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Green Building Specialist
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City Manager's Office

COMMUNITY WORKSHOP: BUILDING ELECTRIFICATION 101

CITY COUNCIL CHAMBERS
FEBRUARY 4, 2020

AGENDA

- Welcome, Introductions, Logistics and Objectives
- Basic Terminology / Local and State Codes
- Why Electrification
- What Other Jurisdictions Have Done
- Considerations for Electrification
- Timeline to Adoption
- Resources
- Q & A
- Workshop Evaluation

MAYOR'S WELCOME

The City of Santa Cruz has declared a climate change emergency

City leaders say urgent action must be taken to combat catastrophic climate change

168 Shares

KSBW8 Updated: 7:12 PM PST Nov 27, 2018

Phil Gomez
Reporter

RESOLUTION NO.

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SANTA CRUZ ENDORSING THE HOUSE OF REPRESENTATIVES' EFFORTS TO ENACT HOUSE RESOLUTION 109, THE GREEN NEW DEAL

OBJECTIVES

1. PROVIDE AN OVERVIEW OF ELECTRIFICATION AND BUILDING ELECTRIFICATION
2. PROVIDE OPPORTUNITY FOR QUESTIONS & ANSWERS
3. PROVIDE MORE RESOURCES AND FUTURE OPPORTUNITIES FOR ENGAGEMENT

DRIVERS TO EXPLORING ELECTRIFICATION

- City Council directed staff to bring back options and align timeline with Monterey Bay Community Power's rollout of support incentives
- Monterey Bay Community Power's Electrification Strategic Plan calls for transportation and building electrification as key emissions reduction strategies for region + incentives
- Contributes to State's carbon neutrality by 2045 target
- Climate Emergency (2018) and Green New Deal (2019) Resolutions

CA HAS AMBITIOUS CLIMATE GOALS, BUT NO POLICY PATHWAY TO ZERO-EMISSIONS BUILDINGS YET

- 40% GHG reduction by 2030

SB 32 (2016)

NEW!

- Electric sector:
- 60% renewable / 2030
- 100% carbon-free / 2045

SB 100 (2018)

NEW!

- Carbon neutrality by 2045

Gov. Exec Order (2018)

NEW!

- 40% GHG reductions in buildings / 2030 (assessment)

AB 3232

NEW!

- $200M incentives for low-emissions buildings and equipment

SB 1477

STATE & LOCAL BUILDING CODES

WHERE: 2019 TITLE 24 PART 6 California Building Code (Title 24 of the California Code of Regulations) governs residential and commercial development

- Part 6 - California Energy Code: Prescriptive or Performance Path
- Part 11 – California Green Building Code (*CAL*Green): Mandatory & Tier1 &2

Updated every 3 years

- Next update: Jan 1, 2023; city adopted 2019 Code in fall of 2019
- City adopts code with local revisions as deemed fit; Energy Code revisions must be approved by the California Energy Commission

Possible modifications to Municipal Code Health and Sanitation Title 6

Base Code Requirements

	2016	2019
Building Electrification	None	Electrification-ready water heating for residential
Electric Vehicle Charging Infrastructure	”EV Capable” parking requirements for single family, multifamily and commercial CALGreen	Same
Solar PV	Solar readiness for single-family, multi-family (up to 10 stories) & low-rise commercial (except healthcare)	+ Mandatory PV for low-rise residential

What is a Reach Code?

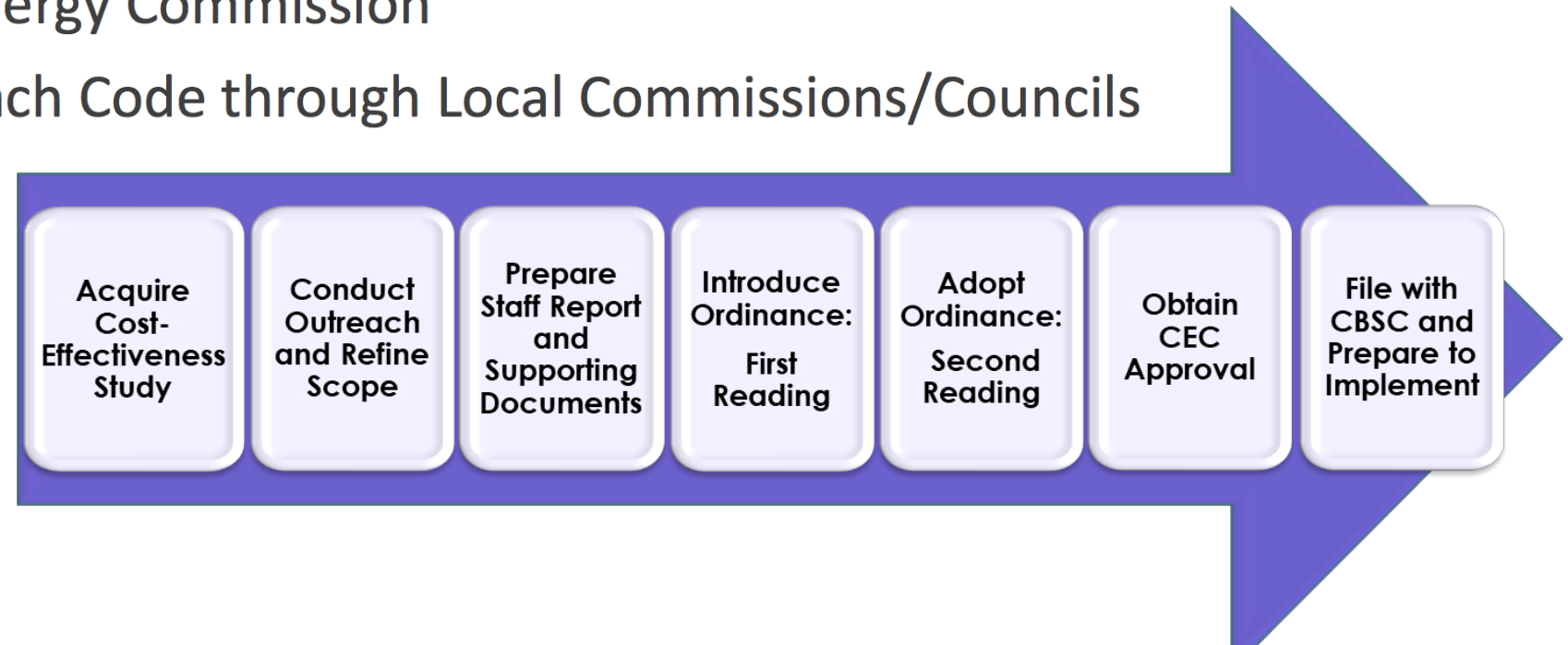
- Overlays the base code
- Includes additional requirements, such as:
  - Energy Efficiency
  - Water Efficiency
  - Renewable Energy
  - EV Charging
  - Electrification

