have higher capital costs than commonly available heat pump equipment. Because of this, policy should encourage very high efficiency appliances for all-electric new construction. New construction without air conditioning was evaluated as an option in the Bay Area climate zone; there, all-electric new construction was not found to result in cost savings if the reference home did not have air conditioning.

- + **All existing homes modeled would see bill savings with a retrofit package combining a heat pump water heater and a heat pump HVAC.** Bill savings are found for both HVAC and water heating individually when compared to the baseline mixed fuel home. Capital cost savings for HVAC also occur for most home types and vintages when replacing both a gas furnace and air conditioner with a heat pump, and these can help to offset capital cost increases for water heating. Electrical panel upgrades may be needed for some older homes that reduce capital cost savings or lead to capital cost increases. Overall, lifecycle savings occur for nearly all single family homes, while most low-rise multifamily homes do not see lifecycle savings because lower HVAC energy demands provide less opportunity for bill savings to offset capital cost increases. Because bill savings already occur for all home types we modeled, policy should be targeted at alleviating incremental capital costs via incentives or market transformation. We only simulated existing homes that include AC in the baseline gas-fueled home, but we do not expect lifecycle savings would occur for homes lacking AC due to the large capital cost increases associated with retrofitting the HVAC functionality to allow air conditioning with a heat pump.



4.2 Understanding Drivers of Differences in Consumer Economics

Within the same electrification and home categories, we identified five major predictors of differences in net lifecycle costs, detailed below.

1. **Heat pump HVAC is more cost-effective in homes with central air conditioning units.** A big factor in the cost-effectiveness of heat pump HVAC retrofits is the presence of central AC. Homes that already have AC or that would benefit from an AC upgrade can generally save money by installing a ducted heat pump (if central ducting is already present) or a ductless system (if no central AC or ducting is present), because of the benefit of displacing two appliances (a gas furnace and AC). In contrast, for older homes that do not currently have AC and the owners do not want AC, the cost of new ducting, placement of a compressor, and/or new electric wiring can make the retrofit for heat pump HVAC prohibitively expensive.
2. **Displacement of gas infrastructure (new construction only).** An important factor in the cost-effectiveness for all-electric, low-rise residential new construction is the value of avoided gas infrastructure both within the home and connecting to the distribution system. Note that we only considered gas infrastructure costs that are typically borne by the builder, not the full infrastructure costs including utility costs. If these costs were included in the analysis, or if future regulatory changes required these costs to be considered in cost-effectiveness analysis, or directly passed onto builders, the capital cost savings for all-electric new construction would likely be significantly larger.
3. **Heating and cooling demands.** Smaller and better-insulated homes with lower heating and cooling requirements tend to have less potential for bill savings from electrification of HVAC to offset any incremental capital costs of electrification packages. However, capital cost savings can still drive lifecycle savings in these homes due to the displacement of two appliances (#1 above) or avoided gas infrastructure (#2 above).

4. **The capacity of the existing electrical panel (retrofits only).** This analysis finds that in existing homes that require an electrical panel upgrade in order to electrify both HVAC and water heating, the cost-effectiveness of electrification is significantly reduced. Unfortunately, there is not good data available about the prevalence of homes with less than 200 amp electrical service, so it is difficult to estimate the precise number of homes in California for which this might be a challenge, although it is expected to be a minority of homes and to decline over time. Developing “retrofit-ready” heat pumps with lower current requirements could be an important technology innovation to allow more wide-spread adoption of electrification technologies in older, pre-1990s vintage homes.
5. **Electricity rates and rate design.** Not surprisingly, the electricity rate is of critical importance for determining the cost-effectiveness of electrification for consumers. SMUD enjoys some of the lowest electricity rates in the state, and as a result nearly always showed significant bill savings from electrification, reaching more than \$600 per year in some cases. In contrast, the other utilities evaluated have higher overall rates, so tended to show less bill savings or net bill costs resulting from electrification. The utilities vary in the extent to which rate designs incorporate fixed costs into volumetric rates rather than fixed charges, which also has an impact on the cost-effectiveness of electrification. However, the implications of these rate design choices are not isolated in this analysis from the overall effects of electricity rates on cost-effectiveness.

4.3 Market adoption barriers

Even when households would save money by switching to electric heat pumps and other appliances from gas appliances, a number of market barriers and market failures act as hindrances to widespread adoption. A broad list of electrification barriers and potential solutions is included in Appendix D: Market Adoption Barriers and Potential Solutions.

Market barriers fall into several key categories: consumer market failures, supplier market failures, and policy misalignment. Consumer market failures include imperfect information, transaction costs, limited access to credit, split incentives, and bounded rationality.⁵³ These can be addressed with consumer-facing incentives, education and outreach campaigns, and low-cost financing. Supplier market failures include lack of contractor familiarity with electric options and principal-agent problems⁵⁴, which can be addressed with contractor training, trusted contractor lists, utility direct install programs, upstream / contractor-facing incentives, and better targeting of code enforcement. Policy misalignment includes lack of regulatory support for fuel-switching incentives and tiered electric rates: incentives for fuel-switching and efficiency should be simplified and aligned with the goal of GHG savings, and rate designs should avoid penalizing electrification or collecting fixed costs via volumetric rates. We note the importance of not unduly burdening low income households when changing rates to make them more efficient and supportive of climate goals. Any new rate design effort would require careful analysis, building on existing research.⁵⁵ More detailed policy recommendations are discussed below.

4.4 Further Research Needs

Below we suggest areas for additional research, which could build on the work presented in this analysis:

- + Investigate the benefits of HVAC flexible dispatch to minimize coincidence with peak TOU periods.
- + Develop a better quantification of the avoided natural gas infrastructure costs associated with all-electric new construction.

⁵³ See, e.g., Dietz et al. (2009), Sallee (2014), Gillingham and Palmer (2014).

⁵⁴ See Blonz (2018).

⁵⁵ Several recent articles highlight problems with existing rate design and opportunities for improvement (Burger et al. 2019; Lo et al. 2019; Borenstein and Bushnell 2018). Burger et al. (2019) notes that a simple move to fixed charges and TOUs could have economically regressive impacts, but there are straightforward solutions, such as making fixed charges a function of income or strong correlates of income.

- + Evaluate electricity system costs and savings, particularly at the distribution system level, resulting from the combined impact of building and vehicle electrification.
- + Investigate the impediments to increasing rates of new construction and building upgrades, including building electrification.
- + Develop a better understanding of the drivers of building electrification retrofit capital costs across regions, including a better understanding of how many homes, and of what types, may require an electrical panel upgrade to enable electrification.
- + Evaluate the customer costs and benefits, and societal costs and benefits of building electrification in the climate zones not evaluated in this study, including colder Northern and mountainous climate zones.
- + Evaluate cost-effective electric solutions for multi-family high-rise and mixed-used high-rise buildings, which are a growing share of the California housing stock but have highly heterogeneous characteristics.
- + Develop a better understanding of the challenges of maintaining reliability and resiliency with electrification of critical household end uses in the context of increasing vulnerability to wildfires and other extreme events related to climate change.
- + Develop a framework to make electric rates more economically efficient and supportive of climate goals while not burdening low income customers or introducing new inefficiencies, building on existing research (Burger et al. 2019; Lo et al. 2019; Borenstein and Bushnell 2018).

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6 Appendix A: Technology Characterization and Screening

6.1.1 INTERNATIONAL MARKET FOR HEAT PUMPS

Electrified heating represents a significant and growing market share in certain European and Asian markets; primarily in regions with energy security, climate, or air quality concerns. Japan, Germany, and Sweden have focused policy attention on increasing the deployment of heat pumps to reduce dependence on imported fossil fuels and greenhouse gas emissions. Policy efforts there have focused primarily on incentives and incorporating electric heat into building codes for new construction, as well as testing and performance standards to ensure quality and build consumer confidence in heat pump technology⁵⁶.

6.1.1.1 Japan

Japan began pursuing air source heat pumps in the mid-1990s as part of a broader efficiency and fuel switching strategy intended to reduce the country's reliance on fossil imports. Consequently, heat pumps have taken a significant share of the total heating market, with about 140 million cumulative installations of air source heat pumps in homes and commercial buildings⁵⁷. Japan appears to be at the forefront of high efficiency heat pump technology development today, with many high efficiency products available in Japan that are not currently available in the United States, such as compressed carbon dioxide heat pump water heaters. For example, the EcoCute is a high-efficiency, carbon dioxide heat pump water heater promoted by government agencies to reduce energy demand for water heating – approximately

⁵⁶ See Hanna, Parrish, and Gross (2016)

⁵⁷ See Shibata (2011)

30% of all household energy demand. The use of carbon dioxide as a refrigerant in the EcoCute is part of a focused effort in Japan to eliminate the use of high-GWP refrigerants common in most residential and commercial heat pumps. Currently at least one manufacturer, Sanden, is selling these heat pump water heaters in the United States market, although they are not expected to achieve a large market penetration because of their high cost⁵⁸.

6.1.1.2 *China*

China has the world's largest market for electric heat pumps, with 40 to 50 million air source heat pumps sold annually⁵⁹. Heat pumps, as well as natural gas furnaces, have been aggressively promoted in some provinces as a key strategy to mitigate urban air quality concerns associated with the open burning of coal common in residential and commercial buildings. The electrification campaign, focused primarily in Beijing and other northern provinces, has coincided with efforts to expand and modernize local electric and natural gas distribution systems, and has often been followed by local ordinances prohibiting the use of coal for heating⁶⁰. Given China's growing population and strong policy directives, this market is expected to drive innovation and cost reductions in heat pump technologies over the coming years.

6.1.1.3 *European Markets*

A combination of policy and economic conditions have created a robust market for electrified heating in certain European jurisdictions, particularly northern and central Europe: these regions share cold winters, high natural gas prices, and favorable policies. These markets began to see significant adoption of early heat pump technologies in the 1970s, following periods of energy security and energy price concerns, and have

⁵⁸ See Gluesenkamp et al. (2017)

⁵⁹ See Zhao, Gao, and Song (2017)

⁶⁰ See Myers (2018)

seen renewed interest as European governments have introduced new policies to address carbon emissions in recent decades.

In 2017, electric heat pumps eclipsed gas heating in residential buildings in Germany for the first time, with 43% of buildings heated by air or ground source heat pumps⁶¹. In Switzerland, approximately 75% of new homes were built with electric space and water heating, while in Scandinavia, heat pumps have become the dominant heat source in Finland⁶² and are a growing share of Sweden's electrical heating market⁶³.

6.1.2 MANUFACTURING AND HISTORY

Consistent with a significant, established international market that overlaps with the manufacturing of air conditioning, the heat pump manufacturing market is large and diverse. There are a broad range of both multinational and regional vendors, primarily consisting of manufacturers of air conditioners and other durable consumer goods. Major manufacturers of heat pumps include A.O. Smith (US), Carrier (US), Daikin (Japan), Danfoss (Denmark), Mitsubishi and Fujitsu (Japan), and NIBE (Sweden).

Carrier and A.O. Smith, the primary US-headquartered manufacturers, offer a broad range of residential and commercial air-to-air, ground-to-air, and air-to-water heat pumps using conventional refrigerants. Additionally, foreign manufacturers like Mitsubishi, Fujitsu and Daikin have developed extensive distribution and installer networks in the US for their heat pumps products.

⁶¹ See <https://www.coolingpost.com/world-news/heat-pumps-overtake-gas-in-germany/>

⁶² See <https://www.sulpu.fi/documents/184029/189661/The%20future%20of%20Heat%20Pumps.pdf>

⁶³ See http://www.varmemarknad.se/pdf/The_heating_market_in_Sweden_141030.pdf

6.1.3 HEAT PUMP PERFORMANCE AND COLD CLIMATE HEAT PUMPS

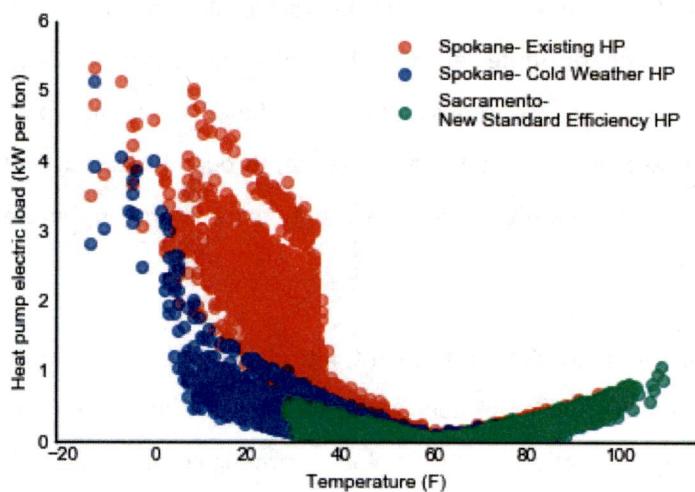
Heat pumps function using the same principles as a refrigerator or an air conditioner. They transfer heat between two systems – for example, extracting heat energy from outdoor air and delivering it as warm air inside a residential building. Because heat pumps transfer heat, rather than converting it directly from chemical or electrical energy, they can deliver useful heat energy in quantities considerably greater than the energy required to operate them. This ratio of input energy to output energy is often measured as the Coefficient of Performance (COP). (COP is defined as the annual average performance, and it can be compared with an efficiency by multiplying by 100; i.e., a COP of 4.0 means an annual average efficiency of 400%.)

Electric air source heat pump space heating technologies range from about 200% to more than 400% efficient, depending on the temperature differential between indoors and outdoors: they heat more efficiently at warmer temperatures. In contrast, high efficiency natural gas furnaces achieve 90% efficiency, while electric resistance heating is approximately 100% efficient. For US markets, the Department of Energy's 2015 appliance efficiency standards effectively mandate minimum seasonal COP of 2.5 for heating and 4.1 for cooling based on a specified set of temperature conditions (the heating seasonal performance standard minimum requirement is 8.2).

Heat pump space heating technology was first widely deployed during the 1970s; however, these early generation technologies were not particularly efficient, and relied heavily on supplemental heat in colder temperatures, such as electric resistance backup heat, often resulting in high winter electric bills for their owners. Heat pump failures and service issues were significant factors in the stagnation of the heat pump industry, leading to industry and policy efforts to improve product and installation quality. However, heat pump efficiency improved considerably in the 1990s, paving the way for a resurgence in the heat pump market in the 2000s.

Similarly, heat pump performance has improved considerably in cold climates, which represent a challenge for older technology single-stage HVAC heat pumps. Using improved compressor technology and improved refrigerants, modern heat pumps can maintain efficient output at much lower ambient temperatures, enabling their use in much colder climates such as the US Midwest and Northeast. Much of this heat pump research has occurred in Northern Europe and Japan, which hosts a range of climate zones, including colder Northern regions with average winter low temperatures below $-10^{\circ}\text{C}/10^{\circ}\text{F}$, where traditional heat pumps were initially unsuitable. Variable-speed (inverter-driven) compressors are one approach to allowing colder temperature operation and enhancing efficiency across the temperature range, that also provide benefits such as reduced noise and improved comfort.

Figure 6-1. Relationship between outdoor temperature and heat pump electric load



Note that "ton" in this figure refers to the tonnage, or power, of the heat pump. Energy usage of the heat pumps in this data was divided by the tonnage of the heat pumps to arrive at kW per ton.

Ductless heat pumps are another recent innovation that have a large market share in Asia and are beginning to enter the US market. They include small, modular indoor and outdoor units connected by

thin refrigerant pipes. In compact houses or apartments lacking existing ducting, they can be an inexpensive option that also allow very high efficiencies because energy is not lost in ventilation and ducting.

6.1.4 THE GREENHOUSE GAS IMPLICATIONS OF REFRIGERANT USE IN HEAT PUMPS

Heat pumps utilize refrigerants, typically in a vapor-compression cycle to transfer heat. Ideal refrigerants have many requirements, including an appropriate boiling point and thermal properties as well as low toxicity and flammability. Unfortunately, like refrigerators and air conditioners, heat pumps originally relied on refrigerants with detrimental environmental impacts. Chlorofluorocarbons (CFCs) were popular throughout the mid-twentieth century but were recognized as ozone depleting and so were phased out beginning in 1987 with the Montreal Protocol.

Replacement refrigerants, such as hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs), while presenting a much lower risk for atmospheric ozone depletion than chlorofluorocarbons (CFCs), still have significant global warming potentials, in some cases thousands of times the global warming potential of carbon dioxide by mass. When these gases escape into the atmosphere, through leaks, accidents, or improper disposal, they contribute to global climate change. As a result, there is growing interest in identifying alternative refrigerants.

The first widespread implementation of a very-low-GWP refrigerant, introduced in a heat pump water heater in 2001 in Japan, was compressed CO₂, which in addition to its low-GWP attributes provides improved performance in many heat pump applications. Having a global warming potential of 1, CO₂ has orders of magnitude lower climate impact than the refrigerants most commonly used today for this application. It has emerged as a promising refrigerant for commercial HVAC heat pumps as well as for heat pump water heaters due to its higher efficiency and ability to reach higher temperatures than other

refrigerants, important for water heating applications⁶⁴. However, because of its lower boiling point and thus higher operating pressure, it requires stronger, more expensive materials and construction, reducing the cost-effectiveness of its use in small applications such as residential heat pumps. Thus far, high-pressure CO₂ systems remain limited to water heating, for domestic hot water or for hydronic space heating, and non-residential applications: no air-to-air heat pumps for space heating have been developed.

Other very-low-GWP refrigerants that are currently being researched include ammonia, and hydrocarbons such as isobutane, propane, and olefins. Olefins represent a relatively lower pressure alternative to compressed CO₂, which may be cost-effective in residential applications⁶⁵. The principal issue with using hydrocarbons as refrigerants is that they are flammable.

The most promising set of refrigerants in the near term is those that are chemically similar to refrigerants currently used, but that have a significantly lower global warming potential. For residential air-to-air heat pumps, the most likely near-term replacement refrigerant is R32 (GWP 675), which would replace R410A (GWP 2088)⁶⁶. Development of low-GWP refrigerants such as R32 is an area of active research.

When an air conditioner using today's refrigerants is replaced with an HVAC heat pump, there is no additional refrigerant leakage risk, assuming the heat pump system has a similar tonnage. A home's refrigerant leakage risk will only increase if an HVAC heat pump is installed when there was previously no air conditioning. There is an increased refrigerant leakage risk when switching to heat pump water heaters and heat pump clothes dryers, but the resulting increase in average greenhouse gas emissions is dwarfed by the savings in emissions from not using natural gas, as seen in Figure 1-1: Annual GHG emissions from

⁶⁴ See Neksa et al. (1998)

⁶⁵ See Watanabe et al. (2017)

⁶⁶ See California Air Resources Board (2017)

a mixed-fuel and all-electric 1990s vintage home in Sacramento and Figure 3-1: Annual GHG emissions from a 1990s vintage single family home for Sacramento.

6.1.5 ELECTRIC RESISTANCE AND INDUCTION STOVES

Induction cooktops have several advantages over gas and electric resistance stoves, principally efficiency and safety. Induction cooking is modeled using an efficiency of 84% (0.74 energy factor for the cooktop), compared to 74% for electric resistance and 40% for gas. Unlike electric resistance stoves, induction stoves can be controlled almost instantaneously, similar to gas stoves.

Induction cooktops are popular in Europe and Asia but have not seen widespread adoption in the United States market. Some cooks value induction stoves for their safety (they do not burn to the touch, since they operate based on electromagnetism) and the precise level of temperature control offered by induction stove. Induction stove are generally slightly more expensive than comparable electric resistance cooktops in the US market, but this appears to be more a function of limited market share, that targets higher-end products, rather than inherent engineering expense, as cheap portable versions are available and popular in markets outside the U.S. At current prices, the markup on an induction stove is generally not recouped through energy savings over the lifetime of the unit. Additionally, aluminum cookware, which is very common in the United States, is not compatible with induction stoves. Switching to induction stoves requires cookware that is magnetic, such as cast iron or stainless steel, which may present an adoption barrier for some consumers. These cost factors, along with consumers' lack of familiarity with induction stoves, represent barriers to widespread adoption. Despite these barriers, induction stoves are a promising alternative to electric resistance stoves, and may become acceptable, or even preferred, by consumers accustomed to gas stoves.

6.1.6 HEAT PUMP CLOTHES DRYERS

Heat pump clothes dryers are relatively common in some European countries but have not yet become widespread in the United States. Heat pump clothes dryers are about 50% more energy efficient than natural gas clothes dryers and are about 35% more efficient than electric resistance clothes dryers. However, there are significant performance limitations with currently available models: they may take longer to dry and require more maintenance.

6.2 Overview of Technology Selection and Efficiencies

6.2.1 HEATING, VENTING AND AIR CONDITIONING (HVAC)

Table 6-1 Electric HVAC system selection

	 Single-Family	 Low-Rise Multifamily
Retrofit (Pre-1978s)	<ul style="list-style-type: none"> Electric: Non-ducted mini-split heat pump Gas: <i>replaces wall furnace with ducted furnace and AC</i> 	<ul style="list-style-type: none"> Electric: Packaged terminal heat pump (PTHP) Gas: <i>new wall furnace and window AC</i> 
Retrofit (1990s)	<ul style="list-style-type: none"> Electric: Ducted split heat pump Gas: <i>replaces ducted furnace with new ducted furnace and AC</i> 	<ul style="list-style-type: none"> Electric: Ducted heat pump Gas: <i>Combined hydronic system + AC</i> 
New Construction	<ul style="list-style-type: none"> Electric: Ducted split heat pump Gas: <i>replaces ducted furnace with new ducted furnace and AC (CZ3: no AC)</i> 	<ul style="list-style-type: none"> Electric: Ducted mini-split heat pump Gas: <i>ducted furnace and AC (CZ3: no AC)</i> 

6.2.1.1 Single family

Table 6-2 Efficiencies of HVAC systems selected for single family homes

Home Type	Equipment	Modeled Efficiency
Mixed Fuel, all vintages	Furnace	80 AFUE ducted attic furnace
Mixed Fuel, all vintages	Split air conditioner	14 SEER, 12.2 EER, 2-speed
All Electric, new construction, 1990s vintage and pre-1978 vintage (CZ10 and CZ12)	Ducted split heat pump	18 SEER, 14 EER, 10 HSPF, 2-speed
All Electric, pre-1978 vintage (CZ03, CZ04, CZ06 and CZ09)	Non-ducted mini-split heat pump	21 SEER, 13 EER, 11 HSPF

6.2.1.1.1 Case 1, 2, & 3: Ducted split heat pump

For single family homes, ducted split heat pumps were selected to replace ducted furnaces with split air conditioners or ducted furnaces alone without cooling. Ducted split heat pumps are a very mature technology with a large range of efficiency options.

6.2.1.1.2 Case 3: Non-ducted mini-split heat pump, multi-head

For pre-1978 existing single family homes, where the basecase system is a non-ducted gas wall or floor furnace and either a window air conditioner or no cooling system, a non-ducted mini-split heat pump (MSHP) with multiple indoor units was selected as the electric replacement. This basecase system is inexpensive and easy to replace but suffers from low performance and does not provide equivalent comfort conditions as a distributed heating/cooling system. Converting to a ducted system is expensive and MSHPs

offer a practical alternative for less cost. Electric single point heating/cooling options such as a MSHP with a single indoor unit may be relatively affordable but compromises comfort and if the electric alternative system does not provide reasonable levels of comfort, there is a risk that the technology will not be accepted. In smaller multifamily homes this trade-off may be acceptable but not in single family homes or larger multifamily. For this case the base case gas replacement assumes conversion to a ducted furnace in order to provide similar comfort conditions across the gas and electric options.

6.2.1.2 Low-rise Multifamily

Table 6-3 Efficiencies of HVAC systems selected for low-rise multifamily homes

Home Type	Equipment	Modeled Efficiency
Mixed Fuel, all vintages	Furnace	80 AFUE ducted attic furnace
Mixed Fuel, all vintages	Split air conditioner	14 SEER, 12.2 EER, 2-speed
All Electric, new construction	Ducted mini-split heat pump	21 SEER, 13 EER, 11 HSPF
All Electric, 1990s vintage	Ducted split heat pump	18 SEER, 14 EER, 10 HSPF, 2-speed
All Electric, pre-1978 vintage	Packaged terminal heat pump	11 EER, 3.3 COP

6.2.1.2.1 Case 4: Ducted mini-split heat pump

For new low-rise multifamily home construction, a ducted mini-split heat pump (MSHP) was selected to replace ducted furnaces with split air conditioners or ducted furnaces alone without cooling. While costs are higher than traditional split heat pumps; MSHPs are most appropriately sized for the low cooling and heating loads expected in small, new construction apartments. MSHPs are already becoming more common in the multifamily market.

6.2.1.2.2 Case 5: Ducted split heat pump

For existing low-rise multifamily units with a single gas water heater providing both space and water heating, coupled with a split air conditioner (depending on climate), ducted split heat pumps were selected as the electric replacement. While a hydronic distribution system with a HPWH would be the most direct replacement option, prior experience has shown that residential HPWHs on the market do not have the capacity to serve both the space and water heating loads without reverting to electric resistance mode. An alternative option would be a larger capacity air-to-water heat pump with a storage tank replacing the water heater. However, there are few products available today and market readiness is lower.

6.2.1.2.3 Case 6: Packaged terminal heat pumps

For pre-1978 existing low-rise multifamily units with a wall or floor furnace and either a window air conditioner or no cooling system, a packaged terminal heat pump (PTHP) was selected as the electric replacement. Similar to Case 3, there is potential comfort issues for any apartments except studios with open floor plans (no rooms with closeable doors) by not providing conditioned air to each room. While comfort issues may arise from a single zone PTHP, the replacement system can provide equivalent or better comfort than the replacement gas equipment and window AC. The incremental cost of other systems such as multi-head MSHPs is more difficult to justify given the low loads of small apartments.

6.2.2 WATER HEATING

Table 6-4 Efficiencies of water heating systems selected for single family and low-rise multifamily homes

Home Type	Equipment	Modeled Efficiency
Mixed Fuel, retrofits	Gas storage water heater	0.63 UEF (0.60 EF) 1900s vintage in garage, 1970s vintage in home
Mixed Fuel, new construction	Gas tankless water heater	0.81 UEF (0.82 EF) in garage
All Electric, all vintages	Heat pump water heater	3.0 EF, NEEA Tier 3 new construction and 1990s vintage in garage, 1970s vintage in home

6.2.3 OTHER APPLIANCES

Table 6-5 Electric cooking and clothes drying selection

	Single-Family	Low-Rise Multifamily
Cooking & Clothes Drying (All vintages)	 HEAT PUMP DRYER	 INDUCTION STOVE

Table 6-6 Efficiencies of selected appliances

Appliances	Case	Efficiency	Features/Notes
Cooking	Gas	Cooktop: 0.4 Energy Factor Oven 0.058 Energy Factor	
	Electric resistance (LRMF)	Cooktop: 0.74 Energy Factor Oven 0.11 Energy Factor	
	Electric induction (Single Family)	Cooktop: 0.84 Energy Factor Oven 0.11 Energy Factor	
Clothes Dryer	Gas	2.75 Energy Factor	
	Electric resistance (LRMF)	3.1 Energy Factor	
	Electric heat pump (Single Family)	4.2 Energy Factor	Moisture sensor
Clothes Washer	All	1.41 MEF	3.5 ft3 drum
Primary Refrigerator	All	Single Family: 15.7 EF (all) LRMF: 14.1 EF (existing homes) 17.6 EF (new construction)	Single Family: 25 ft3 side-by-side refrigerator LRMF: 18 ft3 top freezer refrigerator
Secondary Fridge/Freezer	All	Single Family: mix of efficiency LRMF: none	Single Family: energy use reduced based on a national average of 22.1% saturation for fridge and 34.2% for freezer
Dishwasher	All	318 Rated annual kWh per Energy Guide	8 place settings
All simulation parameters and schedules are based on NREL's BEopt and the House Simulation Protocols			

7 Appendix B: Building Simulation Descriptions

Thermostat Schedules as Modeled

The project team evaluated thermostat schedules to use in the modeling for the electrification study. The project team initially considered using the CEC Title 24 thermostat schedules for single family and low-rise residential buildings for the analysis, however, these schedules were ultimately not used in this analysis for the reasons described below.

A literature review considered the following sources:

- + 2004 SCE report: Programmable Thermostats Installed into Residential Buildings: Predicted Energy Savings Using Occupant Behavior & Simulation
- + 2017 SCE Work Paper SCE17HC054: Residential Smart Communicating Thermostat
- + 2016 Nest Labs report: Supplemental Data for California Smart Thermostat Work Paper
- + 2014 Building America House Simulation Protocols
- + 2016 Residential and Nonresidential Alternative Calculation Method Reference Manual
- + 2011 DOE report: U.S. Department of Energy Commercial Reference Building Models of the National Building Stock

Based on data reviewed, the project team developed the setback schedule in Table 7-1 for use in this project. This schedule assigns specific, rational times to the temperature changes and a 3°F temperature setback in

winter and setup in summer (rounded to the nearest degree). The residential Title 24 thermostat schedule also uses a 3°F heating night setback but no daytime setback. Weekend/weekday schedules are likely to vary if the house is unoccupied during the day, but data from the Residential Appliance Saturation Study (RASS) supports using a daytime setback. The 76°F cooling and 70°F heating setpoint are closely aligned with the Building America settings.

Table 7-1: Thermostat Setup/Setback Schedules Used in this Analysis

	Cooling	Heating		Cooling	Heating
12:00 AM	79	67	12:00 PM	76	67
1:00 AM	79	67	1:00 PM	76	67
2:00 AM	79	67	2:00 PM	76	67
3:00 AM	79	67	3:00 PM	76	68
4:00 AM	79	68	4:00 PM	76	69
5:00 AM	79	69	5:00 PM	76	70
6:00 AM	79	70	6:00 PM	76	70
7:00 AM	79	70	7:00 PM	76	70
8:00 AM	76	67	8:00 PM	76	70
9:00 AM	76	67	9:00 PM	76	70
10:00 AM	76	67	10:00 PM	79	67
11:00 AM	76	67	11:00 PM	79	67

The shaded areas in the table above correspond to when systems are set back in winter and up in summer (or turned off). For heating, the temperature ramps up between 4 AM and 6 AM, and between 3 PM and 5 PM to limit strip heat operation. Although the ramp-up is not needed for base case systems, when applied to both it ensures building loads are the same for both cases.

For new homes the temperature may not drift more than 3°F between setup/setback periods and systems will be minimally active during these periods. For older leakier homes, systems will likely be working to maintain the setpoints.

Other thermostat scheduled evaluated

Table 7-2 summarizes Title 24 and other available thermostat schedules. Title 24 schedules include uncharacteristic setbacks and are different for low-rise and high-rise residential buildings. The differences reflected in the residential and non-residential schedules are not based upon actual differences based on occupancy but independent development of residential and non-residential compliance models.

Table 7-2: Title 24, Building America, and DOE Thermostat Schedules⁶⁷

Residential ACM ¹			Non-Res ACM Residential Living ²		Building America House Simulation ³		DOE Comm. Ref. Bldg. Models ⁴	
Hour	Cooling Setpoint	Heating Setpoint	Cooling Setpoint	Heating Setpoint	Cooling Setpoint	Heating Setpoint	Cooling Setpoint	Heating Setpoint
1	78	65	78	60	76	71	75	70
2	78	65	78	60	76	71	75	70
3	78	65	78	60	76	71	75	70
4	78	65	78	60	76	71	75	70
5	78	65	78	60	76	71	75	70
6	78	65	78	60	76	71	75	70
7	78	65	78	68	76	71	75	70
8	83	68	78	68	76	71	75	70
9	83	68	78	68	76	71	75	70
10	83	68	78	68	76	71	75	70
11	83	68	78	68	76	71	75	70
12	83	68	78	68	76	71	75	70
13	83	68	78	68	76	71	75	70
14	82	68	78	68	76	71	75	70
15	81	68	78	68	76	71	75	70
16	80	68	78	68	76	71	75	70
17	79	68	78	68	76	71	75	70
18	78	68	78	68	76	71	75	70
19	78	68	78	68	76	71	75	70
20	78	68	78	68	76	71	75	70
21	78	68	78	68	76	71	75	70
22	78	68	78	68	76	71	75	70
23	78	68	78	60	76	71	75	70
24	78	65	78	60	76	71	75	70

The Title 24 low-rise residential thermostat schedules assume a 78°F and 68°F cooling and heating setpoints, respectively, with a setback/setup assumption. A 65° heating setback is used, while the cooling set up is as

⁶⁷ Sources: Table 19 of Residential Alternative Calculation Method Reference Manual (<https://www.energy.ca.gov/2015publications/CEC-400-2015-024/CEC-400-2015-024-CMF-REV3.pdf>), Appendix 5.4B of Non-Residential Alternative Calculation Method Manual (http://www.energy.ca.gov/title24/2016standards/ACM_Supporting_Content/), 2014 Building America House Simulation Protocols (Section 2.4) (<https://www.nrel.gov/docs/fy14osti/60988.pdf>), U.S. DOE Commercial Reference Building Models of the National Building Stock (<https://www.nrel.gov/docs/fy11osti/46861.pdf>)

high as 83° but varies depending on the hour. The high-rise residential thermostat schedule has the same setpoints but no cooling setup and a heating setback temperature of 60°F. The heating setback schedule for high-rise is also slightly different from the low-rise schedule.

Also included in Table 7-2 are the thermostat schedules used by DOE's Building America program and those recommended by DOE for high-rise building modeling. These schedules assume more aggressive heating and cooling setpoints than the Title-24 schedules and are fixed.

Project Team Position on Using Title-24 Thermostat Schedules

The project team ultimately decided against using the Title-24 thermostat schedules for the following reasons:

- Project team feels that both low-rise residential thermostat schedules will result in lower than representative heating and cooling energy use.
- The residential cooling setback was created to adjust cooling energy use by hour to align with statewide demand and not representative of actual cooling setback schedules.

Thermostat Settings from SCE Work Paper and Nest Documents

Based on the data from the two plots on p.30 of the work paper (SCE17HC054, also in Figs. 2 & 3 of the Nest document) and excluding CZ1 (minimal data) and CZ16 (outlier), the mean "comfort setpoint" was 70.3°F for heating and 76.4°F for cooling. These are not far from the 71°F heating and 76°F cooling settings in the NREL House Simulation Protocols or the 70°F heating and 75°F cooling settings in the DOE Commercial Reference Building Models document.

The average setpoints reported in the work paper (66.8°F heating and 75.4°F cooling) and based on RASS are presumably averages across all periods and not representative of what settings would be during occupied and non-sleeping periods. The wide setting ranges in the RASS questionnaire make it difficult to zero in on what setpoints people actually used. The Nest data is more suited to this purpose.

Setback Temperatures and Schedules

If it is assumed that the difference between "comfort setpoint" and "average setpoint" is representative of the measured setback temperature, averaging the "Cooling T-diff" and "Heating T-diff" values across CZ2 to CZ15 from the table on p.42 of the work paper (Table 1 of the Nest document), the mean heating setback was 3.3 and the cooling setup was 2.7. Unfortunately, there is no statistical representation of what times the setting changes occurred. Given the way the Nest operates, temperature changes are based on a combination of occupancy and learned temperature preferences.

The RASS data has too wide a temperature range to be useful for determining scheduled temperatures, but the correction factors on p.35 of the work paper suggest people use somewhat higher heating setbacks than cooling or set-ups. It could be assumed that people set back the temperature in winter during non-occupied periods and/or at night, but summer scheduling is less obvious. Some may set thermostats up while they are at work and crank up the AC when they return. Others may maintain the same temperature during the day and lower it at night to make the house more comfortable for sleeping.

The analysis of RASS data described in the 2004 SCE document, "Programmable Thermostats Installed into Residential Buildings: Predicted Energy Savings Using Occupant Behavior & Simulation" includes the following tables:

Figure 7-1: Table 6 and 8 of 2004 SCE Work Paper

Table 6. Percent of Cooling Systems set to "Off"

Region	Standard Thermostat				Change due to Prog T-stat			
	Morn	Day	Evening	Night	Morn	Day	Evening	Night
NC	49%	28%	13%	56%	-2%	3%	7%	-2%
SC	63%	43%	42%	65%	-13%	-6%	-16%	-17%
SI	48%	25%	23%	47%	-13%	-5%	-9%	-10%
CV	43%	24%	11%	40%	-10%	-9%	-3%	-3%
DE	37%	14%	10%	35%	-8%	0%	-4%	-10%

Table 8. Percent of Heating Systems set to "Off"

Region	Standard Thermostat				Change due to Prog T-stat			
	Morn	Day	Evening	Night	Morn	Day	Evening	Night
NC	29%	45%	19%	53%	-12%	-17%	-11%	-13%
SC	40%	57%	35%	54%	-15%	-15%	-16%	-17%
SI	30%	44%	26%	36%	-10%	-12%	-12%	-7%
CV	19%	37%	19%	39%	-10%	-15%	-12%	-10%
DE	27%	34%	23%	35%	-17%	-11%	-14%	-11%

The definitions of time periods are as follows:

- + Morning: 6 am to 9 am
- + Day: 9 am to 5 pm
- + Evening: 5 pm to 9 pm
- + Night: 9 pm to 6 am

The definition of "off" is based on the RASS questionnaire (below), which includes check boxes for "off" as well as six other temperature ranges. Depending on house temperature response to setbacks and setups, "Off" may yield the same change in indoor temperature and perceived setpoint as certain selected temperature ranges. Respondents may have also used "off" as a proxy for setback/setup.

B6 If your main heating system is controlled by a thermostat, what is the average thermostat temperature usually set for each time period during the heating season?
(Choose one answer for each time period. Provide the average setting if it varies.)

	Off	Below 55°F	55 – 60°F	61 – 65°F	66 – 70°F	71 – 75°F	Over 75°F
Morning (6am-9am) (HMRNSET)	100	100	100	100	100	100	100
Day (9am-5pm) (HDAYSET)	100	100	100	100	100	100	100
Evening (5pm-9pm) (HEVNSET)	100	100	100	100	100	100	100
Night (9pm-6am) (HNITESET)	100	100	100	100	100	100	100

C5 What is the typical thermostat temperature setting of your main central cooling system for each time period during the cooling season? *(Choose one answer for each time period.)*

	Off	Below 70°F	70 – 73°F	74 – 76°F	77 – 80°F	Over 80°F
Morning (6am-9am) (CMRNSET)	100	100	100	100	100	100
Day (9am-5pm) (CDAYSET)	100	100	100	100	100	100
Evening (5pm-9pm) (CEVNSET)	100	100	100	100	100	100
Night (9pm-6am) (CNITESET)	100	100	100	100	100	100

Averaging the percentage across all regions from the tables above, the percentage of time systems are off is:

	6 am-9 am	9 am-5 pm	5 pm-9 pm	9 pm-6 am
Cooling	48%	27%	20%	49%
Heating	29%	43%	24%	43%

Applying a 43% threshold for cooling and heating, most cooling systems would be off at night, and most heating systems would be on in the morning and evening and off at night.

Temperature Ramping

Title 24 standards require that thermostats for heat pumps prevent supplementary heater operation when the heating load can be met by the heat pump alone and require a higher setpoint for heat pump heating than for resistance heating (staged settings). Supplementary (resistance) heating is allowed for defrost and where controls use intelligent recovery or ramping that preclude use of resistance heat. Use of temperature ramps is important for proper characterization of heat pump and strip heat operation.

8 Appendix C: Additional Methods Detail

8.1 Fossil emissions from electricity

8.1.1 DESCRIPTION OF AURORA SCENARIO

Hourly marginal electricity rates are generated by a WECC-wide system scenario in the production simulation tool, AURORA. AURORA takes in system load forecasts, grid characteristics, available generators, technical constraints, and operating costs as inputs to set up system scenarios. Based on those system characteristics, AURORA performs an optimal hourly dispatch of the electric grid to determine hourly wholesale marginal electricity market prices. The developed AURORA scenario includes a detailed forecast of California's electricity system, as well as a broader forecast of the Western Electricity Coordinating Council (WECC) system. Build portfolios and operating characteristics for California's electricity system are determined by E3's RESOLVE capacity expansion model.

In this analysis, the renewable energy build portfolio in AURORA is based on a RESOLVE case that achieves approximately a 74% RPS in 2030. The scenario includes approximately 4 GW of energy storage; this number includes the state mandated targeted 1.3 GW of storage, plus an additional 2.7 GW of economically installed energy storage to accommodate the much higher renewable buildout. Furthermore, the scenario assumes improved regional coordination in the WECC compared to present day operations, as well as high energy efficiency and electrification in transportation and buildings.

8.1.2 MARGINAL EMISSIONS METHODOLOGY

For the 2030 timeframe, this analysis uses short-run marginal emissions to make a conservative estimate of emissions reductions from building electrification. Short-run marginal emissions are the change in grid emissions for a change in demand-side consumption, *without* a change in powerplant capacity. This effectively calculates how the dispatch of existing generators would change based on a change in load. It would be more accurate to use a “long-run” marginal emissions factor, that considers the change in renewable energy capacity to meet new load in accordance with state energy policy. For example, with a goal of 60% RPS in 2030, each additional 1 kWh of new load will require 0.6 kWh of additional renewable energy to be integrated onto the grid, thus reducing the total emissions impact of the new load. Due to the complexity of calculating the time-varying emissions impacts of integrating renewable energy in a high RPS world, a well-established methodology to calculate long-run marginal emissions does not currently exist. Since this analysis uses short-run marginal emissions, the emissions impacts of new electrical load in 2030 will be over-stated, and the total emissions reductions from building electrification will be understated.

Hourly short-run marginal emissions are calculated based on hourly forecasted wholesale electricity prices taken from Aurora, using the same methodology that is used in the 2018 CPUC Avoided Cost Calculator⁶⁸. First, forecasted hourly wholesale electricity prices, corresponding forecasted natural gas prices, and assumed variable operations and maintenance costs are used to calculate an implied marginal heat rate. If the implied marginal heat rate is greater than the assumed physical upper bound of existing natural gas power plants, it is then capped at an upper limit; if the implied marginal heat rate is below the lower limit, it is assumed that renewables are the marginal generator, and the heat rate is assumed to be zero. The

⁶⁸ <http://www.cpuc.ca.gov/General.aspx?id=5267>

resulting source energy is multiplied by the distribution losses, and then multiplied by carbon intensity of combusting natural gas to determine the marginal emissions factor.

The marginal emissions rate is reported in metric tons of CO₂, eq/MWh. Figure 8-1 shows the average calculated emissions rate for each month and hour in 2030.

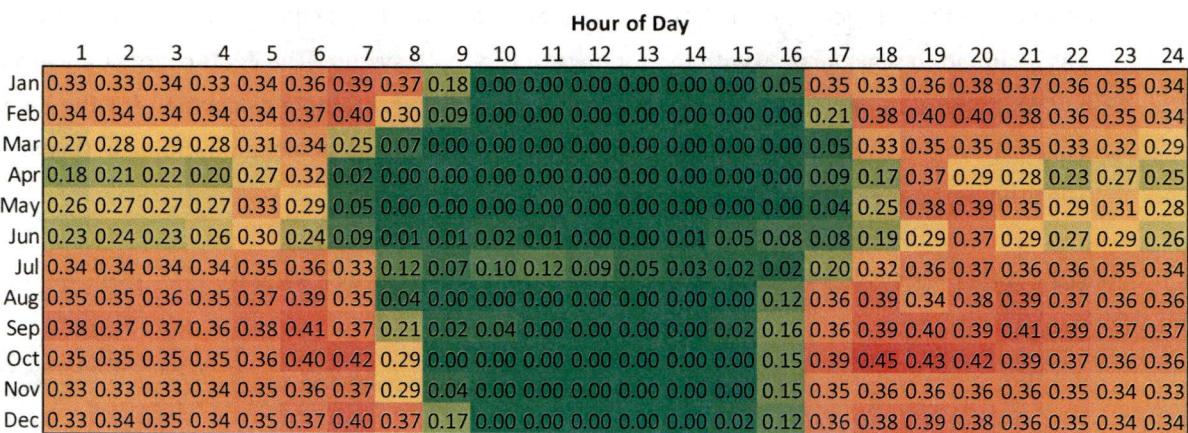


Figure 8-1 Heat map of the assumed marginal emissions rate (metric tons of CO₂, eq/MWh), averaged by month and hour in 2030.

8.2 Methodology for methane and refrigerant leakage calculations

- + Methane leakage was calculated by multiplying the natural gas consumption by 2.8%, the most recent estimate for well-to-burner leakage from scientific literature, and then converted to tonnes of carbon dioxide equivalent emissions (CO₂eq), using the 100-year mass-based global warming potential for methane of 25.⁶⁹

⁶⁹ This is based on the IPCC (2007) as used in the CARB inventory. Some recent studies have suggested slightly higher values.

- Refrigerant leakage for AC and heat pump units was calculated using CARB's data on the average charge and leakage rate of refrigerants for residential equipment in California⁷⁰. The total annual leakage rate was obtained by adding the annual operational leakage rate to the annualized end-of-life leakage rate. This annualized rate was obtained by dividing the end-of-life leakage by 18 years, the estimated lifetime of residential HVAC units we use in our study. The resulting annual leakage in lbs of F-gas was converted to tons of CO_{2eq} emissions using the global warming potential of the refrigerant in each scenario. Additionally, the F-gas charge for each climate zone was assumed to scale linearly with the tonnage of the HVAC system. The F-gas charge data given by CARB was assumed to be for a 4-ton system. Below is an example calculation for the F-gas leakage from the HVAC heat pump for an all-electric, 1978-vintage single family home in Oakland, using the next generation of refrigerants:

$$\text{Annual leakage (tons } CO_{2eq} \text{)} = \text{System charge for 4 ton system (lbs)} * (\text{Annual \% leakage} + \frac{\text{End-of-life \% leakage}}{18 \text{ years}})$$

$$* \frac{3}{4} \text{ tonnage conversion} * \frac{1 \text{ metric ton}}{2204.62 \text{ lbs}} * \frac{675 \text{ tons } CO_{2eq}}{1 \text{ ton R32}}$$

⁷⁰ Data obtained through communications with CARB staff.