LEGAL REQUIREMENTS FOR LOCAL REACH CODE

- Cost-effective
  - Need cost-effectiveness study that demonstrates that the proposed code pays back for itself over life of building
- Non-preempted
  - Code offers at least one compliance pathway that is cost-effective and uses appliances that do not exceed minimum efficiency levels of federal appliance standards
- Buildings use no more energy than state code
  - Local buildings comply with state code

Reach Code Adoption Process

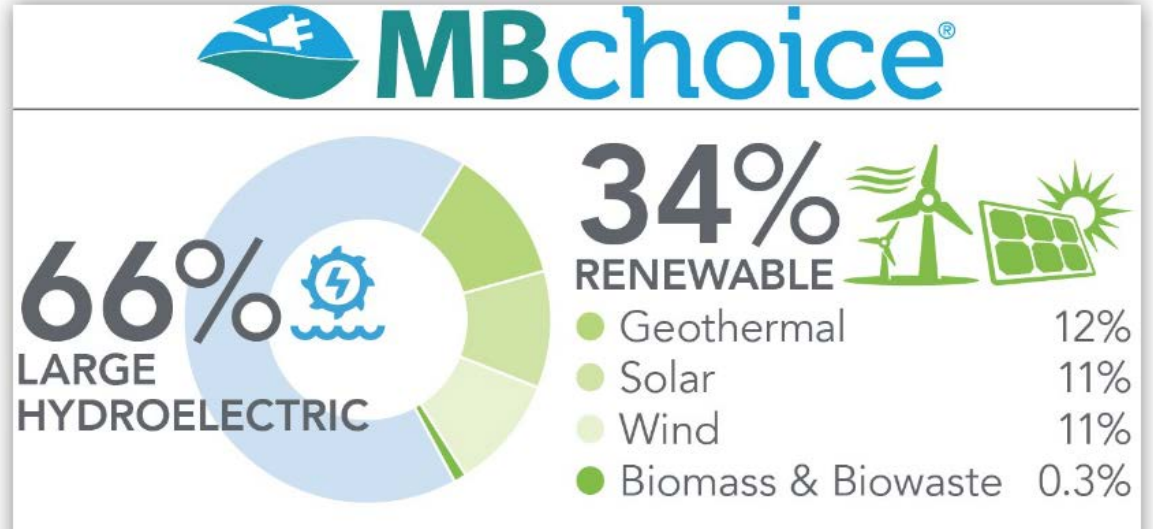
- City Explores Reach Codes
- Evaluate Reach Code Options
- Engage Stakeholders
- Develop Reach Code Ordinance
- Submit Documentation (including Cost Effectiveness studies) to California Energy Commission
- Approve Reach Code through Local Commissions/Councils



WHY ELECTRIFICATION?

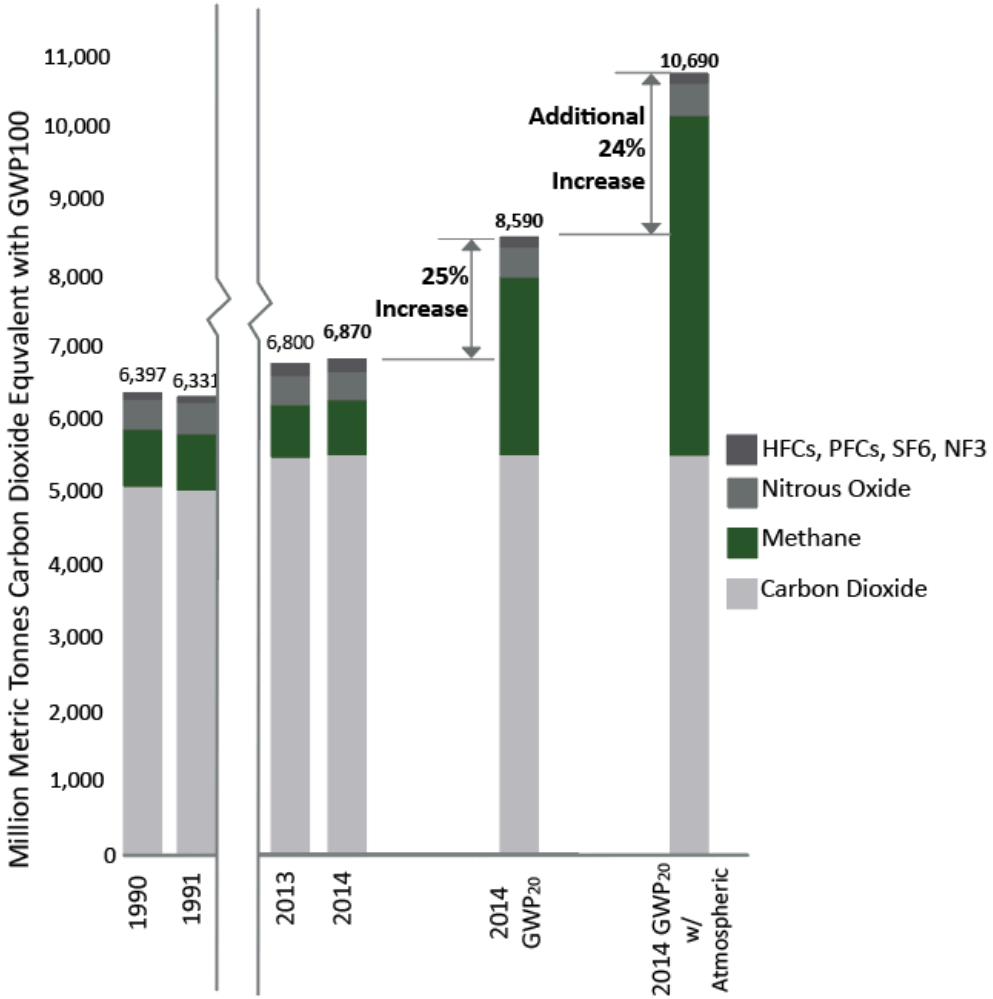
WHY ELECTRIFICATION?