9 Appendix D: Market Adoption Barriers and Potential Solutions

	Market Participant	Barrier	Potential Solutions	Responsible Entity for Solutions
Both retrofits & new construction	Contractors	Contractors may have limited experience and comfort with electric options	Contractor training, best practices guides, trusted contractor lists	NGOs, CEC
			Utility direct install programs	Load serving entities (LSEs, e.g. utilities and CCAs)
			Upstream incentives	Regulators, LSEs
	Homeowners & Landlords	Limited consumer awareness (and negative preconceptions) of high-efficiency electric technologies	Market education campaign (Energy Upgrade California), new tools for understanding lifecycle savings	NGOs, CEC, LSE outreach
		Low-income consumers have limited access to low-cost financing	Third-party ownership & financing, on-bill financing, PAYS model	Regulators, LSEs
		Consumer unwillingness to pay higher upfront costs; bounded rationality	Downstream direct-to-consumer incentives	Regulators, LSEs

	Market Participant	Barrier	Potential Solutions	Responsible Entity for Solutions
Both retrofits & new construction	Landlords	If renters pay utility bill, landlord does not benefit from bill savings	Incentives for landlords to install high efficiency equipment	Regulators, LSEs
	Homeowners & Renters	Tiered rates discourage electrification	Shift away from tiered rates; avoid collection of fixed costs through volumetric rates; develop rates that more accurately reflect marginal cost to the grid	CPUC, LSEs
	Manufacturers	High costs of product introduction into US market	Increasing market demand, reduce barriers to introduce products that are available internationally	Policymakers
	Utilities	Limited market demand in US leads to limited production for US market; premium product pricing	Increasing market demand	Policymakers, LSEs
		Limited regulatory support for utility programs encouraging fuel switching	GHG performance standard EE programs (i.e. CEOPT pilot for SCE); new cost-test mechanisms	Regulators

	Market Participant	Barrier	Potential Solutions	Responsible Entity for Solutions
New construction	Builders	Builder does not pay full gas infrastructure costs; costs are shared among gas ratepayers	Assess whether new construction should bear a higher cost of gas infrastructure costs	Regulators
		Builders look for least cost, commonly used technologies	Upstream incentives	Policymakers
			Title 24 building code	CEC
Retrofits	Homeowners & Landlords	"Hassle factor" of electrification retrofits & "emergency" replacement of failed equipment may not work with longer-lead time for retrofit installation	Incentives to replace water heater, AC or furnace early when another end-use fails	Regulators, LSEs
			Contractor training to reduce delays	Contractors
			"Electrification-ready" building code	CEC
			Clear identification and communication of market needs to manufacturers, with commitment to purchase or subsidize an initial market segment	Policymakers, NGOs

	Market Participant	Barrier	Potential Solutions	Responsible Entity for Solutions
Retrofits	Homeowners & Landlords	"Hassle factor" of electrification retrofits & "emergency" replacement of failed equipment may not work with longer-lead time for retrofit installation	x-prize type competition for heat pump solutions that bring down the "soft costs" of installation	Policymakers, NGOs
		Higher upfront costs of heat pump equipment	Design a "plug-and-play" retrofit ready HPWH, heat pump HVAC, and 3-function heat pump	Manufacturers
	Contractors & distributors	Contractors' existing supply chain focuses on gas technologies; limited stock availability to support emergency replacements	Improved financing; lease-to-own options, third-party ownership and financing/energy services business model	Private sector, NGOs
			Direct install programs; upstream incentives to encourage replacement readiness; higher market demand	Policymakers, LSEs, NGOs, private sector

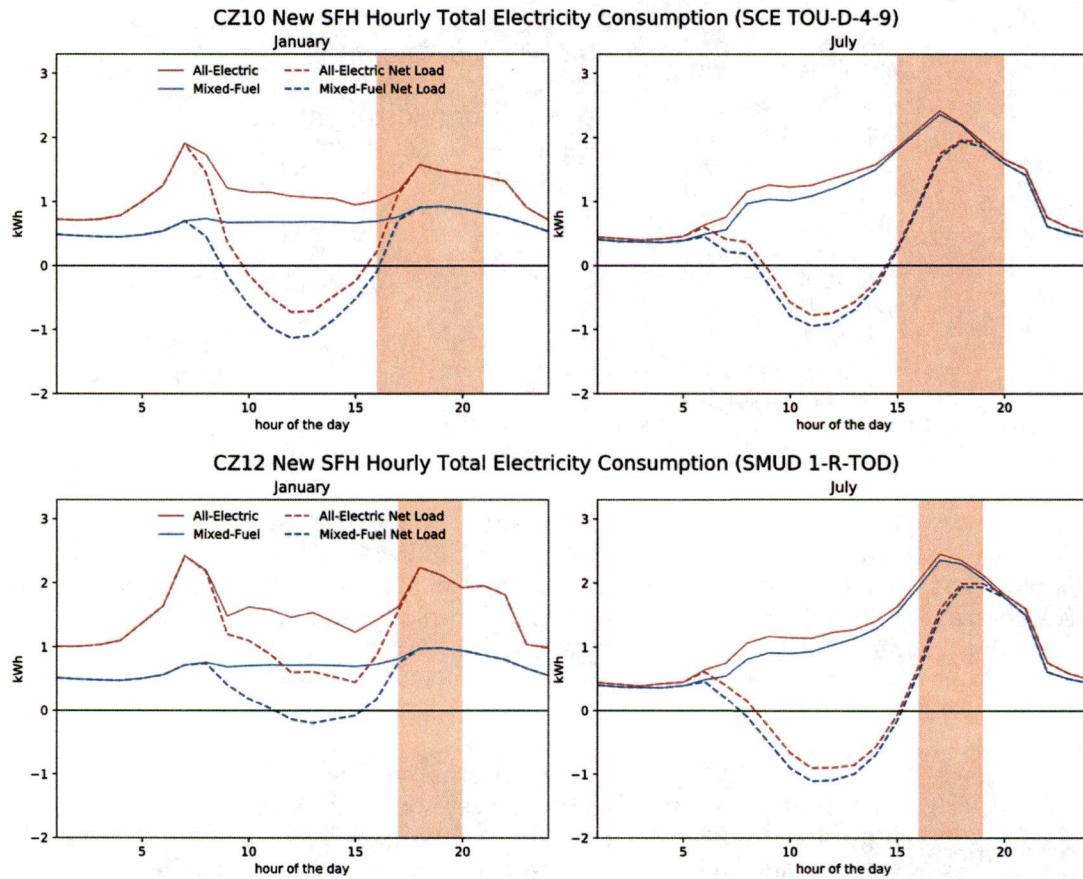
Retrofits, HVAC	Homeowners & Landlords	Offset appliance replacement schedule between heating and cooling appliances	Incentive: Buy-down of remaining useful life of other appliance	Regulators, LSEs
	Contractors	Contractors have limited incentive to sell single HVAC solution instead of two	Upstream incentives; direct install programs	Regulators, LSEs
			Building code requirement for new AC installs to be heat pumps	CEC

	Market Participant	Barrier	Potential Solutions	Responsible Entity for Solutions
Retrofits, DHW	Homeowners & Landlords	Noise and placement concerns when WH is in home	Split-system HPWH products with remote evaporator	Manufacturers
	Contractors	Replacement of gas-fired water heater w/ HPWH requires running 240V power, condensate drain, and possible electric panel upgrade	Develop and install products with 120V/15A capability Upstream or midstream incentives; direct install programs	Manufacturers, Regulators, LSEs
		Adequate ventilation not available when existing WH is in interior or exterior closet	Install product with ducted vent kit	Manufacturers, Contractors
Induction stoves	Homeowners & Renters	Consumer preference for natural-gas stovetops	Market education campaign about induction stoves; upstream or midstream incentives	NGOs, CEC, LSEs
Clothes dryers	Homeowners & Renters	Heat pump dryers require careful maintenance and can take a long time to dry clothes	R&D in alternative electric clothes dryer solutions (e.g. condensing dryers and microwave/sonic dryers). "X-prize" type competition for a better, high efficiency electric dryer	Manufacturers, NGOs, Policymakers

10 Appendix E: Additional Results

10.1 Electricity load shapes for individual homes simulated

Figure 10-1 Hourly electricity consumption of a new construction single family home in Riverside (CZ10) and Sacramento (CZ12)



Red lines represent the load of an all-electric home; and blue lines show the load of a mixed-fuel home. The net load, represented by the dotted lines, is the total load less the hourly PV generation.

10.2 Site energy savings

Energy savings of up to 73% in residential buildings can be achieved by switching from natural gas to electric home appliances, as building simulation results in this study show (Table 10-1). In single family homes, electric air source heat pumps (ASHPs) achieve higher annual site energy savings than the other home appliances. Low-rise multifamily homes feature much lower annual site energy savings from switching to ASHPs due to the smaller space per home. Space heating demand has a significant influence on annual site energy savings by ASHPs. Colder climates result in about two times larger annual energy savings in Northern California (San Francisco, San Jose and Sacramento) than in Southern California (Los Angeles and Riverside). Retrofit homes achieve higher energy savings using ASHPs because they are less insulated and thus have higher space heating and cooling demand than new construction.

Heat pump water heaters (HPWHs) are the biggest contributor to energy savings in multi-family homes. Compared to space heating and cooling, water heating demand depends more on the number of residents than on the area of the home. Our results show similar site energy savings from switching to HPWHs across home types and vintages. Energy savings achieved by an electric appliance is evaluated by comparing it to the energy consumption of an alternative gas appliance. Benchmarking with a higher-efficiency gas alternative would lower the energy savings achieved by the same electric appliance. New construction homes are more likely to consider newer models of home appliances with higher efficiencies, as compared with retrofit homes. In this study, gas tankless water heaters (81% average efficiency) are chosen for mixed-fuel new construction homes (single family and low-rise multifamily) vs. lower-efficiency gas storage water heaters (63% average efficiency) for retrofit homes. As a result, HPWHs in new construction homes show about half of the energy savings achieved in retrofit homes.

Table 10-1 Annual site energy savings (%) from electrifying a home appliance or an entire home of new construction

	Single Family	Low-rise Multifamily
All-electric Home	70-73%	61-64%
HVAC	32-49%	14-27%
Water Heating	15-24%	27-36%
Clothes Drying	4-7%	2-3%
Cooking	5-7%	7-9%

Electrifying cooking and clothes drying, even with induction stoves and heat pump clothes dryers in single family homes, shows lower annual site energy savings, because there is not as great of an efficiency advantage with these products as compared to shifting from gas water heaters and furnaces to heat pump technology. Prioritizing the electrification of space heating and water heating could achieve 90% of the energy savings benefit of an all-electric home.

Significant energy savings are achieved through electrification of end uses across all building types, vintages and climate zones. Electrifying all end uses in new construction reduces the annual site energy consumption by 30-50% (Table 10-2). The energy savings is much higher in winter than summer. This is because ASHPs are 4 to 6 times more efficient than gas furnaces in providing space heating in California's climate, while efficiency gains in space cooling compared to common AC units are only about 10%. Energy savings in winter for an entire home can be up to 60%, but an all-electric home may achieve much higher savings on days with spiking space heating demand thanks to ASHPs (Figure 10-2). The energy savings may be less significant in colder climate zones if very cold temperatures occur and electric resistance heating needs to be triggered,

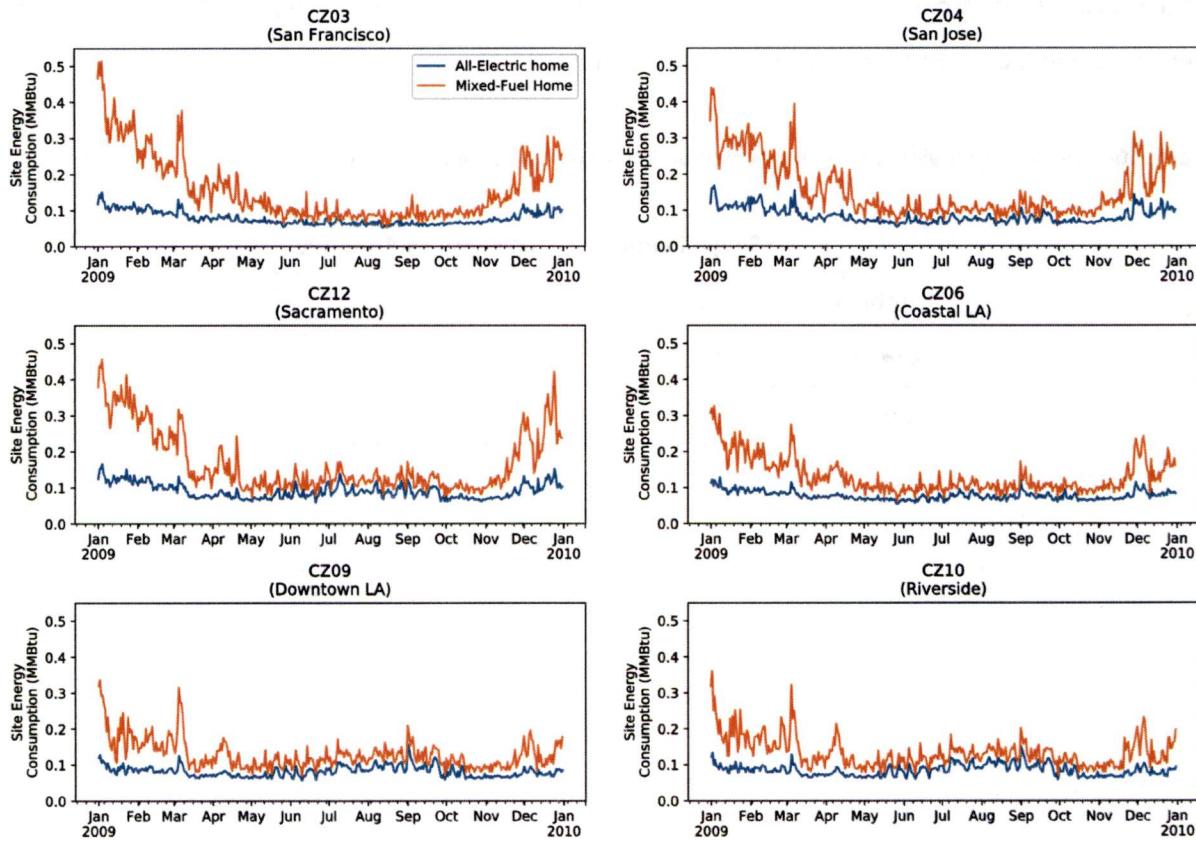
but electric resistance back-up heat was never triggered in the climate zones and appliances simulated here.

Higher space heating demand by retrofit homes contributes to higher site energy savings in all-electric retrofit homes (up to 65%) than in new construction (Table 10-2).

Table 10-2 Site energy savings (%) for new construction, all electric vs. mixed fuel home.

	Single Family	Low-rise Multifamily
Annual	36-50%	34-42%
Summer	25-29%	28-33%
Winter	48-63%	38-51%

Figure 10-2 Daily site energy consumption of all-electric and mixed fuel new construction single family homes



Attachment 2

**Letter: Windsor Jensen Land Company, LLC in re: Town Ordinance Adopting All-Electric Reach Code
dated September 3, 2019**

Tom Micheletti
Windsor Jensen Land Company, LLC
256 West MacArthur Street
Sonoma, CA 95476

Mr. Ken MacNab
City Manager
Town of Windsor
9291 Old Redwood Highway
Windsor, California 95492

September 3, 2019

Re: Town Ordinance Adopting All-Electric Reach Code

Dear Mr. MacNab:

As members of the building industry and citizens of the State of California, we are concerned that the Town of Windsor's implementation of an All-Electric code will result in significant negative impacts to the environment and result in added threats to the health and safety of the community.

In addition, the implementation of the code will have substantial negative impacts to the economic viability constructing new homes which will further exacerbate the current housing crisis.

Accordingly, we do not believe this ordinance is exempt under Section 15308 of the CEQA Guidelines and requires further review and study.

Negative Impacts to the Environment and a Threat to Public Safety

People looking to move to Windsor do so with the foremost intention of creating a safe home for their family. Second, they envision turning their homes into a welcoming space to gather and entertain, which in many instances, will include sharing a meal together that, weather permitting, can be prepared on an outdoor grill.

Needless to say, denying new residents of Windsor with the ability to connect their grills to natural gas will not dissuade these families from gathering and cooking outdoors on an open flame. Therefore, as a direct result of the implementation of the all-electric code, families will be forced to turn to less safe and higher CO₂ emitting fuel sources such as wood, charcoal and propane.

According to the Environmental Protection Agency, the pounds of CO₂ emitted per million British thermal unit of energy (the "CO₂ Factor") for natural gas is 53.06 (US Environmental Protection Agency, 2018). By comparison, the CO₂ Factor for Wood and Wood Residuals is 93.80 (77% higher than natural gas), and the CO₂ factor for Propane Gas is 61.46 (16% higher than natural gas).

Furthermore, Propane grills pose a substantially higher risk of causing home fires. According to the National Fire Protection Association (Ahrens, 2019), annually there are 10,200 home fires caused by grilling of which 7,500 (74%) involve grills fueled by liquid propane gas. By comparison, only 1,000 home

fires (9%) involve grills fueled by natural gas. Propane tanks also pose a safety risk to fire fighters as the tanks can leak or rupture during a wildfire and result in explosions.

In addition to outdoor cooking, many families seek to enjoy outdoor living by including either an outdoor fireplace and/or an outdoor fire pit in their backyard landscaping. With an all-electric code, the environmentally superior option of a natural gas fixture will be eliminated, leaving homeowners with the choice of a wood burning fireplace or firepit. According to the EPA one, wood burning stove can emit as much air pollution as five diesel trucks. The United Nations also recently issued a report that concluded that the two biggest culprits in the developed world in generating black carbon are wood burning and diesel vehicles. Black carbon is a problem because it absorbs heat, which, repeated on a global scale, is a major cause of short-term climate change.

Finally, reliance on a single energy source puts the health and safety of families at risk in the event of a wildfire, earthquake or other natural disaster. PG & E has stated that electricity may be shut off, for several days, when gusty winds and dry conditions, combined with heightened fire risk, are forecasted. Accordingly, families in an all-electric home may be denied access to heat or method to purify water during a natural disaster. In addition, families without power will be reliant on gasoline or diesel powered generators, a significant source of GHG emissions, whose impacts to the environment should also be reviewed.

Practical Impact to the Environment

According to the EPA (US Environmental Protection Agency, 2017), 5.2% of GHG emitted in 2017 by the United States was from the residential sectors of which 89.0% of GHG was emitted from the burning of fossil fuels, primarily for heating. There are 127,590,000 households in the United States, in 2018 permits were issued for 1,328,800 new housing units (or 1.03% of the existing households).

If all new homes built in the United States in 2018 were all-electric, the total estimated reduction in the US Annual GHG emission would only be 0.0536%.

However, we must also consider that the vast majority of residential GHG emissions from fossil fuels in the United States is due to the combustion of heating oil and propane in cold weather states. Due to its Mediterranean climate, the use of fossil fuels to heat homes in Windsor is a fraction of that of States with cold winters.

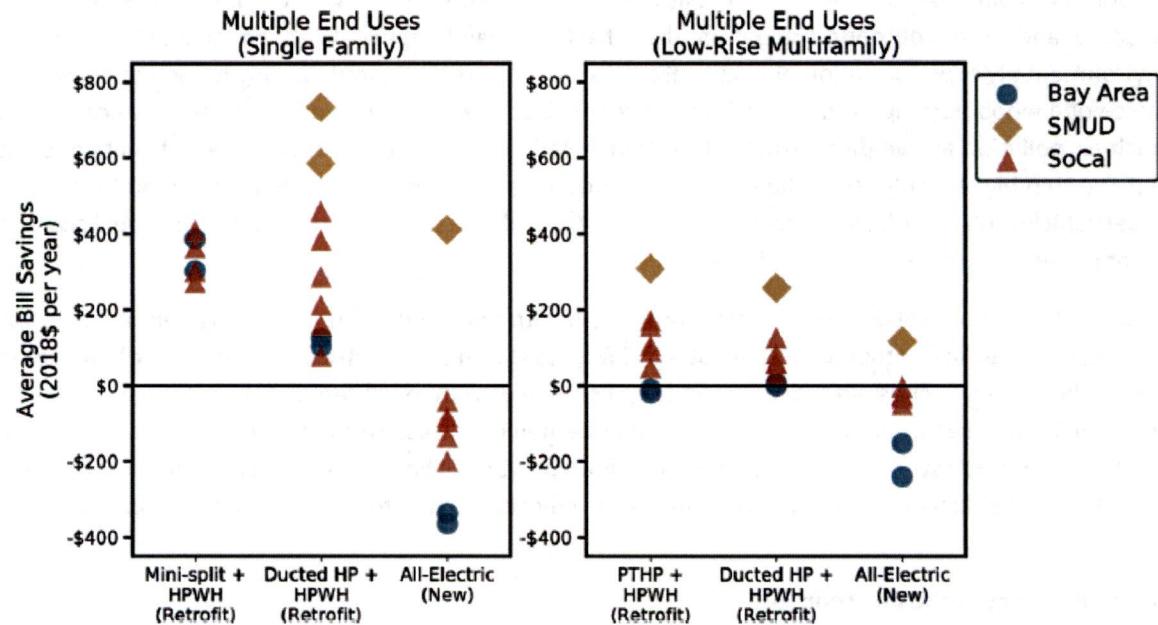
Therefore, the reduction of GHG through the implementation of an all-electric code, even if it were applied to all municipalities in the United States with mild winters, will have an extremely limited positive impact, if any at all, to climate change. After factoring in the unintended consequences, an all-electric code might actually increase greenhouse gas emissions.

Economic Justification: Consumer Bill Impacts and Lifecycle Costs and Savings

Frontier Energy, Inc., the co-author of the “2019 Cost-effectiveness Study: Low-Rise residential New Construction” (the “July 2019 Study”), also authored and published a study on their website in April 2019 entitled “Residential Building Electrification in California” (the “April 2019 Study”).

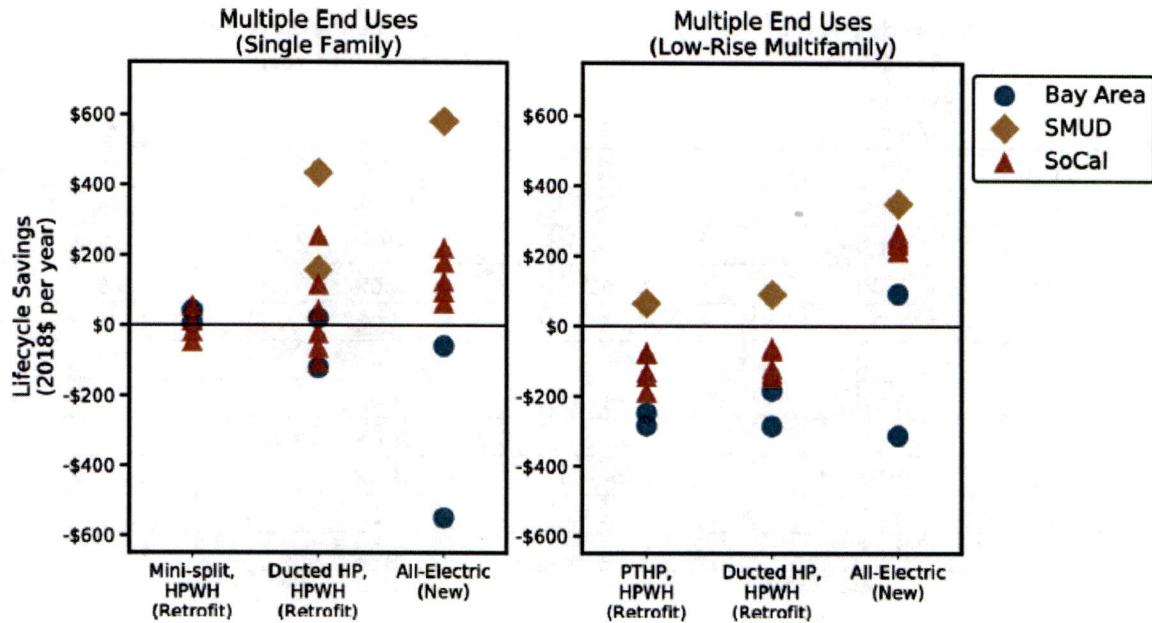
Although, the July 2019 Study indicated a cost savings with respect to consumer bills and lifecycle costs, the April 2019 Study clearly shows an increase in costs for “Bay Area” consumers purchasing new homes (see tables below).

Figure 3-19. Average consumer bill impacts of electrifying multiple end uses, electric rate sensitivity



The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Savings are relative to gas end uses. For retrofit homes, bill impacts reflect electrifying both HVAC and water heating systems. For new construction homes, bill impacts of electrifying an entire home are shown including electric air source heat pump, heat pump water heater, cookstove and clothes dryer.

Figure 3-28. Lifecycle savings of electrifying multiple end uses, electric rate sensitivity



The multiple data points for each color represent the different climate zones in each area. Colors of the dots show the location of the modeled homes: the San Francisco Bay Area including CZ03 and CZ04 (Bay Area), Sacramento including CZ12 (SMUD), and Southern California including CZ06, CZ09 and CZ10 (SoCal). Electrification of HVAC and water heating only is assumed for retrofit homes, and electrification of all end uses is assumed for new construction homes. Savings are relative to gas alternatives. Single family new construction homes have electric induction stoves and electric heat pump clothes dryers in addition to HVAC heat pumps and HPWHs. LRMF new construction homes have electric resistance cookstoves and electric resistance clothes dryers in addition to HVAC heat pumps and HPWHs. Positive values represent savings in both capital and operating costs throughout the lifetime of all appliances over the gas counterpart; negative values indicate lifecycle costs. Heat pump technologies here are the same as modeled for individual appliances above. The new construction blue dot (Bay Area) is an outlier here because in the gas baseline there is no air conditioning assumed.

Further, Frontier also states in the April 2019 study that:

"PG&E's electric rates are assumed to increase faster than the natural gas rates due to wildfire risk and liability, while SCE's, SMUD and LADWP's rates are assumed to increase at the same pace at the gas utility in their service territory."

However, the July 2019 Study assumed a "Statewide Electric Residential Average Rate" of 2% per year from 2020 to 2025 and 1% thereafter. It appears that Frontier used a lower rate escalation in their July 2019 Study versus their own, publicly available April 2019 Study. Therefore, we believe the positive cost benefits of the implementation of an all-electric code in Windsor are misstated.

"2019 Cost-effectiveness Study: Low-rise Residential Construction" (July 17, 2019)

Table 24: Real Utility Rate Escalation Rate Assumptions

	Statewide Electric Residential Average Rate (%/year, real)	Natural Gas Residential Core Rate (%/yr escalation, real)		
		PG&E	SoCalGas	SDG&E
2020	2.0%	1.48%	6.37%	5.00%
2021	2.0%	5.69%	4.12%	3.14%
2022	2.0%	1.11%	4.12%	2.94%
2023	2.0%	4.0%	4.0%	4.0%
2024	2.0%	4.0%	4.0%	4.0%
2025	2.0%	4.0%	4.0%	4.0%
2026	1.0%	1.0%	1.0%	1.0%
2027	1.0%	1.0%	1.0%	1.0%
2028	1.0%	1.0%	1.0%	1.0%
2029	1.0%	1.0%	1.0%	1.0%
2030	1.0%	1.0%	1.0%	1.0%
2031	1.0%	1.0%	1.0%	1.0%

Marketability of New Homes

Based on surveys conducted by the California Building Industry Association (California Building Industry Association, 2018):

- less than 10% of voters would choose an all-electric home;
- 80% of voters prefer homes with both electricity and gas, especially for cooking;
- 80% of voters oppose prohibiting the use of gas appliance; and
- 66% of voters oppose eliminating natural gas.

The idea of entertaining and cooking on a gas range or on a grill in the backyard is a critical part of the vision and emotional draw families have when looking to purchase a home. Eliminating a family's option to use gas creates a significant marketing disadvantage against resale homes, accordingly home builders will be substantially disincentivized from building new, for sale homes.

Closing

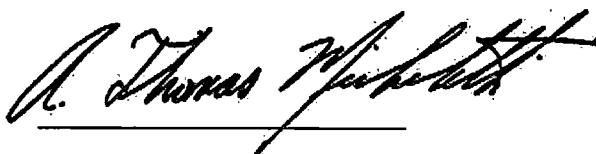
Climate change is a real threat to our society, and we all need to do our part to combat global warming. However, the solutions to climate change are multi-faceted and complex, and we all have to carefully consider and study whether some of the proposed solutions, such as an all-electric code, will have any long-term effect on climate change or may even have a negative impact on the environment. If the goal is to provide the greatest reduction in greenhouse gas emissions, then there are better ways of achieving

such a goal as it relates to new home development. For example, building a more energy efficient home, with a tighter building envelope, increased insulation, better performing windows/doors and/or ultra-efficient appliances will do far more to reduce greenhouse gas emissions than replacing a tankless natural gas water heater and cooktop with electric versions.

Meanwhile, we cannot ignore the other problems we face as a society such as delivering quality health care to our residents, ending homelessness, and addressing the housing crisis. Implementation of the all-electric code is, at best, a marginal positive impact against climate change, while a substantially negative impediment to delivering new homes to families and keeping home prices affordable for future generations.

Regards,

WINDSOR-JENSEN LAND COMPANY, LLC

A handwritten signature in black ink, appearing to read "Tom Micheletti". The signature is fluid and cursive, with a horizontal line underneath it.

Tom Micheletti, Managing Member

References

Ahrens, M. (2019, April). *Home Grill Fires*. Retrieved from National Fire Protection Association: <https://www.nfpa.org/News-and-Research/Data-research-and-tools/US-Fire-Problem/Home-Grill-Fires>

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US Environmental Protection Agency. (2018, March 9). *Emission Factors for Greenhouse Gas Inventories*. Retrieved from epa.gov: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Attachment 3

Letter: Miller Starr Regalia in re: Proposal by Town of Windsor to Adopt All-Electric Residential Reach Code/Natural Gas Ban dated September 4, 2019



**MILLER STARR
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September 4, 2019

Town of Windsor Town Council
Town Civic Center
9291 Old Redwood Highway, Bldg. 400
Windsor, CA 95492
TownCouncil@TownofWindsor.com

Re: Proposal by Town of Windsor to Adopt All-Electric Residential Reach Code/Natural Gas Ban

Dear Town Councilmembers:

This firm represents William Gallaher in conjunction with the above-referenced matter. Our client is extremely concerned with the potentially adverse planning, and environmental and health and safety effects that may occur from adoption and implementation of the All Electric Reach Code/Natural Gas Ban currently being considered for adoption as a local ordinance by the Town of Windsor ("Town").¹ Based on an Agenda Report prepared by Interim Town Manager Ken MacNab for the Town's April 17, 2019 Town Council meeting, the Town is exploring possible incorporation of all-electric reach code provisions into its 2019 California Building Code Update, assertedly in order to achieve energy and cost savings and reductions in local GHG emissions. The Town has also placed a proposed reach code ordinance on the Town Council agenda for the September 4, 2019 meeting (agenda item no. 10.1) with an accompanying staff report ("Staff Report").

We write to emphasize that the Town cannot lawfully enact this ordinance as it now stands, for several reasons. First, the ordinance is premised on information not made available in sufficient advance of the meeting for meaningful public review or comment. Moreover, that information consists of a "2019 Cost-effectiveness Study: Low-Rise Residential New Construction" dated July 17, 2019 ("Study"), which is insufficient to support the proposed findings in support of the ordinance.

Second, the Town must comply with the California Environmental Quality Act ("CEQA"; Pub. Resources Code, § 21000 et seq.), which requires it in this case to prepare and certify a robust and legally-compliant Environmental Impact Report

¹ A "reach" code is so called because it "reaches" beyond the State's Title 24 energy efficiency requirements by enacting different or more stringent regulations on energy efficiency related aspects of new residential and/or commercial construction.

("EIR") that fully analyzes and discloses all of the project's potentially significant environmental impacts and potentially feasible mitigation measures and project alternatives that could reduce such impacts to a less-than-significant level.

The April 17 Agenda Report acknowledges that "[f]uture actions related to the potential adoption of an all-electric reach code will be subject to Environmental Review, at which time the appropriate environmental documents, prepared in accordance with the requirements of the California Environmental Quality Act (CEQA), will be presented to the Council for consideration prior to any action being taken." (April 17 Agenda Report, p. 3.) The Staff Report for the September 4 meeting then concludes that the ordinance is exempt from CEQA review under section 15061 and 15308 of the CEQA Guidelines. Adoption of an all-electric reach code is clearly a discretionary "project" subject to CEQA; that substantial evidence supports a "fair argument" that this project may have one or more significant adverse environmental effects; and no exemption from CEQA applies; therefore, that an EIR must be prepared, certified and considered before such adoption may occur.

I. INSUFFICIENCY OF THE COST EFFECTIVENESS ANALYSIS

As the Staff Report recognizes, the requirements of section 10-106 of the state Building Energy Efficiency standards include the mandate that the Town adopt "[a] determination that the [reach code] standards are cost effective," which require "findings and supporting analyses on the energy savings and cost-effectiveness of the proposed energy standards." (Cal. Code Regs., tit. 24, § 10-106.) The only material submitted in support of the proposed ordinance is the Study. This is insufficient, for several reasons.

First, the Study was only provided to the public on August 29, 2019, less than a week before the ordinance goes before you for a decision. This does not allow for informed comment by the public or informed decisionmaking by the Town Council. It is manifestly unfair to provide the public and interested stakeholders less than one week to read, digest, and comment upon a technical document such as the Study. Basic fairness requires the Town to withdraw the proposed ordinance and give the public time to fully digest the analysis proffered in its support.

Second, it is not clear that the Study satisfies the mandates of section 10-106. It purports to analyze the cost effectiveness of a reach code for the entire state. (Study, p. 1 & Ex. A.) Section 10-106 requires that a local agency make its own "findings and supporting analyses of the energy savings and cost-effectiveness of the proposed energy standards." (Cal. Code Regs., tit. 24, § 10-106, subd. (b)(2).) Relying on a general statewide study does not satisfy this standard.

It is also not clear from the Study whether or not it accounts for tiered electricity pricing and how that would apply to all-electric construction under the proposed ordinance. It is also unclear as to whether all-electric construction would lead to

residential units that cannot meet the requirements of the Building Energy Efficiency Standards in Part 6 of Title 24 of the California Code of Regulations, which would preclude building altogether.

Accordingly, the proposed ordinance is not supported by the requisite cost-effectiveness analysis, and therefore does not satisfy the mandate of section 10-106. The Town therefore cannot enact the reach code.

II. CEQA REQUIREMENTS

Under CEQA's well-established standards, an agency is required to prepare an Environmental Impact Report ("EIR"), rather than a Negative Declaration, whenever substantial evidence in the record supports a "fair argument" that a project *may* have a significant effect on the environment. (*No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal.3d 68, 75, 82; *Quail Botanical Gardens Found. Inc. v. City of Encinitas* (1994) 29 Cal.App.4th 1597, 1602; *Friends of "B" Street v. City of Hayward* (1980) 106 Cal.App.3d 988, 1002.) Courts apply the "fair argument" test as a standard of judicial review for agency decisions to adopt a Negative Declaration. (See, e.g., *Gentry v. City of Murrieta* (1995) 36 Cal.App.4th 1359, 1399; *Stanislaus Audubon Society, Inc. v. County of Stanislaus* (1995) 33 Cal.App.4th 144, 150; *Quail Botanical Gardens Found. Inc.*, *supra*, 29 Cal.App.4th at 1602.) The "fair argument" standard of review applies to mitigated negative declarations. (*Sierra Club v. California Dept. of Forestry and Fire Protection* (2007) 150 Cal.App.4th 370, 382; *Citizens for Responsible and Open Government v. City of Grand Terrace* (2008) 160 Cal.App.4th 1323, 1331-1332; see also Pub. Resources Code, §21064.5 [defining "mitigated negative declaration"].)

In other words, if a non-exempt project *may* cause a significant effect on the environment, the lead agency *must* prepare an EIR. (Pub. Resources Code, §§ 21100, 21151; Cal. Code Regs., tit. 14, § 15064, subd. (a)(1)(f)(1).) An EIR may be avoided only if the lead agency properly finds no substantial evidence in the initial study or elsewhere in the record that the project may significantly affect the environment. A project "may" have a significant effect on the environment if there is a "reasonable possibility" that it will result in a significant impact. (*No Oil, Inc.*, *supra*, 13 Cal.3d at 83, n.16; *Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296, 309.) A "significant effect upon the environment" is defined as "a substantial or potentially substantial adverse change in the environment." (Pub. Resources Code, § 21068; Cal. Code Regs., tit. 14, § 15382.) If *any* aspect of the project may result in a significant environmental impact, an EIR must be prepared even if the overall effect of the project is beneficial. (Cal. Code Regs., tit. 14, § 15063, subd. (b)(1); *County Sanitation Dist. No. 2 v. County of Kern* (2005) 127 Cal.App.4th 1544, 1580.)

As is evident from the above-cited legal authorities, CEQA sets a very "low threshold" for requiring preparation of an EIR. (*Pocket Protectors v. City of Sacramento* (2004) 124 Cal.App.4th 903, 928; *Bowman v. City of Berkeley* (2004)

122 Cal.App.4th 572, 580; see also *Sundstrom v. County of Mendocino*, *supra*, 202 Cal.App.3d at p. 310), such that if any substantial evidence supports the requisite "fair argument" that a project may have a significant environmental effect, the lead agency must prepare an EIR – even if it is also presented with other substantial evidence indicating that the project will have no significant effect. (*No Oil, Inc. v. City of Los Angeles*, *supra*, 13 Cal.3d at p. 85; *Brentwood Association for No Drilling, Inc. v. City of Los Angeles* (1982) 134 Cal.App.3d 491, 503-504; *Friends of "B" Street*, *supra*, 106 Cal.App.3d at 1002; Cal. Code Regs., tit. 14, § 15064, subd. (f)(1).) Under the "fair argument" test, the lead agency may not weigh the competing evidence to determine who has a better argument concerning the likelihood or extent of a potential environmental impact, but must direct the preparation of an EIR to resolve the issue. (See, e.g., *Friends of "B" Street*, *supra*, 106 Cal.App.3d at 1002; *Architectural Heritage Association v. County of Monterey*, (2004) 122 Cal.App.4th 1095, 1109, 1122.)

"Substantial evidence" is evidence that has ponderable legal significance, i.e., evidence that is reasonable, credible and of solid value (*Stanislaus Audubon Society, Inc. v. County of Stanislaus* (1995) 33 Cal.App.4th 144, 152; *Newman v. State Personnel Board* (1992) 10 Cal.App.4th 41, 47; *Pennell v. Pond Union School Dist.* (1973) 29 Cal.App.3d 832, 837), and has been defined in the CEQA context as "enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached." (Cal. Code Regs., tit. 14, § 15384(a); see also, Pub. Resources Code, §§ 21080(e), 21082.2(c); Cal. Code Regs., tit. 14, § 15064, subd. (f)(5).) "Substantial evidence" is defined by the CEQA Guidelines to include, inter alia, "expert opinion supported by facts." (Cal. Code Regs., tit. 14, § 15384, subd. (a); see *id.* at § 15064, subd. (f)(5).) Opinion evidence submitted by a qualified expert, showing that significant impacts may occur from a project, is normally conclusive, and requires preparation of an EIR under the "fair argument" standard. (See, e.g., *City of Livermore v. LAFCO* (1986) 184 Cal.App.3d 531, 541.) "Statements by members of the public may [also] constitute substantial evidence that a project may have a significant effect on the environment." (1 Kostka & Zischke, *Practice Under the California Environmental Quality Act* (Cont.Ed.Bar 2d ed. 2015), § 6.42, pp. 6-46.1 to 6-47, and cases cited; see also *Pocket Protectors v. City of Sacramento* (2004) 124 Cal.App.4th 903, 928 ["Relevant personal observations of area residents on nontechnical subjects may qualify as substantial evidence for a fair argument."].)

III. SUBSTANTIAL EVIDENCE SUPPORTS A "FAIR ARGUMENT" THAT AN ALL-ELECTRIC REACH CODE IS A DISCRETIONARY PROJECT THAT MAY HAVE SIGNIFICANT UNMITIGATED ADVERSE ENVIRONMENTAL IMPACTS IN A NUMBER OF AREAS, THUS REQUIRING PREPARATION OF AN EIR

A. The Proposed Ordinance Is a CEQA "Project."

There can be absolutely no doubt that a proposed local ordinance adopting a reach code, such as the one being proposed for consideration by the Town, is a "project" that is subject to CEQA review. CEQA broadly defines "projects" to include any activities directly undertaken by public agencies which have the potential to ultimately culminate in physical change to the environment. (*City of Livermore v. Local Agency Formation Com.* (1986) 184 Cal.App.3d 531, 537; *Bozung v. Local Agency Formation Com.* (1975) 13 Cal.3d 263, 277-278, & fn. 16.) The Supreme Court and Courts of Appeal "ha[ve] given the term "project" a broad interpretation and application to maximize protection of the environment." (*Tuolumne County Citizens For Responsible Growth, Inc. v. City of Sonoma* (2007) 155 Cal.App.4th 1214, 1222-1223, and cases cited; see *Aptos Council v. County of Santa Cruz* (2017) 10 Cal.App.5th 266, 278; *McQueen v. Board of Directors* (1988) 202 Cal.App.3d 1136, 1143.)

The courts' broad definition of a CEQA "project" is compelled by the plain language of the CEQA statutes and Guidelines. Thus, "'Project' means an activity which may cause either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and which is any of the following: (1) An activity directly undertaken by any public agency." (Pub. Resources Code, § 21065, subd. (a).) "[T]his division shall apply to discretionary projects proposed to be carried out or approved by public agencies, including, but not limited to, the enactment and amendment of zoning ordinances . . ." (Pub. Resources Code, § 21080(a).). While a reach code is not a classic "zoning ordinance," it operates like a zoning ordinance because it "ha[s] the effect of [r]egulat[ing] the use of buildings, structures, and land" (*People v. Optimal Global Healing, Inc.* (2015) 241 Cal.App.4th Supp. 1, 8), and as a local law regulating those areas it shares, for purposes of CEQA, the key attribute of zoning ordinances. (See *Morehart v. County of Santa Barbara* (1994) 7 Cal.4th 725, 750 ["The purpose of a zoning law is to regulate the use of land."].)

Zoning ordinances and local ordinances akin to them are categorically CEQA "projects." The CEQA Guidelines, in relevant part, define "project" as "the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and that is any of the following: (1) An activity directly undertaken by any public agency including but not limited to . . . enactment and amendment of zoning ordinances . . ." (Cal. Code Regs., tit. 14, § 15378, subd. (a)(1).) Indeed, under CEQA's broad definition of a "project," ordinances, laws and regulations

affecting the use of land or structures have consistently been held to be CEQA "projects" over the course of many decades. (See, e.g., *Apartment Assn. of Greater Los Angeles v. City of Los Angeles* (2001) 90 Cal.App.4th 1162, 1169 ["Ordinances passed by cities are clearly activities undertaken by a public agency and thus 'projects' under CEQA."], citing 60 Ops. Cal. Atty. Gen. 335, 338 (1977); *County Sanitation Dist. No. 2 v. County of Kern* (2005) 127 Cal.App.4th 1544, 1558 [treating County ordinance restricting sewage sludge application on County lands as project under CEQA and further holding "CEQA requires the preparation of an EIR whenever substantial evidence supports a fair argument that an ordinance will cause potentially significant environmental impacts"]; *id.* at p. 1578 ["Amendment or adoption of an ordinance is a legislative act subject to review under section 21168.5"], citations omitted; *Plastic Pipe & Fittings Assn. v. California Building Standards Com.* (2004) 124 Cal.App.4th 1390, 1412 ["A regulation fitting the description of a discretionary project is a discretionary project under CEQA."]; *Rosenthal v. Board of Supervisors* (1975) 44 Cal.App.3d 815, 823 ["In view of the fact that city ordinances were the subject matter in the *No Oil* case, it appears that it was held impliedly therein that adopting an ordinance was a project within the meaning of the Environmental Quality Act"], citing *No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal.3d 68 [impliedly holding adoption of zoning ordinance permitting drilling of oil test wells was project within meaning of CEQA].)

B. The Proposed Project Is Not Exempt.

There can further be no doubt that a project proposing adoption of an all-electric reach code is not subject to any exemption from CEQA. Yet the staff report for the proposed ordinance cites two CEQA exemptions – the so-called "common sense" exemption, and the class 8 exemption for actions that are protective of the environment. Neither applies here.

CEQA's "common sense" exemption may properly be invoked *only* when the lead agency can declare "with certainty that there is no possibility that the activity in question may have a significant effect on the environment." (Cal. Code Regs., tit. 14, § 15061, subd. (b)(3).) "In the case of the commonsense exemption, the agency has the burden to "provide the support for its decision before the burden shifts to the challenger. Imposing the burden on members of the public in the first instance to prove a possibility for substantial adverse environmental impact would threaten CEQA's fundamental purpose of ensuring that government officials 'make decisions with environmental consequences in mind.'" (California Farm Bureau Federation v. California Wildlife Conservation Bd. (2006) 143 Cal.App.4th 172, 186, citing *Davidon Homes v. City of San Jose* (1997) 54 Cal.App.4th 106, 116, quoting *Bozung, supra*, 13 Cal.3d at 283.) "A remote or outlandish possibility of an environmental impact will not remove a project from the common sense exemption, but if legitimate, reasonable questions can be raised about whether a project might have a significant impact, the agency cannot find with certainty the project is exempt." (*id.* at p. 194, citing *Davidon Homes, supra*, 54 Cal.App.4th at pp. 117-118.)