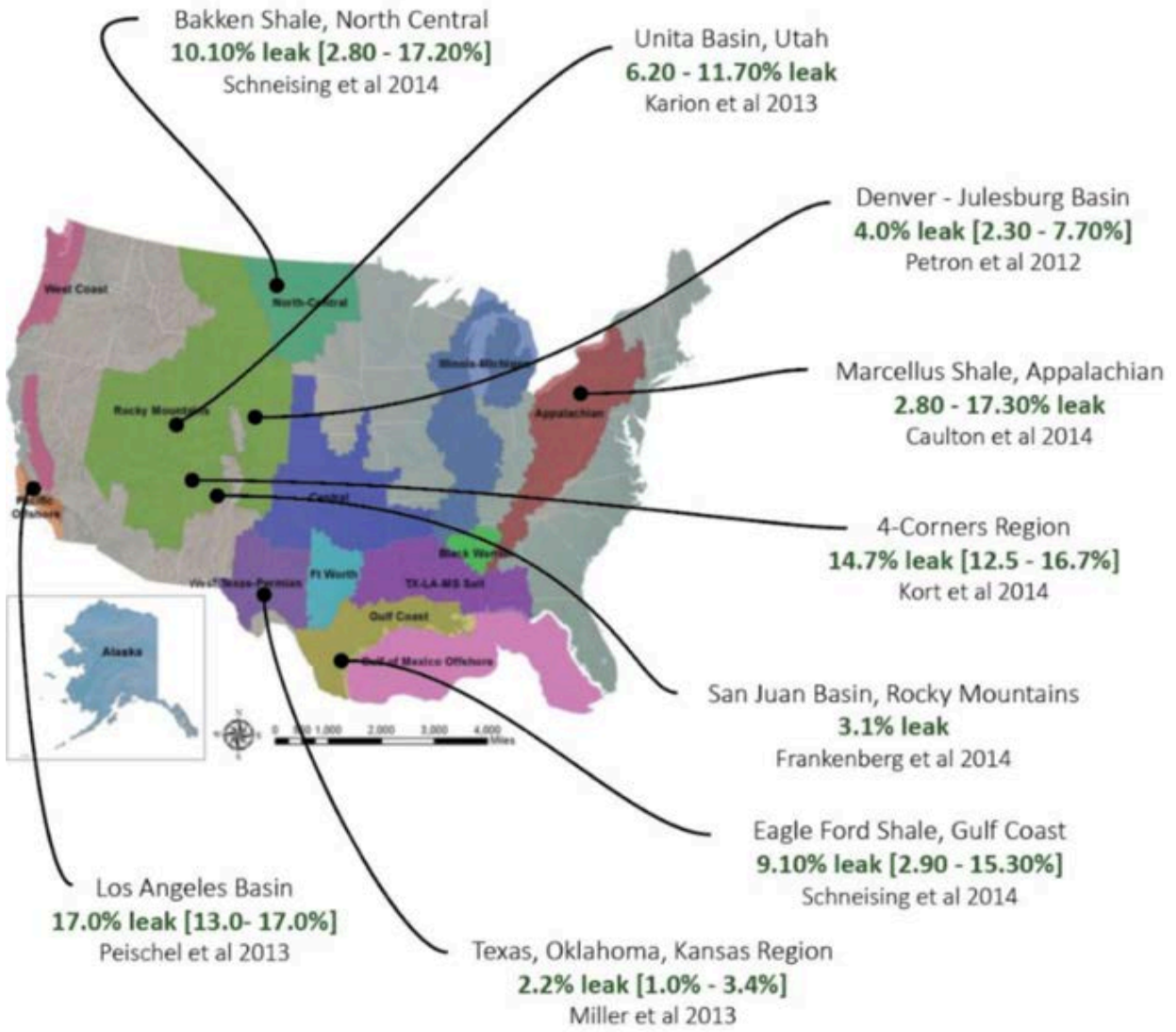
Eliminate natural gas (methane) related emissions by switching appliances and systems to electric powered by carbon-free sourced electricity