"[T]he primary duty to comply with CEQA's requirements must be placed on the public agency. To make faithful execution of the duty contingent upon the vigilance and diligence of particular environmental plaintiffs would encourage attempts by agencies to evade their important responsibilities. It is up to the agency, not the public, to ensure compliance with [CEQA] in the first instance." (Concerned Citizens of Costa Mesa, Inc. v. 32nd Dist. Agricultural Assn. (1986) 42 Cal.3d 929, 939, citing *County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 205.) "CEQA places the burden of environmental investigation on government rather than the public." (*Leonoff v. Monterey County Bd. of Supervisors* (1990) 222 Cal.App.3d 1337, 1347 ("CEQA contemplates serious and not superficial or pro forma consideration of the potential environmental consequences of a project.").)

"[A] party challenging what is essentially a claim of the commonsense exemption under Guidelines section 15061, subdivision (b)(3), unlike a party asserting an exception to a categorical exemption, need only make a "slight" showing of a reasonable possibility of a significant environmental impact. (*Davidon Homes, supra*, 54 Cal.App.4th at p. 117.) It is the lead agency that has the burden of establishing the commonsense exemption, i.e., that there is *no* possibility the project may cause significant environmental impacts. "[T]he agency's exemption determination must be supported by evidence in the record demonstrating that the agency considered possible environmental impacts in reaching its decision." (*California Farm Bureau Federation, supra*, 143 Cal.App.4th at 195-196, citing *Davidon Homes, supra*, 54 Cal.App.4th at 117, *East Peninsula Ed. Council, Inc. v. Palos Verdes Peninsula Unified School Dist.* (1989) 210 Cal.App.3d 155, 171.)²

With respect to the class 8 exemption under section 15308 of the Guidelines, such can only be used for an action that constitutes a preservation of the environment. (*Save Our Big Trees v. City of Santa Cruz* (2015) 241 Cal.App.4th 694, 707.) Here, the proposed reach code cannot be said to rise to this standard as it merely substitutes one source of energy for another, without any sufficient analysis as to whether that substitution will actually yield any benefit to the environment.

In this context the case of *Dunn-Edwards Corp. v. Bay Area Air Quality Management Dist.* (1992) 9 Cal.App.4th 644 is instructive. There, the Bay Area Air Quality Management District sought to use the class 8 exemption for regulations reducing the solvent in architectural coatings. The Court of Appeal held that in spite

² A lead agency intending to invoke the common sense exemption thus has the burden to consider the record and facts in the case before it prior to doing so. (*Muzzy Ranch, supra*, 41 Cal.4th at 386 ("Insofar as it failed to consider the record in determining that adopting the TALUP fell within the common sense exemption, the Commission erred."). "An agency obviously cannot declare "with certainty that there is no possibility that the activity in question may have a significant effect on the environment" (Cal. Code Regs., tit. 14, § 15061, subd. (b)(3)) if it has not considered the facts of the matter." (*Id.* at p. 387, citing *Davidon Homes, supra*, 54 Cal.App.4th at 117.))

of the fact that the regulations imposed more stringent standards there was not sufficient evidence in the record justifying the conclusion that it would actually protect the environment. The exact same analysis applies here, for the reasons discussed throughout this letter. There is simply no basis for the Town to conclude that the reach code will not have a potentially significant impact on the environment. Thus, reliance on the class 8 exemption is not warranted. (See *International Longshoremen's & Warehousemen's Union v. Board of Supervisors* (1981) 116 Cal. App. 3d 265.)

Finally, note also in this context that section 10-106 of the Building Energy Efficiency Standards upon which the Town relies requires the submission of materials in support of an application for a reach code. The specific submittals required do not extend to a notice of claimed exemption but a "negative declaration or environmental impact report, required pursuant to the California Environmental Quality Act, Public Resources Code Section 21000 et seq." (Cal. Code Regs., tit. 24, § 10-106, subd. (b)(4).) The provision clearly does not contemplate the use of an exemption because a reach code will invariably require environmental analysis under CEQA. Thus, the reliance on an exemption here is plainly in error.

C. The City Must Conduct an Initial Study and Prepare an EIR Prior to Considering Adoption of an All-Electric Reach Code Ordinance.

Because proposed adoption of an all-electric reach code is a project that is subject to CEQA, and does not qualify for any exemption from CEQA review, the Town is required to conduct an initial study to determine whether it may have any significant environmental effects; if the initial study shows the project does not qualify for a negative declaration, the Town must prepare an EIR. (*Muzzy Ranch Co. v. Solano County Airport Land Use Com.* (2007) 41 Cal.4th 372, 380-381.) The Town's good faith performance of such a study here will show that adoption of an all-electric reach code may have significant and adverse environmental effects in numerous areas, including, but not limited to, aesthetics, recreation, utilities/service systems, GHG emissions, land use/planning, population/housing, air quality, wildfire, public safety, energy, hazards and hazardous materials, and public services. A few of these numerous areas of potentially significant impact are discussed in further detail below.

- **Hazards/Public Safety.** Ironically, an all-electric reach code ordinance is being considered at a time when the supply of electrical power to the Town and surrounding communities may be less reliable and subject to more and longer planned outages than ever before. (See attached August 15, 2019 Press Democrat article, "PG&E Map Sheds Light On Planned Power Outages In Sonoma County.")³ As noted in the article, the "unprecedented" planned power outages are

³ See <https://www.pressdemocrat.com/news/9898428-181/pge-map-sheds-light-on>.

expected to "cover all of Cloverdale, Cotati, Healdsburg, Sebastopol and Windsor" and critics of the planned outages have "point[ed] to impacts on public safety, businesses and disabled people who rely on access to electricity." The article states "[a] prolonged, widespread outage... could have the potential to be very disruptive, officials acknowledged, posing problems ranging from cell phone service to storage of food." An announcement of the Petaluma Fire Department is quoted as stating: "ATM machines won't work, gas stations won't be able to pump gas, traffic signals will be out, garage doors will need to be opened manually.... Are you ready?" Without adequate battery storage of electricity, or an alternative power source, such as natural gas which powers backup generators and other appliances, "all-electric" homes and businesses will be subject to hazards and risks to public safety during outages when heat, lighting, water, refrigeration, food, and air conditioning may be unavailable.

Given the risk of blackouts, some residents will rely on propane or gasoline generators or other combustible sources of power which are more prone to accident or spillage than fixed natural gas lines. There is no discussion of the risks or impacts associated with such increased usage, including air quality, GHG, and fire impacts.

Note also that the 2018 Camp Fire, the deadliest in California history, was apparently caused by electrical transmission lines.⁴ There is no analysis whatsoever in the Staff Report or any supporting materials as to any potential increase in fire risk from expanded electrical service facilities which the reach code would necessitate. Instead, the Staff Report claims, without supporting evidence, that "natural gas infrastructure is a potentially significant source of fire." (Staff Report, p. 4.) Suffice it to say the Town cannot accuse natural gas of providing a wildfire risk without supporting evidence while ignoring the fact that electricity lines gave rise to the most lethal California wildfire ever less than a year ago.

- **Utilities/Service Systems/Wildfire.** The CEQA Guidelines Appendix G checklist – a template for the initial study the Town is required to conduct under CEQA – requires evaluation of the question of whether the project would "[r]equire or result in the relocation or construction of new or expanded ... electric power, natural gas, or telecommunications facilities, the construction of which could cause significant environmental effects?" Projects requiring significant new construction to rely solely on electricity as a power source clearly have the potential to result in the installation,

⁴ See, e.g., https://www.fire.ca.gov/media/5038/campfire_cause.pdf.

upgrading, and/or maintenance of associated infrastructure (e.g., roads, fuel breaks, power lines), and where such occurs in or near areas of high fire hazard the resulting environmental impacts must also be studied. (See Appendix G, Section XX WILDFIRE [listing potential impacts such as impairment of adopted emergency response and evacuation plans, exacerbation of wildfire risks, and other human safety and environmental risks and impacts].) And, as noted above, the most deadly fire in California history was started not by natural gas facilities, but by electrical lines. Moreover, also as noted above, increased generator use may give rise to its own increased risk of fire.

Similarly, the Staff Report and Study do not analyze whether the existing electrical grid is sufficient to satisfy the demand of all new construction under a 100% electricity standard. Given PG&E's warnings about potential blackouts, the grid's ability to handle this new demand is questionable at best. Moreover, the Staff Report and Study do not sufficiently discuss the sources of the additional electricity required under the proposed reach code, nor the impacts related to those sources. Natural gas powered plants will naturally obviate most if not all of the supposed benefit of gas-free construction. Wind and solar have well-known impacts relating to wildlife, aesthetics, etc.⁵ And hydroelectric power comes with its own suite of impacts as well, including harm to anadromous fish and other species⁶ and the risk of failure and flood (as with the Oroville Dam crisis of 2017). In fact, hydroelectric facilities in California and the west are being removed, making this source of power uncertain for future electricity needs.⁷

- **GHG/Air Quality.** While the cursory four-page April 17 Agenda Report appears to proceed on the assumption that GHGs are the *only* concern and impact at issue, such a facile assumption is clearly incorrect. An all-electric reach code would eliminate gas-powered

⁵ See https://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html;
https://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html.

⁶ See <https://www.fs.fed.us/psw/publications/lind/lind6.pdf>;
https://www.researchgate.net/profile/Liba_Pejchar/publication/11779066_A_River_Might_Run_Through_It_Again_Criteria_for_Consideration_of_Dam_Removal_and_Interim_Lessons_From_California/links/004635277e83e0f755000000/A-River-Might-Run-Through-It-Again-Criteria-for-Consideration-of-Dam-Removal-and-Interim-Lessons-From-California.pdf.

⁷ See <http://www.klamathrenewal.org/>.

heaters, stoves, water heaters, built-in outdoor barbeques, gas burning fireplaces, fire pits, and, as noted above, gas-powered backup generators to protect against losses, disruptions and safety problems from blackouts of a fragile and overburdened electrical grid. Alternative fuel sources – such as wood, gasoline or charcoal – exist for many of these amenities, and could be substituted for the cleaner-burning natural gas that the proposal would eliminate, leading to greater GHG emissions and air quality impacts. Such unintended, but clearly reasonably foreseeable, adverse environmental consequences must be fully evaluated under CEQA. (See, e.g., *Rodeo Citizens Association v. County of Contra Costa* (2018) 22 Cal.App.5th 214 [recognizing that to extent captured butane and propane were used to displace use of other fuels such as coal, home heating fuel, fuel oil, diesel, kerosene, gasoline and ethanol, they would also displace GHG emissions otherwise resulting from use of those alternate fuels].) For example, propane barbeques produce only one-third of the GHG emissions of charcoal barbeques (*id.* at p. 226), and natural gas is similarly a much cleaner burning fuel than charcoal, wood or gasoline. Moreover, the increased use of gasoline or propane generators may also give rise to air quality and/or GHG impacts that are completely unanalyzed in the Staff Report.

Population and Housing/Human Impacts. Projects that would displace substantial numbers of people or housing, or render housing unaffordable, may have significant adverse impacts on the environment and human beings that require CEQA analysis and mitigation. (See CEQA Guidelines, Appdx. G, Section XIV.) To the extent an all-electric reach code could, for example, substantially increase the cost of new multi-family apartment dwelling construction and/or retrofitting, it could lead to increased rents, unaffordable housing, and tenant displacement from the same, with resulting adverse human impacts. Alternatively, renters or home buyers may prefer residences with traditional gas appliances and therefore show a greater propensity to move outside of the Town and commute. Tenant displacement, in and of itself, has been recognized as a significant adverse environmental impact subject to CEQA analysis and mitigation. (*Lincoln Place Tenants Assn. v. City of Los Angeles* (2007) 155 Cal.App.4th 425 [holding CEQA mitigation measures designed to mitigate tenant displacement impacts of project, contained in a vesting tentative map, were enforceable and did not conflict with Ellis Act].) Public entities possess the power under

existing law “to mitigate adverse impacts on displaced tenants.” (*San Francisco Apartment Assn. v. City and County of San Francisco* (2016) 3 Cal.App.5th 463, 484, citing *Pieri v. City and County of San Francisco* (2006) 137 Cal.App.4th 886, 892; see Gov. Code, § 7060.1.) As explained by the *Lincoln Place* Court of Appeal, “CEQA... is made relevant... by the Ellis Act’s explicit exceptions for a public agency’s power to regulate, among other things,... the mitigation of adverse impacts on persons displaced by reason of the withdrawal of rental accommodations. *Such items are the common focus and byproducts of the CEQA process....*” (*Lincoln Place Tenants Assn.*, *supra*, 155 Cal.App.4th at 451, emph. added.) Indeed, the Supreme Court has recently reaffirmed “that CEQA addresses human health and safety” and “that public health and safety are of great importance in the statutory scheme.” (*California Building Industry Assn. v. Bay Area Air Quality Management Dist.* (2015) 62 Cal.4th 369, 386, citations omitted.) CEQA’s “express language... requires a finding of a “significant effect on the environment” ([Pub. Resources Code,] § 21083(b)(3)) whenever the “environmental effects of a project will cause substantial effects on human beings, either directly or indirectly.”” (*Id.* at p. 386, emphasis in original.)

- **Land Use/Planning.** Given the foregoing, the Staff Report’s analysis of the consistency of the proposed ordinance with the Town’s General Plan is absurdly abbreviated, consisting of less than two pages and citing a mere five goals and policies out of the more than 250 pages that make up the General Plan.⁸ (Staff Report, pp. 4-5.) While the Town has discretion in interpreting and applying its General Plan, it cannot do so in a way that frustrates the purpose of the General Plan. (*Napa Citizens for Honest Government v. Napa County Board of Supervisors* (2001) 91 Cal.App.4th 342, 378-381.) The analysis in the Staff Report is far too brief to fully address the proposed ordinance’s consistency with the General Plan and its overall purpose. Accordingly, further analysis of this issue is required.

⁸ See https://www.townofwindsor.com/DocumentCenter/View/21498/Final-Town-of-Windsor-2040-General-Plan_2018-06-04.

IV. CONCLUSION

While Mr. Gallaher reserves all rights to submit further comments, arguments, and evidence, it is evident for the reasons set forth above that (1) the Town cannot lawfully make the findings required to enact the proposed reach code ordinance, and (2) a full and robust EIR that complies with CEQA must be prepared and certified before any ordinance adopting an all-electric reach code can be considered by the Town for approval.

Very truly yours,

MILLER STARR REGALIA

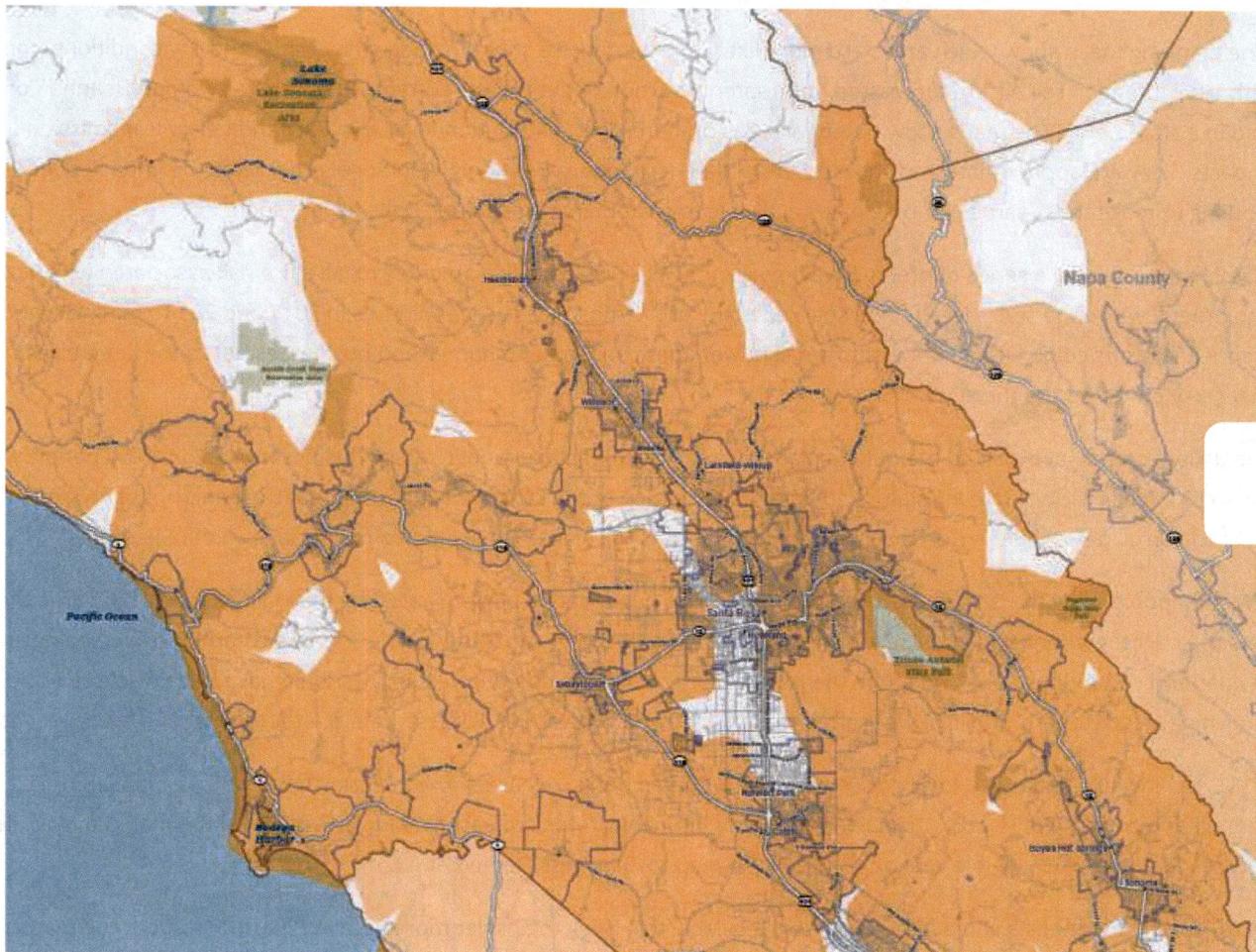


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PG&E map sheds light on planned power outages in Sonoma County



SLIDE 1 OF 3

PG&E could shut off power for several days to reduce fire risk this summer and fall. This map shows the areas that could be affected by the planned outages. (PG&E)



WILL SCHMITT

THE PRESS DEMOCRAT | August 15, 2019

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A majority of Sonoma County's cities and much of the surrounding North Bay could be affected under the wide-scale planned power outages that PG&E has signaled it intends to use to reduce the risk of its equipment sparking devastating wildfires, according to a map the utility company provided earlier this month to local government officials.

The map, obtained this week by The Press Democrat, illustrates the unprecedented scope of fallout for local electricity customers, showing areas that are more likely to have their power cut during periods of hot, dry, windy weather that can give rise to catastrophic fires.

The map's orange "affected areas" cover all of Cloverdale, Cotati, Healdsburg, Sebastopol and Windsor. Though PG&E has said that any of its 5.4 million customers in Northern and Central California could be affected by planned outages, swaths of Santa

Rosa, Petaluma, and Rohnert Park are not tinted orange.

The map also indicates that much of northern Marin, southern Lake and western Napa counties could be affected by planned outages. Southern Mendocino County appears largely unaffected outside of the Highway 101 and Route 128 corridors.

"The planning maps show which areas are more likely to experience a shut off when gusty winds and dry conditions, combined with a heightened fire risk, are forecasted to threaten a portion of the electric system," PG&E spokeswoman Deanna Contreras said in a statement. "The maps show potential areas of more likely distribution-level and 70kV and below transmission-level impacts. They are approximate and show potential de-energization areas only. Additional areas could be impacted. PG&E is working to make these same planning maps available to customers through our website very soon."

PG&E has conducted a series of preemptive power outages since last fall in an effort to curb fire risk associated with its equipment, which the state determined sparked many of the most destructive wildfires in 2017 and 2018. Going forward, the planned shutoffs could extend not just to small power lines connected to homes and businesses but to the large transmission that carry power across the state.

The utility's critics have blasted the outage plans, pointing to impacts on public safety, businesses and disabled people who rely on access to electricity. State legislators on Wednesday added to the scrutiny, suggesting that the bankrupt utility and other electricity providers would err on the side of power shutoffs to shield themselves from mounting wildfire liabilities.

"We are approaching the one-year anniversary of the first public safety power shutoff by this utility and it is past time that PG&E gets their act together," said state Sen. Mike McGuire, D-Healdsburg, a member of the Senate's committee overseeing energy, utilities and communications. "All of the measures addressed in the meeting yesterday should have been discussed prior to launching last October's public power safety shutoffs. We're talking about all these details after the fact and it's unacceptable."

PG&E, meanwhile, had urged local governments to withhold public release of the new North Bay outage map, arguing it lacked context and could be misleading to viewers. Sonoma County last week released a blurred version of the map that was illegible. A source with access to a legible version provided the map to The Press Democrat.

PG&E declined to make a subject-matter expert available this week to answer more detailed questions about the map and the methodology used to chart the scope of planned power outages. Contreras said the utility would provide additional information when it makes the maps public.

Preparing For Planned Outages

Make sure PG&E has your current contact information by going online to www.pge.com or calling 1-800-743-5000.

Get local emergency alerts: Go to SoCoAlert.com or call 866-939-0911, press "0" at the menu and ask the operator for assistance in registering.

For a closer look at the map, including the ability to zoom in on certain areas, go [here](#)

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The utility is preparing to release maps of its entire service area through its website in the next few weeks, officials said.

The North Bay map was provided this month to officials in Sonoma County and Santa Rosa through a secure data portal to help them plan for PG&E's outages. Though most of Sonoma County is marked as "affected," local officials have cautioned that the likelihood of an outage affecting the entire county is very low.

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A prolonged, widespread outage, however, could have the potential to be very disruptive, officials acknowledged, posing problems ranging from cellphone service to storage of food.

"This is a significant new challenge," Chris Godley, Sonoma County's emergency management director said last week. "It's been a generation since we've seen large-scale power outages in Sonoma County."

PG&E has said it intends to provide advance notice to its customers and the public before cutting power, and Contreras said the utility also will provide "maps of impacted areas in a variety of formats."

"We've always said that while customers in high fire-threat areas are more likely to be affected, any customer could have their power shut off because the energy system relies on power lines working together to provide electricity across cities, counties and regions," she said. "The specific area and number of affected customers will depend on forecasted weather conditions and which circuits PG&E needs to turn off for public safety."

Amid the scorching heat this week, the Petaluma Fire Department highlighted the potential for such outages and called on residents to be prepared.

"PG&E may cut power to all of Petaluma this summer and fall for several days," the fire department wrote in an announcement about the opening of cooling center in town. "ATM machines won't work, gas stations won't be able to pump gas, traffic signals will be out, garage doors will need to be opened manually..... Are you ready?"

Staff Writer Alexandria Bordas contributed to this report. You can reach Staff Writer Will Schmitt at 707-521-5207 or will.schmitt@pressdemocrat.com. On Twitter @wsreports.

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OUR NETWORK

Nearly 40,000 Sonoma County customers could be affected by possible PG&E outage



SLIDE 1 OF 9

Debbie McCormick, owner of Sunnyside Cottage, brings her outdoor display inside at closing time, in Santa Rosa, California, on Monday, November 18, 2019. (Alvin Jornada / The Press Democrat)



GUY KOVNER

THE PRESS DEMOCRAT | November 18, 2019, 2:17PM | Updated 31 minutes ago

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PG&E warned it could shut off power this week in Sonoma County for the sixth time in two months to prevent its equipment from sparking a wildfire, a practice that has set fire-prone Northern California on edge.

The state's largest power company began sending notices Monday to more than 303,000 customers in 25 counties, including nearly 40,000 in Sonoma County, warning that it may start shutting off portions of its electrical grid on Wednesday morning during another period of windy, dangerous fire weather.

PG&E said the outage would impact a broad swath of Sonoma County from Cloverdale south to the town of Sonoma, mostly east of Highway 101; along the coast from Bodega Bay to Gualala; and along the Russian River from Forestville to Jenner.

The blackout could affect 140,849 people, or more than a quarter of the county's population, based on mapping and census data, according to Permit Sonoma, the county's planning agency.

"Here we go again," said David Rabbitt, chairman of the Sonoma County Board of Supervisors. "The shutdowns have proven to be horribly impactful, but not as horribly impactful as wildfire."

The Kincade fire, which erupted in the hills east of Geyserville last month and scorched 120 square miles before it was fully contained two weeks ago, may have been caused by a malfunction on a PG&E transmission line that was not deactivated, Rabbitt said.

PG&E has been faulted for most of the deadly and destructive wildfires in Northern California in 2017 and 2018. Now in bankruptcy facing billions of dollars in wildfire liabilities, the utility has adopted preventive shut-offs as a defense against more conflagrations.

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The shut-offs have prompted harsh criticism from state and local officials.

"PG&E has failed us too many times. All options need to be studied and on the table — including breaking up the utility," said state Sen. Mike McGuire, D-Healdsburg, who participated in a legislative hearing on the shut-offs Monday.

State Sen. Bill Dodd, D-Napa, who also attended the hearing in Sacramento, said he hoped PG&E "recognizes what they've put people through time and time again. This could cause PTSD for people," referring to the traumatic stress disorder suffered by war veterans.

Sonoma County officials have commissioned a study on the economic impact of the blackouts, which have forced local business owners to shut down and send workers home without pay.

Debbie McCormick, owner of Sunnyside Cottage in the Montecito Shopping Center, said she lost seven days of business during outages in October that cost her about \$10,000 in sales at her gift, toys and home decor shop. Unable to pay her employees when the shop is closed, McCormick said the economic hit "trickles down" from business owners into the community. She has not come up with a plan for dealing with blackouts.

"I wasn't expecting to have to figure it out so quickly," she said. "I was hoping we'd seen the last of them."

Dry, windy weather returning to Northern California will create high-risk fire conditions that start early Wednesday morning and last into Thursday, PG&E said in a press release Monday. "Worsening dry conditions and expected high wind gusts pose an increased risk of damage and sparks on the electric system that have the potential to ignite fires in areas with dry vegetation," the company said.

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To check if your address is impacted, go to psps.ss.pge.com.

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Map: Proposed PG&E power outages for Wednesday, Nov. 20

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The National Weather Service has issued a red flag fire warning for the North Bay and East Bay hills from 4 a.m. Wednesday through 7 a.m. Thursday, noting that it will not be "anywhere as strong" as the warning in late October that preceded the Kincade fire, the largest in Sonoma County history.

North winds are expected to gust from 35 to 45 mph in the hills, especially late Wednesday, and possibly exceed 60 mph over Mount St. Helena, the forecast said.

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Map: Proposed PG&E power outages for Wednesday, Nov. 20

PG&E may cut power to 250,000 customers in Sonoma, 18 other counties due to wind

Notices 48 hours in advance of the potential shut-off were sent Monday to more than 91,000 customers in five North Bay counties: Sonoma (39,940 customers), Marin (23,440), Lake (13,700), Napa (11,180) and Mendocino (3,080).

Notices were also sent to 212,000 customers in 20 other Northern California counties: Alameda, Amador, Butte, Colusa, Contra Costa, El Dorado, Glenn, Nevada, Placer, Plumas, San Mateo, Santa Clara, Santa Cruz, Shasta, Sierra, Solano, Tehama, Trinity, Yolo and Yuba counties.

Notifications will also be issued 24 hours and four hours prior to the shut-off.

Customers can use an online address tool — www.pge.com/pspsupdates — to find out if their property may be included in the shut-off.

PG&E said it expects the high winds to subside at mid-morning Thursday. It will then begin inspecting the deenergized lines, with the goal of restoring power to most customers by the end of the day.

The utility has cut power to customers five times in Sonoma County since Sept. 25.

You can reach Staff Writer Guy Kovner at 707-521-5457 or guy.kovner@pressdemocrat.com. On Twitter @guykovner.



NWS Bay Area
@NWSBayArea

The Fire Weather Watch begins at 4 AM PST Wed for the North Bay Mtns, East Bay Hills, & Diablo Range. A combination of the offshore winds, low relative humidity values, & unseasonably dry fuels will likely lead to critical fire weather conditions for the higher elevations. **#CAwx**



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CALIFORNIA

What will the next heavy winds bring? Assessing the great power shut-off of 2019



A sign at Mary's Pizza Shack informs customers the restaurant is closed because of a Pacific Gas & Electric power shutdown in Sonoma, Calif., on Wednesday. (Christopher Chung / Associated Press)

By MAURA DOLAN, TARYN LUNA, COLLEEN SHALBY, SAMMY ROTH

OCT. 15, 2019
3 AM



SAN FRANCISCO — Less than a week after utilities shut off power to hundreds of thousands of customers up and down California, experts and regulators are beginning to assess what went wrong and what the future portends.

Pacific Gas & Electric cut power to more than 700,000 customers in 34 counties early Wednesday because of high winds. Some households were without electricity for 72 hours, a spokesman said. Southern California Edison shut off electricity to more than 24,000 customers, also starting Wednesday.

The biggest failure, experts and customers alike said, was communication. Residents complained they did not receive adequate notice of the shutdown or no notice at all and could not get on the utilities' websites.

Lessons learned from the shutdowns are critical because more will take place, experts said.

"I suspect for the next few years these are going to occur," said Severin Borenstein, faculty director of UC Berkeley's Energy Institute. "No one involved in this thing thinks it was a one-time event."

The California Public Utilities Commission on Monday ordered PG&E to take immediate corrective actions, and Gov. Gavin Newsom called on the utility to give residential customers who lost power \$100 rebates.

Commission President Marybel Batjer told PG&E it must try to restore power within 12 hours in the future, reduce the size of outages, develop systems to ensure call centers and the website are accessible and develop a "communication structure" with counties and tribal governments so they can respond to emergencies.

"Failures in execution, combined with the magnitude of this ... event, created an unacceptable situation that should never be repeated," Batjer said.

After Newsom's request and the commission's letter, Bill Johnson, PG&E's chief executive, said the utility looked forward to learning how it could improve but called the power shut-off "the right decision."

PG&E spokesman Jeff Smith said the utility cannot determine whether rebates should be given until the utilities commission evaluates the shutdown. He also said PG&E could not rule out more shutdowns later this fall.

Some experts said utilities should not have unilateral power for deciding when to shut off power. Utilities have "too much incentive" to cut power because they bear full liability if their equipment sparks a blaze, Borenstein said.

During a shutdown, the risk shifts. "We bear the cost," he said.

He said the state should create some sort of committee that includes public safety officials, elected officials, utilities and the Public Utilities Commission to make power shut-off calls in the future.

Utilities have sparked fires for decades, but they are now more destructive because of droughts produced by climate change and the movement of people into more remote, highly vegetated regions, experts said.

Southern California Edison's customers complained the utility failed to give them adequate warning.

They hit the utility with questions about the timing, criticism over lack of immediate notice and outrage over spoiled food, stress-related health effects and fears that trapped cars beneath electric garage doors would leave people stranded in the event of a fire.

"We strive to keep the customer informed always, but we may not be able to depending on circumstances," said Edison spokesman Robert Villegas.

UC Berkeley professor Alexandra von Meier, an expert on energy grids, said utilities need to give customers adequate notice to prepare for shutdowns but must weigh that against the fact that weather forecasts are less accurate days in advance.

"The bottom line is no one should be in a situation where they really need to fear the power going out," she said. "We heard from medical patients with essential needs powered by electricity" who were caught off-guard when the electricity went out. They should be provided with backup power, von Meier said.

Janice Bell, a Chatsworth resident who has multiple sclerosis, lost power Thursday morning. At 4:30 a.m. Friday she heard sirens go past her house as a sheriff instructed people to evacuate because a fire had exploded in Porter Ranch, just two miles away.

But Bell's car was trapped inside her garage, beneath an electric door, and she could not open it.

After two hours of waiting, she flagged down a neighbor who helped her open the garage door and she drove to her office in Woodland Hills.

Bell is part of Edison's Medical Baseline program, which offers financial assistance for those who rely on medical equipment. But she said she didn't receive any advance notice of the power outage through the program. To add further complication, Bell said that Edison's website was down for two days.

"This was the opposite of responsible," Bell said. "What about people like me? I live alone. What if the fire was in my backyard? It was two miles away and the winds were blowing 60 mph."

Villegas said SoCal Edison's critical care customer program offers people who need further assistance advance warning for outages. But it's unclear whether most customers in need of such service are aware that the program is available, or if the warning time is enough.

Curtis Child, legislative director of Disability Rights California, said these decisions are left to utility companies without any official direction of how to mitigate the effect on people with disabilities. The standard 48-hour warning is not always enough time for people with disabilities to prepare for backup services, such as alternative respirators or physical assistance, he said.

State Sen. Mike McGuire (D-Healdsburg) said the state needs to force PG&E to speed up efforts to harden its equipment, perform necessary vegetation management and modernize its grid in high-hazard wildfire zones — work anticipated to take a decade to complete.

He and other lawmakers hope to introduce legislation early next year to address several problems related to shut-offs. It could include setting criteria that utilities must meet before flipping off the lights and requiring companies to develop accurate lists of medically fragile patients.

“You’d think the largest electricity utility in America could do better, but it’s obvious that they can’t,” he said.

Rooftop solar panels paired with batteries are one of the most straightforward strategies for coping with a future of fire-driven power outages, experts said. But they noted that investor-owned utilities such as Edison and PG&E don’t have much motivation to push solar-plus-storage as a solution for their customers.

For-profit electric utilities have traditionally seen “behind-the-meter” solar panels as a threat to their bottom line, and have fought to limit financial incentive programs for rooftop systems, arguing that those incentives harm customers unable to afford solar power.

“The utilities will oppose accelerating the deployment of behind-the-meter solar and batteries, even in areas that are subject to the shut-offs, because it’s just so diametrically opposed to their business model,” said Bill Powers, a San Diego electrical engineering consultant and consumer advocate.

Joe Eto, a staff scientist at Lawrence Berkeley National Laboratory, said ratepayers may be asked to bear the costs of improving PG&E’s grid.

It is impossible to know whether PG&E’s decision to cut electricity avoided a wildfire, but the utility reported it found 50 instances of equipment damaged by wind, including downed power lines.

“To the extent they avoided another catastrophic wildfire, that seems like something that is very important,” Eto said.

Dolan reported from San Francisco, Luna from Sacramento and Shalby and Roth from Los Angeles.

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Maura Dolan is the California-based legal affairs writer for the Los Angeles Times. She covers the California Supreme Court and the U.S. 9th Circuit Court of Appeals. A California native, she graduated from UC Berkeley and has worked in Washington and Los Angeles for The Times. She is now based in San Francisco.



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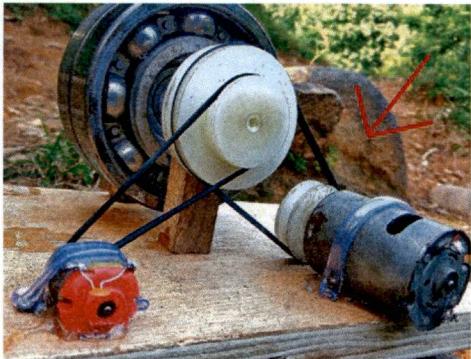
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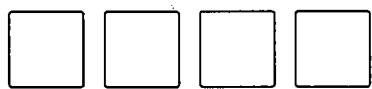
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Be Ready, Windsor!

Given the growing threat of extreme weather conditions, PG&E wants all of its customers to be prepared for potential power outages. If extreme danger conditions threaten a portion of the electric system serving our area, it may be necessary for PG&E to turn off electricity in the interest of public safety. This is called a Public Safety Power Shutoff (PSPS). If PG&E needs to turn off an electric line for safety, all customers who receive power from that line will be affected, including [Medical Baseline Program customers](#).

Be ready to act if PG&E notifies you that a shutoff is possible. Keep emergency phone numbers handy and consider staying with a friend or relative during an outage. For information on how to prepare for a Power Shutoff or to sign up for Alerts, visit: [Prepare for Power Down website in English and Spanish](#)

What do you need to do to prepare for possible loss of power?

1. **Make sure PG&E has your current contact information.** Update your contact information with PG&E online or call (866) 743-6959. If you have life-saving medical equipment:

- Verify PG&E has you registered with their [Medical Baseline Assistance program](#).
- Plan to have [back-up power sources](#) for all critical medical needs (including refrigerated life-saving medications), and
- Have pre-established connections with nearby family or neighbors to assist if needed.

2. **Check and update your emergency kit** and supplies (include hard copies of critical information and life-saving prescriptions)

3. **Identify a place you can go to cool off** if necessary

4. **Have a back-up charging system** for cell phones and keep devices fully charged at all times.

5. **Consider alternate power generation choices** for your home or critical business systems. Be sure to follow all safety instructions for stand-alone power generators. See links below for more information:

- [Electrical Generators](#)
- [Battery-Operated Radios](#)
- [Portable Generator Safety Tips](#)

6. **Learn how to manually open** your garage door.

7. **Keep some cash on hand** (credit/debit stations, and ATMs may be without power).

8. **Learn more about Public Safety Power Shutoffs** in your area and work with your neighbors to make sure everyone is ready.

9. **Stay informed** during disasters and sign up for alerts

To learn more, please contact PG&E at 1-866-743-6959 and pgawindsor@pg&e.com or click on below links.

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CALIFORNIA

PG&E power outage brings lines for gas, batteries, groceries and generators



PG&E power outage brings lines for gas and demand for portable generators (Justin Sullivan / Getty Images)

By TARYN LUNA, JAMES F. PELTZ, MAURA DOLAN

OCT. 9, 2019
2:11 PM



The massive blackouts imposed across Northern California on Wednesday led to a run on gasoline, portable generators and other supplies while retailers struggled to serve customers.

Millions were expected to lose power as Pacific Gas & Electric [shut down service](#) in a bid to avoid wind-driven fires caused by downed power lines.

Angie Sheets of El Dorado Hills outside Sacramento noticed that generators were flying off the shelves at the local Costco as she shopped for groceries earlier in the week.

Considering the nearly \$1,000 worth of food she planned to purchase and the imminent power outage, Sheets said she called her husband to talk about buying a generator for their home.

"By the time I had done that, the last big generator was gone off the shelves," she said. Her husband, a law enforcement officer, later found a generator at a Costco in Rancho Cordova.

On Tuesday night, they filled their bathtubs in case water service was disrupted.

CALIFORNIA

Full coverage: California power outages

Oct. 11, 2019

Sheets said she went to Safeway to pick up more bottled water and saw a line of cars snaked around a gas station parking lot.

"In this particular area they did say we could lose power for up to seven days," Sheets said. "I think that's what's making people on edge, the fear of the unknown and wanting to be safe for your family."

Denise Boldway, owner of Blossoms Florist in Eureka in Humboldt County, said she was getting some power via an extension cord connected to a generator in her RV.

But the generator isn't strong enough to keep powering the cooler that holds her roses, dahlias and other flowers needing refrigeration, she said.

"I take what I need out of the cooler and close the door," Boldway said in a telephone interview. "I'm probably going to lose some flowers."

PG&E's isn't expected to turn the power back on til Thursday afternoon, she said.

In Eureka, "it's pretty much pandemonium here," she said. "You couldn't get gas last night and there was a two-hour wait at the grocery store to check out."

Stoplights were out Wednesday, and traffic was backed up in every direction, she said.

"Still, "I fully support PG&E in this," Boldway said. "The winds are 30 to 45 mph today and you don't even want to walk outside. I feel like it's totally justified."

In the East Bay, as residents waited for the power cuts to begin, many stores had run out of batteries for flashlights.

Raley's, a grocery chain based in West Sacramento, said nine of its stores affected by the blackouts remained open, but refrigerated and frozen goods were not available at its stores in Red Bluff, Chico and Jackson and at its Bel-Air store in Auburn.

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Taryn Luna covers Gov. Gavin Newsom and California politics in Sacramento for the Los Angeles Times.



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James F. Peltz has covered nearly every aspect of national business news – including corporate America, Wall Street and global economic matters – for more than 25 years in Los Angeles and New York.



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Maura Dolan is the California-based legal affairs writer for the Los Angeles Times. She covers the California Supreme Court and the U.S. 9th Circuit Court of Appeals. A California native, she graduated from UC Berkeley and has worked in Washington and Los Angeles for The Times. She is now based in San Francisco.

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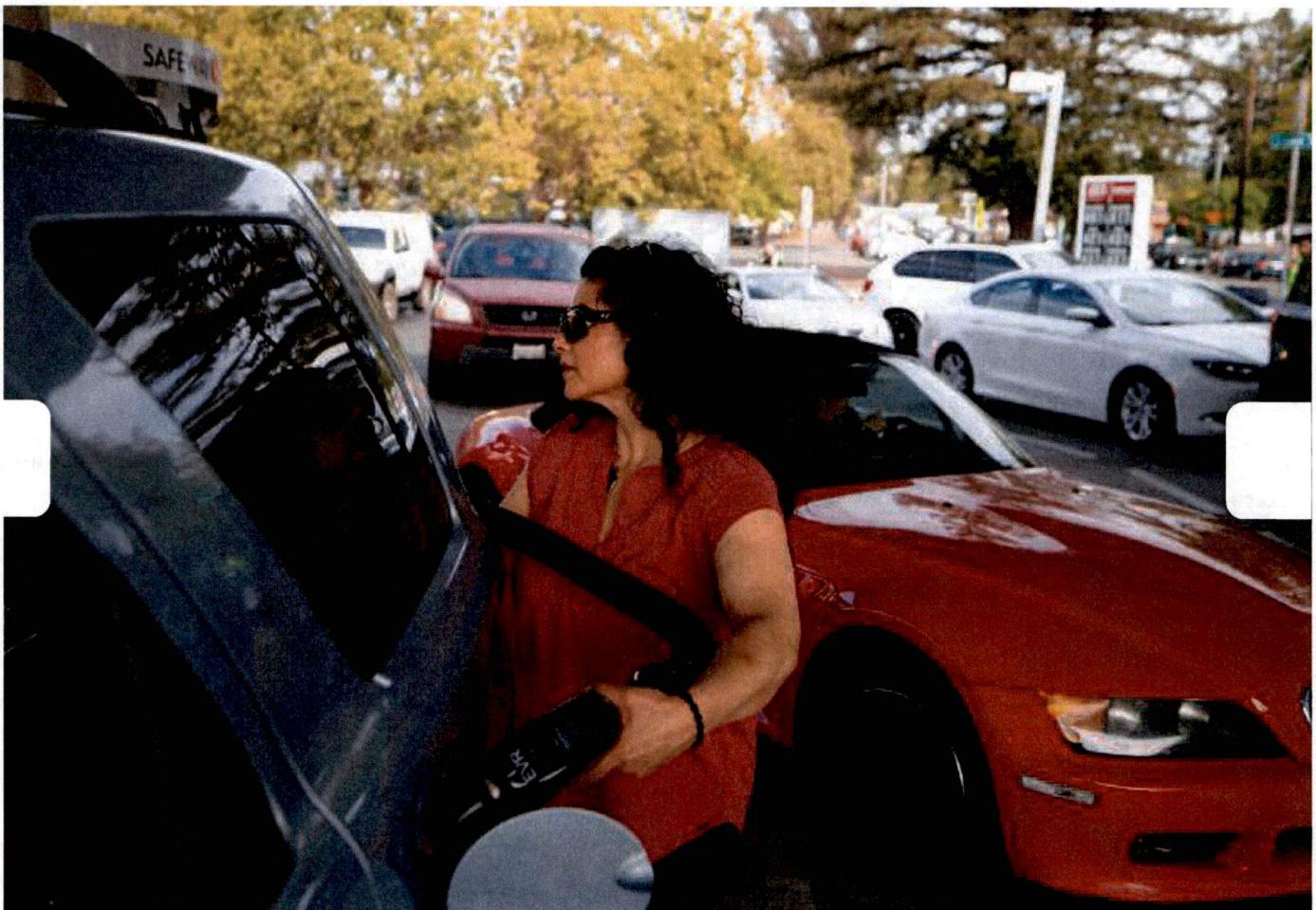
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PG&E slowly shuts off power to 800,000 customers in California



SLIDE 1 OF 7

Deborah Arnett of Santa Rosa pumps gas into her SUV, as she and other motorists top off their gas tanks in preparation for the PG&E outage at the Safeway gas station in Santa Rosa on Tuesday, Oct. 8, 2019. (Alvin Jornada / The Press Democrat)



GUY KOVNER, WILL SCHMITT AND CHANTELLE LEE

THE PRESS DEMOCRAT | October 8, 2019

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In a historic move to avert another fiery disaster, PG&E is turning off power to as many as 800,000 customers in Northern and Central California Wednesday, prompting residents, schools, businesses and local officials to make hurried plans to cope without electricity possibly for several days.

With wind speeds expected between 40 mph and 70 mph over sunbaked land Wednesday and Thursday, the state's largest utility opted to preemptively cut power in parts of 34 counties, including Sonoma, Marin, Napa, Mendocino and Lake counties in the North Bay.

PG&E, driven into bankruptcy in January facing about \$30 billion in liabilities for wildfires in 2017 and 2018, adopted temporary power shut-offs as a key part of its fire prevention plan. A majority of those catastrophic blazes two years ago as well as the Camp fire in 2018 were attributed to the company's equipment.

About 66,000 of the utility's Sonoma County customers will lose power, which equates to about 262,000 residents. Of that total, there will be 24,000 Santa Rosa customers affected, including an estimated 72,000 residents, a city official said Tuesday.