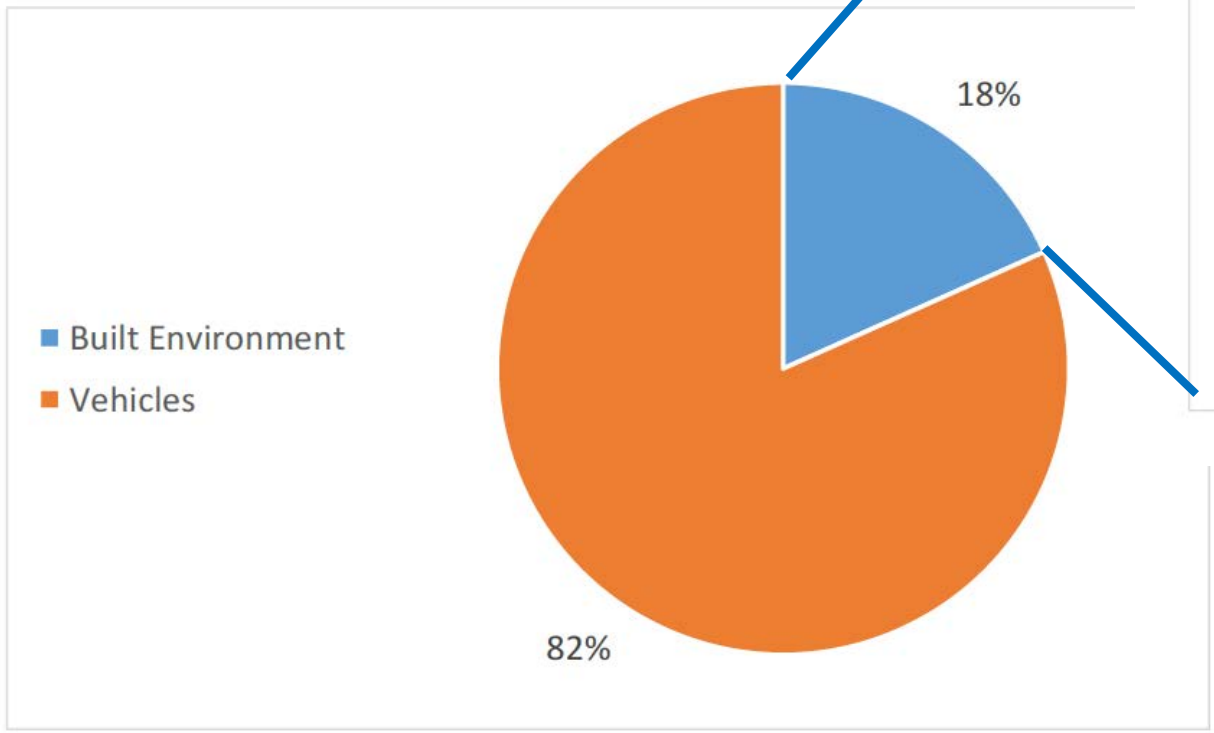
IPCC Update of Methane's Global Warming Potential and New Leakage Data Illustrates Causes of Near Term Climate Change

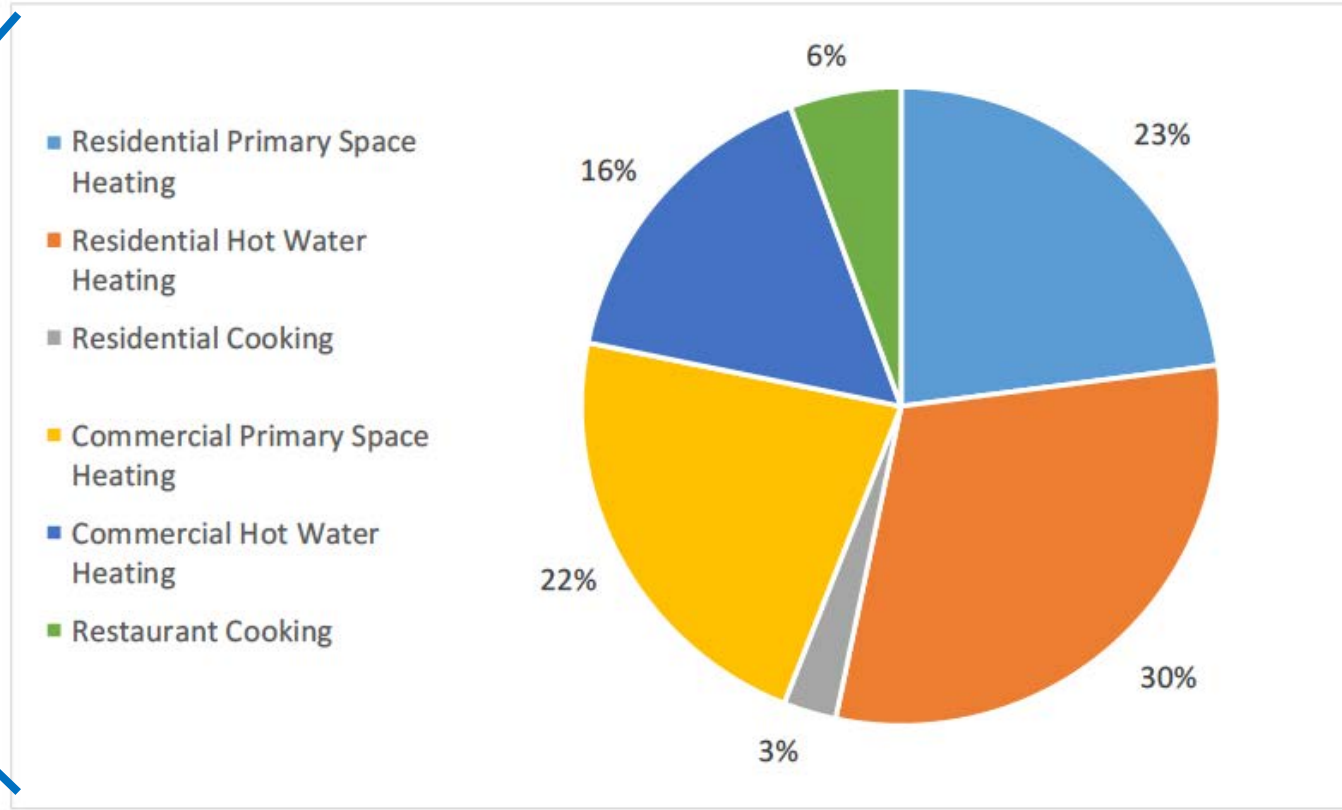
Figure 7: USGHGI Increase with Atmospheric Measurement