With many PG&E customer accounts serving more than one person, the planned outage could affect well over 1 million people. The utility plans to cut power in two stages, the first early Wednesday morning before sunrise and the second between noon and 5 p.m.

Much of eastern and northern Sonoma County, including parts of Santa Rosa, Sonoma, Petaluma, Rohnert Park, Windsor, Healdsburg, Cotati and Cloverdale, are expected to be included in the shutdown, according to PG&E maps.

The utility is expected to start restoring power Thursday around noon and it could take five days to complete that process. Densely populated parts of the county could have power restored within 48 hours.

For thousands of residents, Tuesday's news of the impending power outage was an eerie reminder of the catastrophe that struck exactly two years ago, when the 2017 North Bay wildfires killed 40 people and destroyed nearly 6,200 homes.

Christine Ratliff, a leader of a Larkfield neighborhood's campaign to replant the trees lost to the Tubbs conflagration, spoke with an almost matter-of-fact voice of the expected widespread power shut-off.

"You hear that this is going to happen, and you look outside and say, 'It's so nice; it's not even windy.' You think, 'Are they just overreacting?'" Ratliff said. "I would hope they wouldn't be doing this unless it was absolutely necessary, especially such a large area."

The planned outage will be the largest in Northern California's history, said Chris Godley, Sonoma County's emergency management director.

"Today, we need to step up," Godley said Tuesday. "Check on your neighbors. Step out of your comfort zone. Go find somebody and make sure they're going to be OK. Government can only do so much. The real resource (is) our people."

Ratliff's kindergartner will be off school Wednesday, one of the thousands of local students who won't go to class because many schools in the Santa Rosa area, Sonoma Valley, Cloverdale and Rohnert Park will be closed. Also, Santa Rosa Junior College and Sonoma State University canceled classes.

Beverly Nystrom, 85, is living in a Santa Rosa condominium while her new Larkfield home is built.

PG&E potential outage map

Schools close across county

All Santa Rosa Junior College campuses will be closed Wednesday and all activities and classes, including online classes, are canceled. Sonoma State University also canceled classes.

Seven Santa Rosa City Schools will be closed Wednesday because of the shut-off and will likely remain closed Thursday and Friday: Maria Carrillo High, Rincon Valley Middle, Santa Rosa Accelerated Charter School, Santa Rosa Middle, Hidden Valley Elementary, Proctor Terrace Elementary and Lewis Education Center. All after-school programs, such as athletics and childcare, will also be canceled at these schools. Other schools within the district may also be closed Thursday and Friday, depending on the duration of the outage and possible increase in the affected area.

Alexander Valley — closed Wednesday and Thursday.

Bennett Valley Union School District, Cloverdale Unified School District, Cotati-Rohnert Park Unified School District, Kashia School District, Geyserville Unified School District, Old Adobe Union District's Sonoma Mountain and Old Adobe charter schools — closed Wednesday. Mark West Union School District and Windsor Unified School District — closed Wednesday with a projected closure Thursday.

Sonoma Valley Unified School District — closed Wednesday through Friday.

Waugh School District — closed Wednesday with non-student days Thursday and Friday.

Sonoma County Office of Education — Skylane campus closed Wednesday. Special education classes at school district sites will be closed along with district closures.

Parents are encouraged to go to their school or district website for the latest information.

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Nystrom wasn't aware she might lose power at her condo, but didn't seem too concerned. A self-described farm girl, she had no electricity at home until she graduated from high school.

"So I know have to survive," she said, before adding about PG&E: "They still need to have a better solution."

As many of its anxious utility customers scrambled Tuesday to fill up their cars with gas, buy nonperishable foods at supermarkets, get cash from ATMs and otherwise prepare for the outage, PG&E officials sought to reassure them of the need for the shut-off.

Michael Lewis, PG&E's senior vice president of electric operations, said in a statement that the "safety of our customers and the communities we serve is our most important responsibility, which is why PG&E has decided to turn power off to customers during this widespread, severe wind event.

"We understand the effects this event will have on our customers and appreciate the public's patience as we do what is necessary to keep our communities safe and reduce the risk of wildfire," Lewis said.

In Santa Rosa, PG&E is offering restrooms, bottled water and a recharging area for electronic devices at the Veterans Memorial Building, 1351 Maple Ave.

Meanwhile, Godley said local hospitals and health care systems will prioritize essential functions, with plans to curtail all elective surgeries and normal office visits.

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The power shut-offs will force the closure of three Santa Rosa Community Health clinics, including two of the nonprofit's largest clinics: the Vista Campus, 3569 Round Barn Circle; the Dutton Campus, 1300 North Dutton Ave.; and the Brookwood Campus, 983 Sonoma Ave.

The three campuses decided to close because they only have enough backup power for refrigerators where vaccines and other drugs are kept.

Godley said the Sonoma County Jail will perform essential functions using generators. If the shut-off goes beyond 48 to 72 hours, inmates may have to be relocated.

County officials are concerned about 911 phone access for residents, particularly those who don't have landline phones, which are more resilient during power outages.

"After four, six, eight hours, cell towers will begin to drop off," Godley said. "Only old-fashioned phones will work, and less than 2% of the county has those phones."

He compared the anticipated effects of PG&E's outage with a Southern California outage in 2011 and the power grid failures of the 1970s.

"People will be inconvenienced immediately. Alarm clocks won't go off," Godley said. "Maybe the lights don't come on, as well."

Most grocery stores "might keep the lights on, but the freezer aisle's going to be a pretty wet mess," he said.

The Safeway store and gas station on Fourth Street in Santa Rosa were crowded Tuesday afternoon, with lines at the ATM and gasoline pumps, and the adjacent CVS drugstore was out of ice.

Karen Varner of Santa Rosa, who has to travel for her job, was waiting to fill her tank in preparation for the blackout.

"Of course it worries me," she said. "(But) I think the community has done a great job preparing us, letting us know that this is going to happen."

Liz Byers of Santa was stocking up on emergency supplies, including batteries at the CVS store. She called the shut-off a "hardship," especially for people without generators or unable to work without power.

"I know it's preventative, but it does trigger a lot of anxiety," she said. "We all remember the fires, and we question our preparedness."

Santa Rosan Mark Walters said he thought the whole thing could have been avoided.

"I think this is another burden that PG&E is placing on its customers and communities," he said.

Major cellphone service providers have said they will use backup power sources, including batteries and generators, to keep their North Bay cell sites operating. However, their ability to service cell towers largely relies on accessing the sites, which could be compromised by inclement weather or emergency conditions.

Sonoma County Transit and the Santa Rosa CityBus will continue to operate on their regular schedules Wednesday, but advised customers that trips may be delayed because of traffic signal outages throughout the county.

SMART plans to continue its regular weekday train schedule, including stops at stations without power, but said passengers should expect delays.

Although Charles M. Schulz-Sonoma County Airport falls within PG&E's planned outage area, a generator will power main operations and commercial flights are expected to continue as scheduled. Airport security will shift to manual screenings so passengers are encouraged to arrive to the airport early for their flights.

Individual airlines may choose to cancel flights, county spokeswoman Maggie Fleming said, advising passengers to check with their carriers before heading to the local airport Wednesday.

Golden Gate Ferry, Golden Gate Transit and the Golden Gate Bridge are expected to operate public transit services Wednesday with generators.

In 2018, PG&E started using planned power shut-offs, turning off distribution lines in an attempt to prevent wildfires. This year the utility significantly expanded the fire-prevention tactic to include powering down the larger transmission lines that carry electricity across the state.

Each time PG&E conducts a planned outage, it must file a report with the California Public Utilities Commission.

California investor-owned utilities like PG&E can use preemptive power cuts if necessary to help ensure the safety of their customers, California Public Utilities Commission spokeswoman Terrie Prosper said.

"The utilities can exercise this authority during severe wildfire threat conditions as a preventative measure of last resort," Prosper said.

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June 27, 2016



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- 1. Storms:** Wind, heat, ice and snow are the most common causes of widespread power outages.
- 2. Trees:** During high winds, or trimming by an untrained professional, limbs can come into contact with power lines and cause interruptions. You can always request a tree trimming service on SCE's website.
- 3. Vehicles:** A vehicle collision with a utility pole can cause a power outage.
- 4. Earthquakes:** Quakes of all sizes can damage electrical facilities and power lines.
- 5. Animals:** Although we place barriers between wildlife and electricity equipment, squirrels, snakes and other small animals may still cause a short circuit.
- 6. Lightning:** When lightning strikes electrical equipment, transmission towers, wires and poles, outages can occur.
- 7. Excavation digging:** Sometimes, underground cables are disturbed by digging. It's important to call 811 before any gardening or digging project.
- 8. High Power Demand:** During heat waves and other times of unusually high power demand, overburdened electric cables, transformers, and other electrical equipment can melt and fail.

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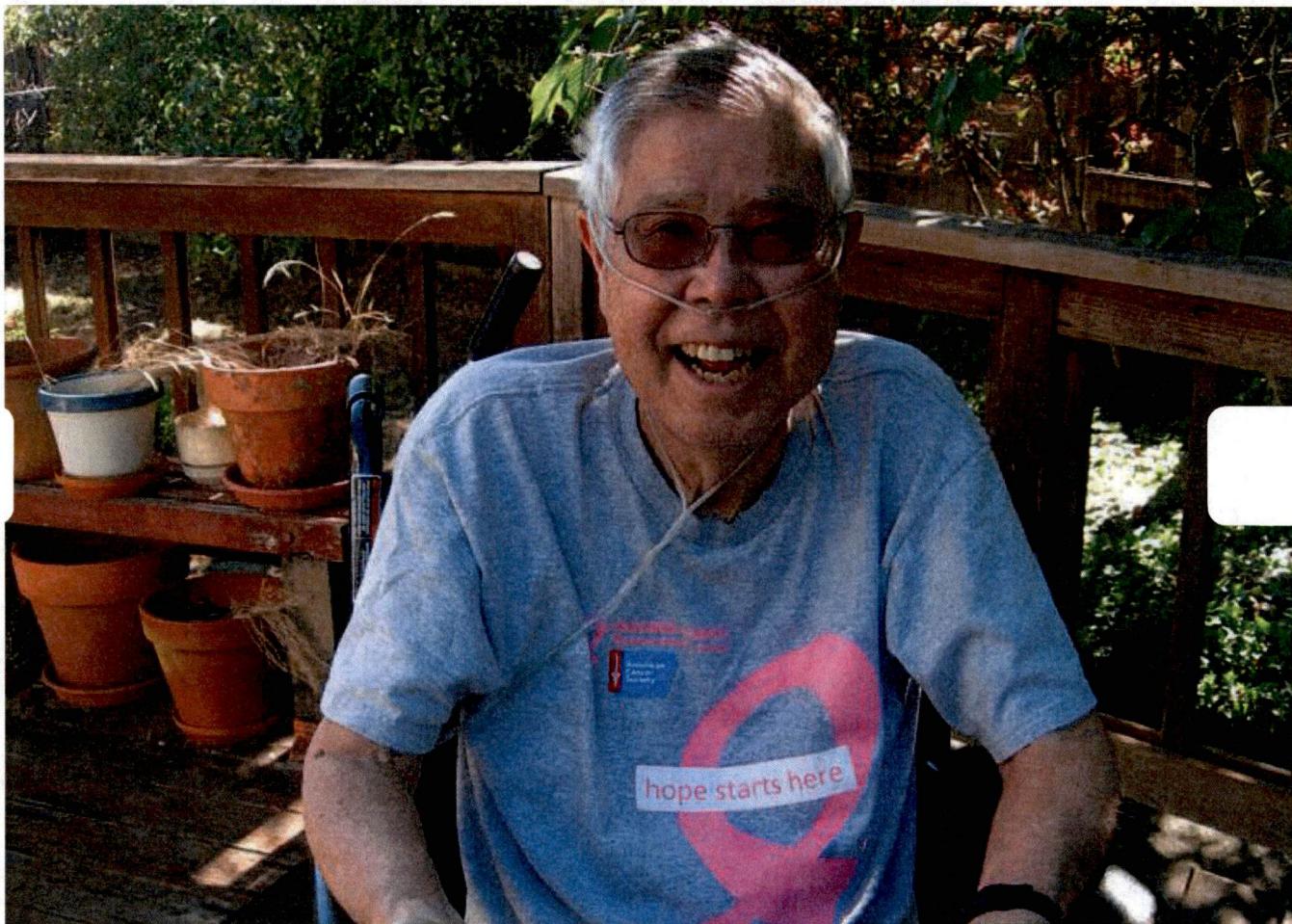
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Santa Rosa man on oxygen dies after PG&E shut-off



SLIDE 1 OF 2

Gerald Niimi, who used machines that helped him breathe, died Oct. 15, following a power shut-off aimed at minimizing the risk of wildfires caused by electrical equipment. (Naomi Niimi)



WILL SCHMITT

THE PRESS DEMOCRAT | October 26, 2019

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Gerald Niimi survived the October 2017 firestorm, and so did the home near Santa Rosa's Skyhawk community where he and his wife, Naomi, lived for 40 years. But smoke from the blazes that devastated Sonoma County didn't help his lungs, nor did smoke from the Camp fire that blanketed the Bay Area last November. Early this year, an incurable lung disease he learned he had the year before forced him to start using oxygen machines to breathe.

Naomi Niimi, in an interview, recalled how she found him after a summer car crash on Calistoga Road cut their power for a few hours. Unable to call out for help with a dead landline and without a cellphone, the former Vietnam veteran stationed himself in the still dark heat of their powerless home, with his tank's level cranked down to preserve his oxygen.

Then came PG&E's big planned anti-wildfire outage that knocked out power to more than 2 million Californians earlier this month, including the Niimis. Gerald Niimi lost his life in the aftermath of that shut-off, when he and Naomi had to scramble to a bed and air that Gerald could breathe. He was one of about 6,900 Sonoma County customers in a PG&E financial aid program for customers with certain medical conditions.

As the Oct. 9 shut-off took effect, even a small generator to power the oxygen concentrator Gerald used to breathe was too heavy for Naomi. She couldn't lift the respirator either. Their oxygen provider was overwhelmed with requests for extra tanks, she said, and she figured Gerald's remaining oxygen would last for maybe nine hours if he didn't eat, speak or exert himself.

"The power wasn't going to turn back on in nine hours," she said, "so it was up to us to figure something out."

She drove them to Santa Rosa Memorial Hospital, trying to get Gerald admitted through the emergency room. Hospital staffers offered oxygen, but not a place in the medical facility. Gerald's hospice provider wasn't able to find him a space in Santa Rosa, but did track down a bed in Cloverdale. There was a smaller oxygen machine there, but that barely provided enough air for Gerald's battered lungs.

"He spent two days essentially gasping for breath," Naomi said.

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All summer, he'd been in good spirits, if not great health. The stress of worrying about running out of oxygen during the outage, plus the increased energy he needed to expend to breathe, wore him down.

The Tuesday after the fire, he was given some morphine in hopes of calming down his respiratory system. Naomi remembers what she heard before Gerald Niimi, 75, passed away in his sleep Oct. 15.

"He said, 'I just can't go on like this,'" she said. "'I can't breathe. My lungs are shot.'"

She has friends who lost their homes in the Tubbs fire and said she doesn't begrudge PG&E's decision to cut the power. But she can't help but think Gerald's death was a consequence of the outage, however indirect and unintentional.

"I think that that power outage, the stress, the lack of oxygen — it was really the tipping point for him," she said.

PG&E has about 6,900 Sonoma County customers in its medical baseline program, which provides financial aid to customers who need power because of certain medical conditions, said PG&E spokeswoman Deanna Contreras. (Naomi identified Gerald as one of them.) About 2,700 were expected to be impacted in the outage planned for this weekend, and about 1,950 were affected during the outage that preceded Gerald's death, Contreras said.

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Map: Proposed PG&E power outages for Wednesday, Nov. 20

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Customer privacy issues made it difficult to provide specifics, Contreras said, but she offered her condolences when a reporter relayed Gerald's fate over the phone.

"Our hearts definitely go out to the family, though, for their loss," Contreras said. "That sounds like a terrible incident."

Contreras said the planned, indefinite outages were "definitely a hardship for everybody, especially our medically fragile," but she also defended PG&E's decision to shut off the power.

"It is a difficult situation for everybody," Contreras said, "but we do stand behind our decisions to call these public safety power shut-offs, because the wildfire threat is that real and is that extreme."

Gerald signed up for the medical baseline program earlier this year, Naomi said. She didn't have a problem receiving notifications from PG&E, and said the utility "did better" with the outage that began Wednesday than the one that preceded Gerald's death, which she said "seemed somewhat premature" because the lack of obvious winds in many places.

She acknowledged that PG&E had set up community resource centers but noted that it would be tough for her to get there, and thought that she might have had to leave behind her 10-year-old beagle, Monkey Business, or Monkey for short. (Contreras said the rules allowed for pets in cases of emotional support, and "there is a broad definition of emotional support.")

Though Naomi believes PG&E's outage hastened her husband's demise, she also said she thinks she could have done more to prepare. Maybe if she had to do it over, she would have had the generator set up on a cart to make it easier to move, or would be more willing to impose on neighbors for help.

"We considered what we thought were reasonable possibilities at the time," she said.

Gerald, a native of Hawaii, would have turned 76 next month. He was a U.S. Navy Seabee who served in Vietnam before he and Naomi settled in Southern California, where he worked as an electrical engineer on offshore oil rigs near Santa Barbara, according to his obituary. Upon moving to Santa Rosa, he worked as a geothermal engineer and geothermal consultant. His later career included consulting related to energy production in The Geysers — the origin of the Kincade fire that broke out this week and has swollen to nearly 24,000 acres.

Naomi described Gerald as a sports-wild introvert, at his social best among small groups. He was a highly competitive golfer — his short game was solid, though his driving suffered with his illness — and "he didn't like making crummy shots," she said. Two comments she heard from other people who knew him well were that he was "such a nice guy" and "really smart."

A celebration of life will be held at the Bennett Valley Golf Course at 1 p.m. Nov. 17 at Legends at Bennett Valley, 3328 Yulupa Ave. There later will be a private ceremony in Hawaii.

Though Naomi misses him, she doesn't relish the thought of him having to endure the smoke blowing down into Santa Rosa from the Kincade fire.

"In a perverse way, I'm just very glad he's not here to experience this, because he would just be freaking out."

You can reach Staff Writer Will Schmitt at 707-521-5220 or will.schmitt@pressdemocrat.com. On Twitter @wsreports.

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OUR NETWORK

'This Did Not Go Well': Inside PG&E's Blackout Control Room

As the utility turned off power to millions of Californians, its website went down and it struggled to communicate with local officials and inform residents.

By [Ivan Penn](#)

Oct. 12, 2019

SAN FRANCISCO — It was a problem that California had come to dread. Weather models were signaling extreme winds and dry conditions from one end of the state to the other. The risk of wildfires was high.

Pacific Gas & Electric, the giant utility whose power lines and transformers have been blamed for a series of disastrous wildfires in recent years, was determined to prevent another one.

Just before last weekend, the company informed state officials that it might shut off power to a large area of Northern California, potentially leaving millions of people in the dark — something no United States utility had done in recent memory. It made that news public on Monday. By Tuesday morning, about a hundred utility executives, state officials, meteorologists and others had gathered at an operations center in San Francisco to coordinate the effort.

Things quickly began going wrong. PG&E's communications and computer systems faltered, and its website went down as customers tried to find out whether they would be cut off or spared. As the company struggled to tell people what areas would be affected and when, chaos and confusion unspooled outside. Roads and businesses went dark without warning, nursing homes and other critical services scrambled to find backup power and even government agencies calling the company were put on hold for hours.

All told, more than 700,000 homes or businesses — from the state's northernmost reaches to the outskirts of Silicon Valley — lost electricity beginning early Wednesday morning, and the state's emergency center usually used for natural disasters was activated. Most residents had power restored by noon on Friday, and just over 12,000 were still without it on Saturday morning.

"There were definitely missteps," said Elizaveta Malashenko, a representative for the state Public Utilities Commission who was in the control center. "It's pretty much safe in saying, this did not go well."

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While California prides itself on its technical prowess and economic might, PG&E had to send crews out into the fields, in a few cases, to manually flip switches to turn off power and then turn it back on, rather than doing it remotely.

Residents were left asking why so many people had to lose power and whether rolling blackouts would become routine as climate change makes wildfires more frequent and intense.

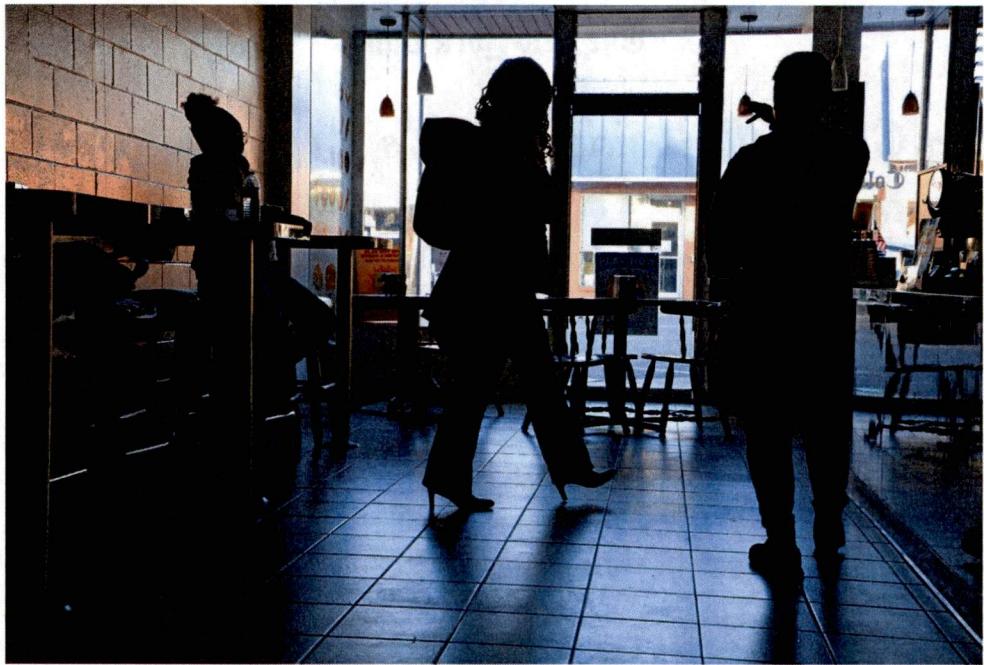
The company, which is facing \$30 billion in liabilities from recent wildfires started by its equipment, has drawn intense scorn from both its customers and state officials.

"This current operation is unacceptable," Gov. Gavin Newsom said Thursday. "The current conditions and circumstances are unacceptable."

Trouble has long dogged PG&E, California's largest utility and one of the biggest in the country. The company has said one of its transmission lines was probably responsible for the most destructive wildfire in state history, the Camp Fire, which killed more than 80 people and destroyed the town of Paradise last November. About a decade earlier, one of the company's gas lines south of San Francisco exploded, destroying a neighborhood and killing eight people.