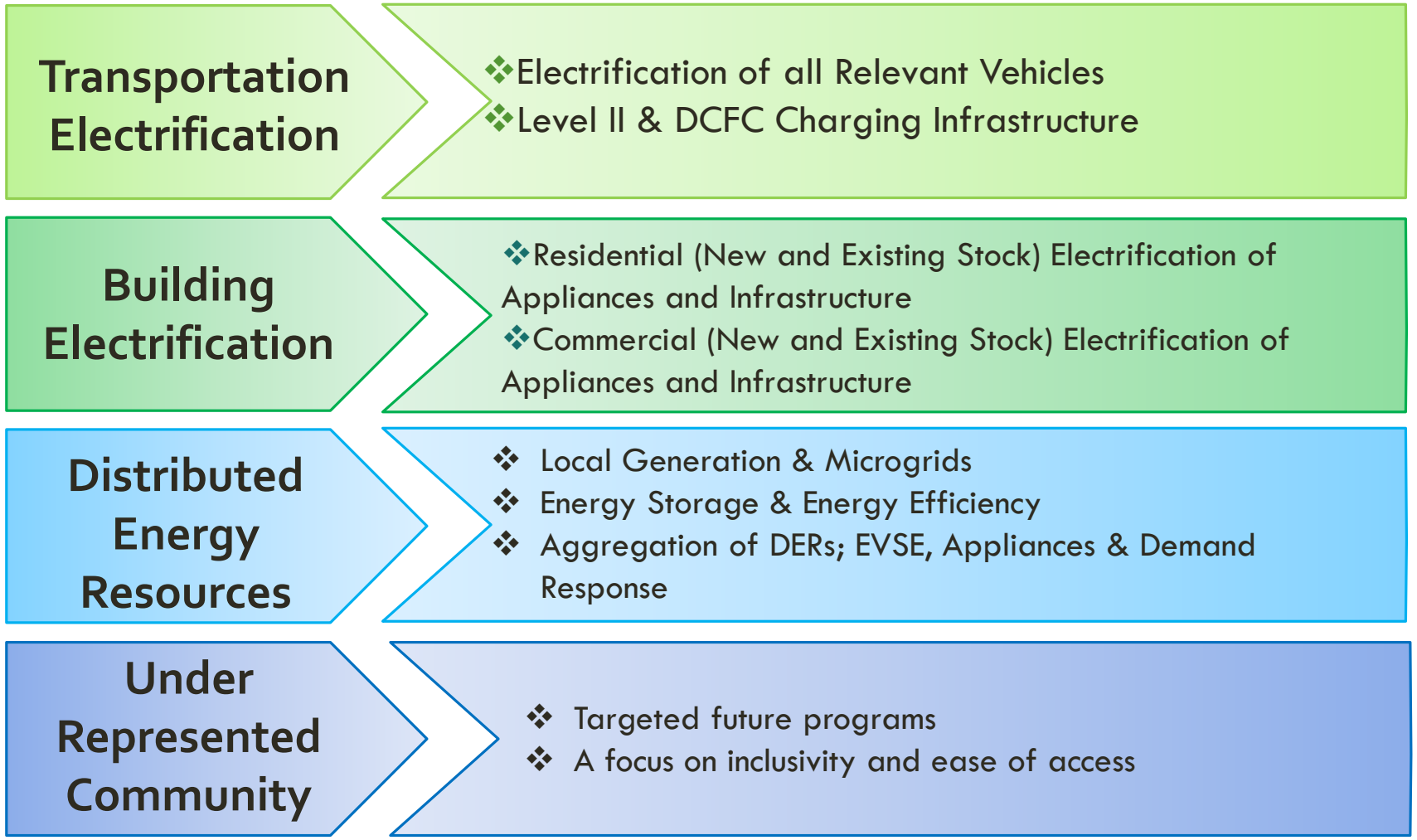
MBCP SERVICE AREA TOTAL ANNUAL GHG BY SOURCE





Monterey Bay Community Power

MBCP ENERGY PROGRAMS POLICY



TRANSPORTATION ELECTRIFICATION

- 20 miles bike lanes, >90% Rail Trail funded
- ~500 JUMP bikes
- Go Santa Cruz transportation demand mgmt platform
- Electrify America electric vehicle charging investment
- 14 public and 20+ fleet electric vehicle charging
- Electric passenger vehicle and bike fleet
- MBCP and Air District: EV and EV charging incentives
- State and Federal EV rebates

WHY **BUILDING** ELECTRIFICATION?

On-site fossil fuel use to create heat and hot water is the largest source of energy use and GHG emissions in buildings across the U.S.

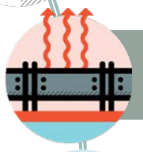
Over 70 million homes and businesses in the U.S. burn fossil fuel on-site for space heating and hot water production

In a typical U.S. city, on-site fossil fuel use in buildings accounts for between **15%-40% of total citywide GHG emissions**

Electrification benefits: not just emissions!

Superior comfort (air source heat pumps)

Air quality and health



Safety and resiliency

Save energy and lower bills*

* Depends on electricity tariffs, rooftop solar, and local conditions

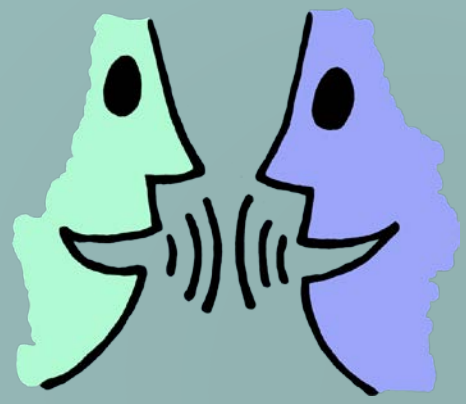
Renewable energy integration

New jobs to retrofit buildings, install heat pumps

Slashes GHGs, path to Zero Emissions Buildings

PARTNER ACTIVITY

>>Think about your home or work building…take 1 minute to introduce yourself to the person sitting beside you and together try to identify at least 3 appliances or building systems that use a combustion flame that could be converted to electric….



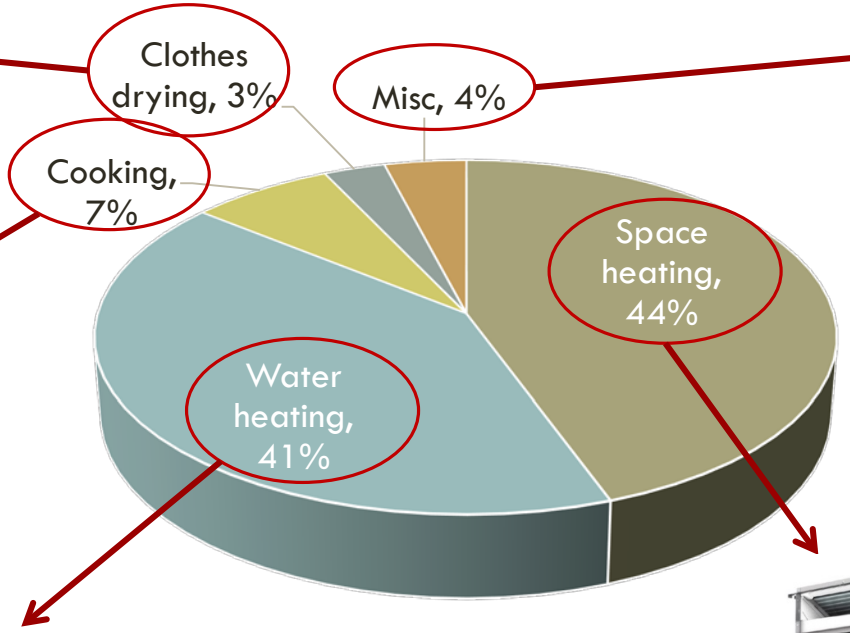
PARTNER ACTIVITY

Heat-pump clothes dryer

Induction or ceramic cooktop

Heat-pump water heater

CA Gas Use in Homes – 2018*



Electric fireplaces

Heat pump space heating

*CEC, 6/14/2018 IEPR workshop

BENEFITS OF BUILDING ELECTRIFICATION

Policy Triggers for California Decarbonization: Explosions

1994: Ruptured gas line after 1994 Northridge Earthquake destroys two homes on Balboa Boulevard, LA. *The Atlantic, Jan 14, 2014.*

2010: Ruptured gas line in San Bruno kills 8, destroys 38 homes, PG&E fined for hiding responsibility. *KPCC News, 2016*.

2015: Aliso Canyon leak sends hundreds of children home from school with mass nose bleeds and vomiting, 12,000 citizens evacuated. *EDF, 2015*.

“Supper Smog” From Gas Stoves

Sean Armstrong: A New Yorker article in April of 2019 about the hidden air pollution in our homes[26] said kitchen air during cooking was so dirty that there is actual smog formation after twenty to thirty minutes of cooking on a gas stove. Was that an exaggeration?

Dr. Brett Singer: If you add pollutants like NO2 from gas stoves to the cooking emissions, it is a mixture of pollutants deserving of a name like “smog,” although that name is already taken by outdoor air pollution.