This summer, PG&E and its newly appointed chief executive, Bill Johnson, had promised to do better. Blamed for its lax safety practices, the utility submitted a detailed plan to regulators on the protocol it would use to pre-emptively black out parts of its service area to prevent fires. It also promised to step up the trimming of trees along its transmission lines and make other changes.

"We did not deliver on this commitment this time," Mr. Johnson said Thursday evening as hundreds of thousands of his customers sat in the dark. "We were not prepared to manage the operational event."



At Colonial Donuts in Oakland, pastries were available but no hot drinks. The only illumination came from a large window in the front of the store. Jim Wilson/The New York Times

A Communications Breakdown

Catherine Maynes, who handles logistics for Generators Unlimited, which supplies power backup equipment throughout Northern California, said she knew it was going to be a busy week as early as last weekend, when reports of the growing fire hazard started to surface.

Monday was a normal day at Generators Unlimited because it was not yet clear when the blackouts would start and who would be affected. It was on Tuesday that everything changed.

"First thing in the morning, as we opened the door, the calls started pouring in," said Ms. Maynes, who works in Brisbane, south of San Francisco. "It never stopped ringing."

While people and companies with means could turn to businesses like Ms. Maynes for backup power, many others did not have that luxury. When they tried to get more information, answers were often not forthcoming.

One option was community resource centers, places run by the utility where affected residents were supposed to be able to cool off and charge their phones. But they often got little information or assistance there because PG&E had not adequately staffed the centers, said a senior state official with knowledge of the situation who was not authorized to speak publicly.

Meanwhile, state agencies, in charge of services like railways and the water supply, were forced to open the state's emergency operations center, which is normally used for actual disasters like earthquakes and fires, the official said. The center was running at Level 2, the same level it operated on during the Ridgecrest earthquake over the summer. And the local authorities were forced to bear the cost of additional staffing, including overtime hours for police officers, to deal with the shutdown.

This was a big moment for PG&E, which does not have extensive experience using what California officials refer to as a "public safety power shut-off." Its previous wildfire shut-offs had been limited to tens of thousands of customers — and it was ill prepared for the task.

Ms. Malashenko, deputy executive director for safety and enforcement at the California Public Utilities Commission, arrived at 9 a.m. on Tuesday for the first of her two 12-hour shifts at PG&E's operations center. She said she was stunned by what she saw. PG&E's website crashed just ahead of the first rounds of power shut-offs that would leave thousands in the dark.

In addition, the systems the company uses to alert residents and businesses that they would lose power didn't work as they were supposed to, Mr. Johnson, the chief executive, later acknowledged.

The situation got so bad at one point that Ms. Malashenko called in information technology specialists from the state to help restore PG&E's systems. (Besides Ms. Malashenko, representatives from the state emergency services and forestry and fire prevention agencies were also at the center to help coordinate the government's response with the utility and to relay information to state leaders, including Mr. Newsom.)

PG&E declined requests for interviews for this article with company officials who were at the emergency center.

Communication seemed to improve later on Tuesday before the first round of shut-offs began at 2 a.m. on Wednesday after Ms. Malashenko's colleagues from the state lent the company a hand. But within four hours after those blackouts began, PG&E's website crashed again.

"It never got to the point where it worked well," Ms. Malashenko said.

At the same time, on Tuesday, the weather forecast was becoming even more dire. PG&E's team of meteorologists were now identifying 34 counties as under threat from strong winds and dry conditions, up from 30 earlier.

Utility executives rely on the meteorology team, along with information from the National Weather Service, to decide what areas will lose power and when conditions are safe enough for crews to restore power.

Based on its models, PG&E now anticipated that the winds would reach 40 to 55 miles per hour from Wednesday morning through Thursday morning, with isolated gusts up to 60 to 70 m.p.h.

That forecast was off a good bit: Winds reached as high as 77 m.p.h. at Mount St. Helena in Northern California. Wind speeds are important because strong gusts can blow trees into power lines or knock utility equipment into brush, setting off fires.

By Thursday evening, as the winds died down, PG&E began dispatching its 44 helicopters and 6,300 employees and contractors to inspect damage and restore power to some areas.

A Different Approach

While some experts think utilities ought to have better ways to prevent wildfires than cutting off power, the utility industry considers this acceptable in cases of grave weather threats, and other California utilities have used the approach.

What was unusual about PG&E's approach was that other utilities had never targeted as many customers.

"Today marks an unprecedented turn in the history of electricity in California," State Senator Jerry Hill, chairman of the Subcommittee on Energy, Utilities and Communications, said in a letter on Wednesday to the utilities commission. "This situation is not acceptable nor sustainable."

Mr. Hill said PG&E appeared not to have reviewed or learned from the utility that pioneered use of blackouts to prevent wildfires, San Diego Gas & Electric.

The San Diego utility was widely criticized when it first used power shut-offs as a wildfire prevention tool in the late 2000s.

"Our journey began over a decade ago with the devastating wildfires of 2007," said Caroline Winn, chief operating officer for SDG&E. "Those fires became a game changer for our company."

Ms. Winn said there was no blueprint that her company could consult when it created its wildfire prevention program. Among the steps it took early on were hiring a large team of meteorologists, including veterans of the National Weather Service; installing devices that measure weather conditions at various locations in its service area; and using technology that allowed the utility to remotely switch off power to designated areas.

Even though many fire and energy experts credit the company with being proactive and thoughtful, residents and lawmakers in its service area initially expressed frustration with the utility's approach.

"It was met with fierce opposition," Ms. Winn said. "Why are you doing it? Nobody else is doing that."

To address those concerns, Ms. Winn said the San Diego utility conducted town hall meetings and adjusted its efforts by, for example, limiting the size of areas that were blacked out.

The president of the state utilities commission, Marybel Batjer, said PG&E needed to similarly adapt its approach and learn from its mistakes.

"The situation frankly has been unacceptable," Ms. Batjer said at a commission meeting on Thursday while PG&E was still wrestling with its blackouts. "The impacts to individual communities, to individual people, to the commerce of our state, to the safety of our people, has been less than exemplary. This cannot be the new normal. We can't accept it as the new normal. And we won't."

Tim Arango contributed reporting from Los Angeles and David Yaffe-Bellany from New York.

A version of this article appears in print on Oct. 13, 2019, Section A, Page 1 of the New York edition with the headline: Blackout Effort 'Did Not Go Well' For Californians

READ 981 COMMENTS



A PG&E truck outside the Embarcadero substation. (Kevin N. Hume/S.F. Examiner)

Updates: Second wave of PG&E shutdowns rolls into Bay Area; thousands more powerless

Follow along as the planned outages unfold around Northern California

BAY CITY NEWS / EXAMINER STAFF / Oct. 9, 2019 1:30 a.m. / NEWS

Thursday, 12:14 p.m. PG&E officials say all shutoffs are completed, but total restoration of power in all areas could take days. [See related story for latest updates.](#)

Thursday, 1:47 a.m.: PG&E has continued the second phase of its Public Safety Planned Shutoff late Wednesday night and early Thursday morning, with locales in and near the Peninsula, Berkeley, Oakland, San Jose, Santa Clara Valley and the Santa Cruz area losing power.

The second phase of PG&E's shutdown and de-energizing started around 10:15 p.m. Wednesday, PG&E officials said.

According to PG&E's outage website, the new round of outages further south in the San Francisco Bay Area began around 10:45 p.m., with customers in locations affected as far north as Pinole (2,372 customers), as far west as Half Moon Bay (12,491), as far south as Morgan Hill (6,459) and communities

near Watsonville (La Selva Beach – 626) and as far east as an area just south of Livermore (63 customers) and Walnut Creek (2,643) as of 1:30 a.m.

Among the bigger cities and communities affected in the immediate Bay Area by the shutdown: Berkeley (3,537 customers), Oakland (13,365), San Jose (4,295) and Castro Valley (6,144). San Jose Mayor Sam Liccardo tweeted early Thursday that approximately 15,000 homes in Almaden and Evergreen neighborhoods were without power.

South of the Bay in the Santa Cruz County area, the major locales of Santa Cruz (3,793 customers), Scotts Valley (8,694) and Aptos (7,356) have also seen major outages during the second phase.

PG&E officials haven't provided an estimate to when power will be restored and have said it could be out for several days.

Solar customers are also affected by the shutdown.

"When PG&E restores power, rooftop solar systems should re-engage automatically," PG&E officials said in a statement. "Solar systems cannot be powered off a generator as the two technologies do not work together. Customers who have a home battery system paired with their solar system may generally have up to two hours of backup power, depending on the size of their battery."

PG&E officials said the company doesn't reimburse customers for losses during shutdown events "as power will be shut off for safety when gusty winds and dry conditions, combined with a heightened fire risk, threaten a portion of the electric system."

Despite the fact that reimbursement is unlikely, PG&E officials said customers can file claims that are reviewed on a case-by-case basis at any time at https://www.pge.com/en_US/residential/customer-service/help/claims/claims.page.

The University of California at Berkeley and Evergreen Valley College in the southeast San Jose foothills confirmed they will be closed on Thursday.

10:37 p.m.: PG&E officials said they have initiated the power shutoff that was expected Wednesday night in the East Bay, South Bay and Santa Cruz and southern Coastside area, including Half Moon Bay.

As of 10:37 p.m., the shutoffs for those areas had begun and will continue through midnight, PG&E spokesperson Karly Hernandez said.

9:50 p.m.: PG&E launched a new website Wednesday night amid the continuing power shutoff. The website is meant to give customers a chance to find out if they will be affected by the planned outage Wednesday. It allows customers to type in their address for information about whether their power will be shut off. However, in some cases, the answer brings only more uncertainty, saying, for example, "PG&E may need to turn off power for public safety at this address." PG&E's main website had problems Tuesday and Wednesday as customers tried to find out whether the preemptive shutdown was going to affect them.

7:37 p.m.: School districts in both Oakland and Contra Costa county announced school closings for Thursday in due to the Public Safety Power Shutoff that's expected to begin as early as 8 p.m. on Wednesday in the East Bay.

Oakland Unified School District officials said they will close nine schools on Thursday.

Only one school, Skyline High School in the Oakland hills, was closed on Wednesday and will remain closed on Thursday.

The other schools that will be closed on Thursday are Fruitvale, Grass Valley, Montclair, Sequoia and Howard elementary schools, Elmhurst United Middle School, Rudsdale Continuation High School and Sojourner Truth Independent Study.

The school district's 74 other schools will remain open on Thursday.

Pinole Valley High School and Ellerhorst Elementary School, in Pinole, Madera Elementary School in El Cerrito, Olinda Elementary School in Richmond and Kensington Elementary School in the Kensington area of unincorporated Contra Costa County will all be closed on Thursday.

Related: Why San Francisco remains spared

6:55 p.m: Power may be shut down in the East Bay and South Bay anywhere between 8 p.m. and 10 p.m. tonight, including Alameda, Santa Clara and Santa Cruz counties, according to PG&E officials.

PG&E warned that its power lines were close to vegetation that could spur wildfires in high-wind conditions expected to swell through the Bay Area tonight.

Some of that much-warned-of wind did not materialize in some Bay Area counties Wednesday, causing Bay Area residents to cry foul. But in a Wednesday evening press conference, PG&E meteorologist Scott Strenfel said those winds were just late.

"It's a pretty serious situation," he said, because a windstorm via Diablo Winds is on the way.

"Don't get complacent, because the strongest winds are coming tonight," Strenfel said.

PG&E also said it would launch a new website with an interactive map for Bay Area residents to check where power outages would occur. PG&E's original interactive map and website crashed earlier Wednesday due to the crushing loads of web traffic.



PG&E
@PGE4Me

We are experiencing a high volume of traffic to our website & understand your frustration w/ the delay of accessing **#PSPS** related web pages. We apologize for the inconvenience and thank you for your patience. Our team is working as quickly as possible to restore access.



87 11:12 AM - Oct 9, 2019

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Still, the weather has remained somewhat elusive. Though PG&E shut off power for some 513,000 customers early Wednesday in its Phase 1 de-energization plan, its Phase 2 de-energization planned for noon was postponed until later tonight, leaving East and South Bay communities in limbo.

"If the weather doesn't materialize as expected we have the opportunity to abort," Strenfel said, but would need to be iron-clad certain.

PG&E officials are expected to make that call by 9 p.m. at the latest.

Importantly, communities not along the planned shutdown areas may still lose power, as PG&E grids overlap and intersect, utility officials said.

While a total 800,000 customers may see power shut down from the fear of severe winds, PG&E did restore power for some 50,000 customers in the Sierra Foothills that were originally expected to lose power for days, said Sumeet Singh, vice president of assess and risk management at PG&E.

Note, a PG&E customer is analogous to a household, which may contain many people, meaning more than a million people may be affected by this week's power outages.

The utility was able to restore that power by isolating transmission lines from high-risk lines that may be susceptible to causing wildfires. That utility aims to do the same for Humboldt county Wednesday night.

"Due to the large number of outages and potential unknown to the system, it could take several days to fully restore power," Singh warned.

PG&E owns roughly 25,200 circuit miles of overhead distribution line and 5,563 circuit miles of overhead transmission line in wildfire risk areas, according to the utility's records.

PG&E is "on track" to clear roughly 150 miles of overhead transmission lines of vegetation that might pose a wildfire risk this year, Singh said.

4:45 p.m.: Power in Santa Cruz County is expected to be shut off sometime between 8 p.m. and 10 p.m. as part of PG&E's Public Safety Power Shutoff, Watsonville police said.

3:59 p.m.: PG&E opened a “community resource center” with electricity and creature comforts in the parking lot of Merritt College in the Oakland hills Wednesday in an attempt to offset the impact of the Public Safety Power Shutoff, now scheduled to go into effect in the area at 8 p.m.

A large tent was set up to provide shade, air conditioning and bottled water. Inside, there are chairs and tables with electrical outlets so people can charge their phones and devices.

Nany Safford, a resident of the Crown Ridge or Ridgement neighborhood in Oakland, shares information with her neighbors by email, and came to the center to get the latest information about the outage.

Safford is unhappy with the phone number and website PG&E set up to disseminate information about the outage and said the utility has not been effective at getting the word out.

“Their map is not accurate,” Safford said.

She’s also upset with PG&E for what appears to be a very chaotic handling of a potentially dangerous situation caused by inadequately maintained equipment.

“I understand the need for caution, but they also need to be more proactive in recognizing the impacts of their actions,” Safford said.

People across the state have voiced frustration after going to PG&E’s website for information about the outage, only to find that it was not functioning properly.

U.S. Rep. Barbara Lee, D-Oakland, posted a Constituents Guide on Power Outages in the East Bay on Wednesday afternoon advising affected residents to consider staying with a friend where the power is still on and prepare for any health needs involving refrigeration of medication and power for medical devices.

For more information from Lee’s office on how to get through the shutoff, people can go to <https://bit.ly/2Mqlkgw>.

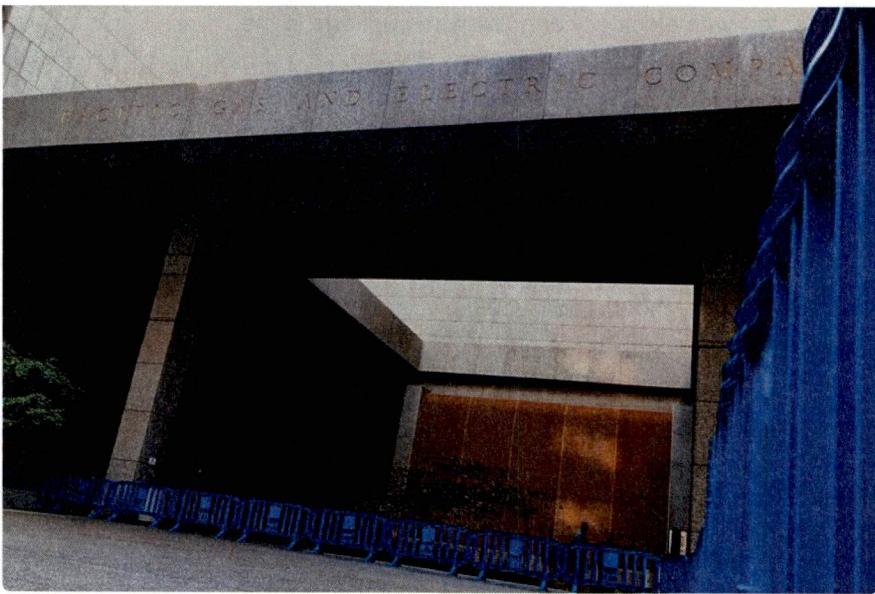
3:02 p.m.: PG&E has placed barricades around the entrance to its San Francisco headquarters on Beale Street. When asked about the barricades and whether the utility had received threats, a spokesperson for the company said “our most important responsibility is the safety of our customers and the communities we serve and our employees.”

“With regard to the barricades in front of our San Francisco offices, it is not uncommon for us to do this to help our employees safely get where they need to go,” said PG&E spokesperson Kristi Jourdan in a statement. “Our employees are working hard to ensure that our system operates safely and that power will be restored quickly after the weather passes.”



Kevin N. Hume
@KevinNHume

Plastic barricades in place outside PG&E headquarters in downtown SF [@sfexaminer](#)



1 2:46 PM - Oct 9, 2019

[See Kevin N. Hume's other Tweets](#)

Earlier Wednesday, the California Highway Patrol told multiple news outlets that a PG&E truck had possibly been shot at in Colusa County. The incident happened at around 8 p.m. Tuesday.

1 p.m.: PG&E's planned Public Safety Power Shutoff, which was expected to impact hundreds of thousands of people across the Bay Area around noon on Wednesday, has been delayed until 8 p.m. in some areas, according to government agencies in the East Bay.

The City of Lafayette and the Town of Moraga have both issued statements on www.nixle.com indicating that PG&E officials have delayed the power outage for about eight hours due to weather conditions, since the anticipated high winds that prompted the National Weather Service to issue a Red Flag Warning have not yet occurred.

The Contra Costa County Fire Protection District confirmed that information, adding that fire danger remains high and urging area residents to be "ultra cautious in ALL outdoor activities & report any fires to 911 immediately," in a tweet around 1 p.m.

9 a.m.: With PG&E's Public Safety Power Shutoff underway Wednesday morning, for the second straight day the utility's website is not accessible for customers to find out the latest information about the shutoff.

For most of Tuesday, PGE's website was down, and the utility had to post maps on Twitter of the affected portions of all 34 counties across the state that would be losing power. The site remained down as of shortly after 7 a.m. Wednesday.

PG&E spokeswoman Kristi Jourdan said their teams had doubled the database capacity on the website earlier this week in anticipation for increased traffic, but that there is seven or eight times the normal traffic on the site.

Jourdan said PG&E is continuing to work to increase server capacity and the number of customer requests the site can handle, as well as developing other ways to communicate outage information.

"Our teams are fully engaged and working on multiple fronts to address the issue as quickly as we can," she said.

According to PG&E, the shutoff is happening in three phases, with power having been shut off in the early morning hours Wednesday to 513,000 customers across 22 counties, including Marin, Napa, Solano and Sonoma counties.

Around noon, an additional 234,000 customers will lose power in the second phase of the shutoff, including those in Alameda, Contra Costa, San Mateo and Santa Clara counties.

A third phase of the shutoff is still being considered for the southernmost part of PG&E's service range.

The decision to turn off power was because of a forecast for dry, hot and windy weather, with peak winds reaching 60-70 mph at higher elevations, according to PG&E.



PG&E crews work to replace telephone poles that were burned by the Camp Fire on Billie Road in the town of Paradise in Butte County on Saturday, Nov. 17, 2018, more than a week after the fire broke out. (Kevin N. Hume/S.F. Examiner)

PG&E workers disassemble broken power lines after the Camp fire ripped through Paradise, Calif., on Nov. 15, 2018. (Joel Angel Juarez/Zuma Press/TNS)

8:30 a.m.: As the first phase of power outages due to PG&E's Public Safety Power Shutoff starts, the number of customers affected in the San Francisco Bay Area has rapidly increased early Wednesday morning.

What started as 20,000 PG&E customers without power across the region has jumped to several thousand more across several locales, per PG&E's outage map.

Solano, Sonoma and Napa counties have been hit the hardest so far, with the cities of Fairfield having 17,963 customers powerless and Vacaville 13,665 as of 2:30 a.m. The city of Napa has been hit hard as well, with 19,357 PG&E customers without power as well. Sonoma has 15,925 powerless, St. Helena 6,685 and Calistoga 3,321.

Outages have also spread to Santa Rosa (8,140 customers), Rohnert Park (2,105), Sausalito (2,564) and Tamalpais-Homestead Valley (2,034). Several unincorporated areas in Napa, Marin, Solano and Sonoma counties have also been hit with power outages.

"We understand the effects this event will have on our customers and appreciate the public's patience as we do what is necessary to keep our communities safe and reduce the risk of wildfire," said Michael Lewis, PG&E's senior vice president of Electric Operations, in a statement.

PG&E officials released a statement early Wednesday citing forecasted winds of 60-70 mph at higher elevations from Wednesday morning until Thursday morning for the start of the shutdowns.

According to the National Weather Service, which issued a Red Flag Warning on Tuesday morning from Wednesday morning until 5 a.m. Tuesday, locations above 4,000 feet are the most likely to see wind speeds above 60 Mph.

PG&E officials didn't provide an exact number of total outages, and referred to its website outage map for up-to-date numbers and locations of customers without power.

Phase No. 1 of the shutdown encompasses the shutdown of power to approximately 513,000 customers in several Northern California counties.

Phase No. 2 is expected to start around 12 p.m. Wednesday and is expected to affect 234,000 more PG&E customers, including those in the more immediate Bay Area, including Oakland and San Jose.

PG&E customers impacted by the shutdown can visit PG&E community resource centers starting at 8 a.m. Wednesday. The centers will be equipped with restrooms, bottled water, electronic-device charging and air-conditioned.

seating for up to 100 people. The utility company said the centers will only be open during daylight hours.

Here is a list of centers in the Bay Area:

In Napa County: Solano County Fairgrounds at 1001 Fairgrounds Dr.

in Vallejo and the Napa County Fairgrounds at 1601 N. Oak St. in Calistoga.

In Santa Clara County: Avaya Stadium, 1123 Coleman Ave. San Jose.

In Contra Costa County: Bishop Ranch Parking Lot, 2600 Camino Ramon, San Ramon.

In San Mateo County: Pasta Moon Restaurant, 845 Main St., Half Moon Bay.

In Solano County: Mission Church, 6391 Leisure Town Rd., Vacaville.

In Sonoma County: Santa Rosa Veterans Memorial Building 1351 Maple Ave., Santa Rosa.

In Alameda County: Merritt College, Lot B, Leona St., Oakland.

In Santa Cruz County, Twin Lakes Church, 2701 Cabrillo College Dr., Aptos.

For more information on outages across the region, visit pge.com/psps or @PGE4ME on Twitter.

Bay City News