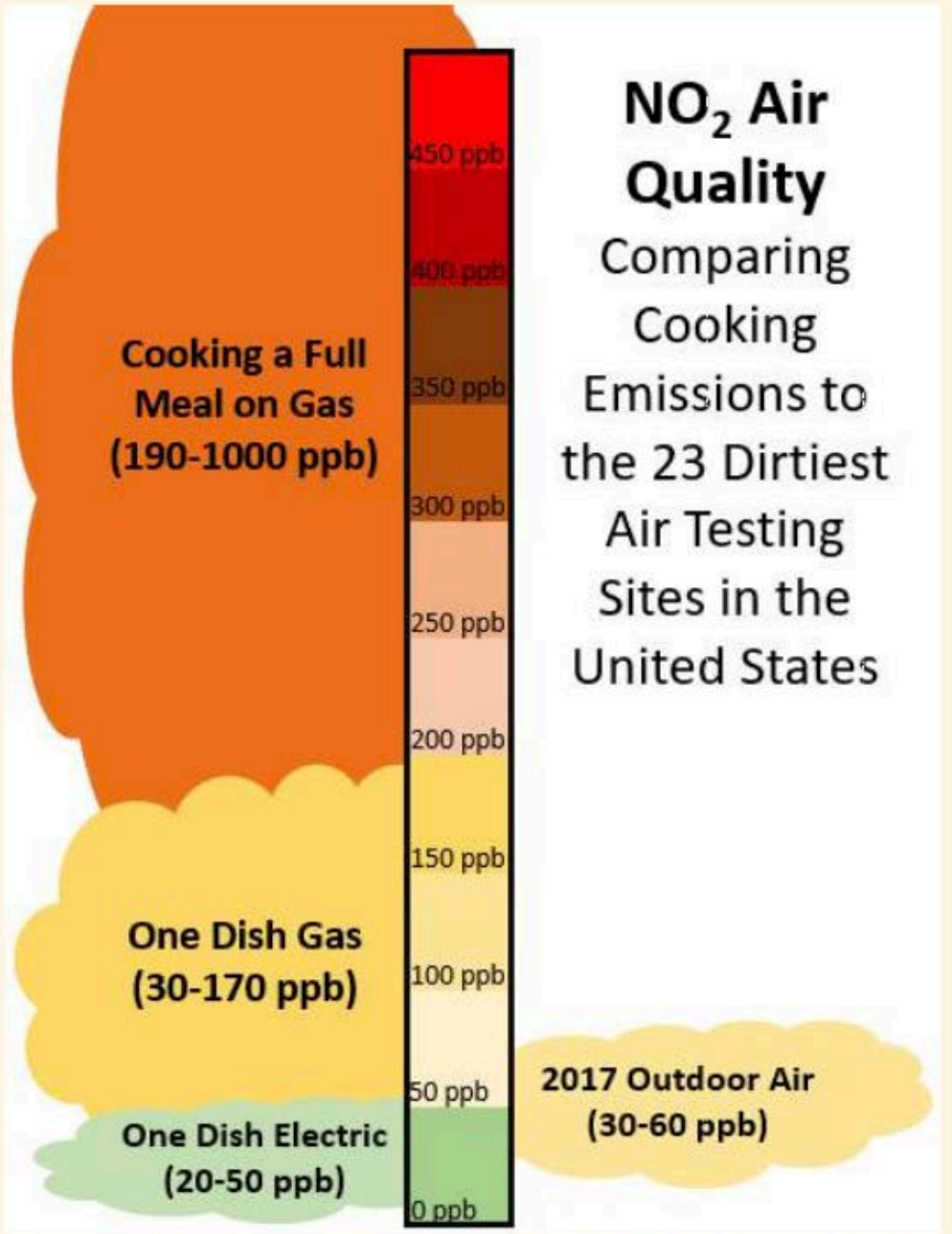


Figure 9: Comparison of 2017 outdoor NO2 air quality data[24] and cooking NO2 emissions for various tests: full meal on gas and single dishes (stir fry, tortillas, French fries)[25].

INDOOR AIR POLLUTION

Carbon monoxide,
Nitrogen dioxide,
Nitric oxide,
Formaldehyde,
Acetaldehyde,
Ultrafine particles…

Air pollution levels in 55 – 70% of homes with gas stoves would be illegal if found outdoors. (LBNL)

Cooking with Gas Can Harm Children:

Cooking with gas stoves is associated with increased risk of childhood respiratory illnesses, including asthma

Andee Krasner, MPH* and T Stephen Jones, MD, MPH

EARLY LIFE

Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children

Weiwei Lin,[1] Bert Brunekreef[1,2] and Ulrike Gehring[1]*

[1]Institute for Risk Assessment Sciences, Utrecht University, Utrecht, The Netherlands and [2]Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht, Utrecht, The Netherlands

Pollutant concentrations and emission rates from natural gas cooking burners without and with range hood exhaust in nine California homes

Brett C. Singer*, Rebecca Zarin Pass, William W. Delp, David M. Lorenzetti, Randy L. Maddalena

Indoor Environment Group, Energy Technologies Area, Lawrence Berkeley National Laboratory, Berkeley CA, United States

California Environmental Protection Agency

Air Resources Board

Residential Cooking Exposure Study Finds Unhealthful Levels

REDUCES ECONOMY-WIDE ENERGY CONSUMPTION

According to several analyses, widespread building electrification in the U.S. will likely increase electricity consumption, but will decrease total economy-wide energy consumption when including the net decrease of fossil fuels.

Increased Electricity Consumption

- A recent scenario analysis by NREL suggests that that widespread deployment of electrification technologies (including EVs, heat pumps, etc.) could **increase 2050 U.S electricity consumption by 20-38%**

+

More Efficient Technologies

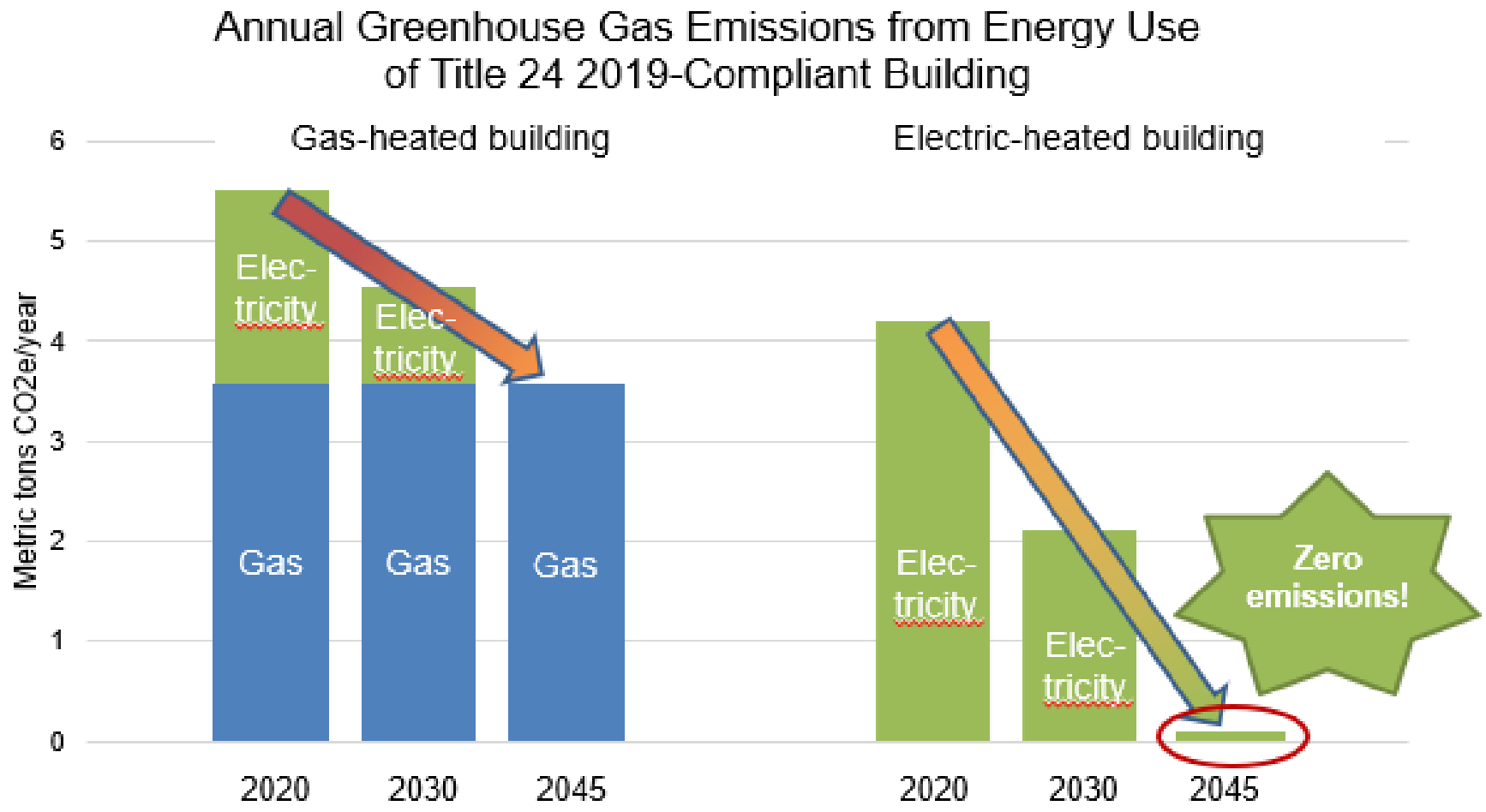
- Since electrification technologies are highly efficient, the quantity of electricity required to produce a specified output (e.g. heat an average home) is less energy intensive than the quantity of energy required to produce the same output through direct combustion of fossil fuels.

=

Decreased Economy-Wide Energy Consumption

- Despite the increase in *electricity* consumption from electrification, NREL's analysis suggests that the efficiency of electrification technologies (along with overall improvements in appliance and building efficiency) could result in **13-21% lower final energy consumption.**

Electrification Offers Pathway To Zero Emissions Buildings Sector



NRDC analysis, climate zone 13 (Fresno) with rooftop solar. Including methane leakage

Electrification improves affordability

Building all-electric saves +1,500 to $6,000 in construction costs.

Residents save $4,000-$10,000 on utility bills over 20 years.

Adding solar lowers utility bills by an additional $500 per year.

Gas rates rising. Utilities expect 24-46%% rate hike between 2019-2022

PG&E

SoCalGas

A Sempra Energy utility®

Source: E3 Study 2019 and Synapse 2018

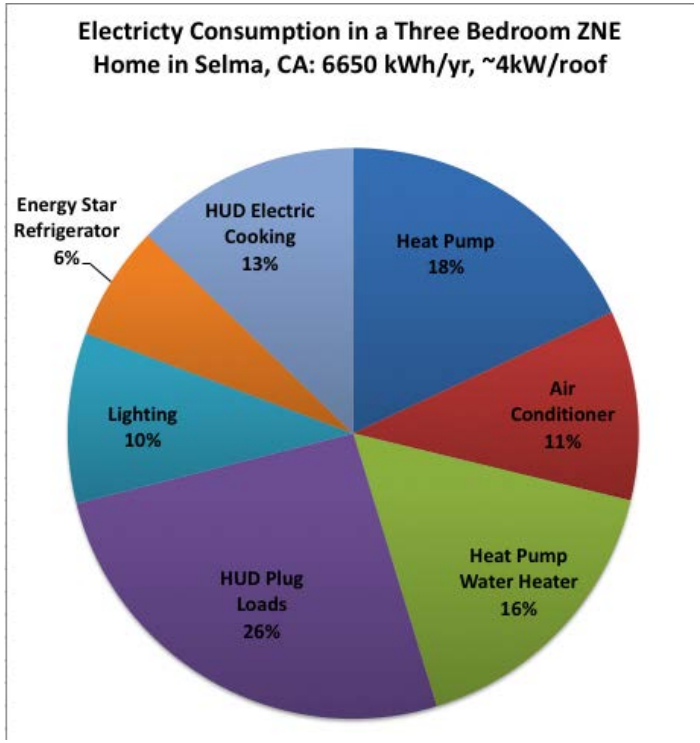
WHAT DOES BUILDING ELECTRIFICATION LOOK LIKE?

Modern electric equipment

	Space Heating	Water Heating	Cooking	Clothes Drying
Residential				
Commercial				

The New Valley View Homes of Selma, CA

PSH1BG iQ Drive® | Maytag® M1200 up to 19 SEER, 10 HSPF Heat Pump



RETROFIT-READY HVAC—1200W AT 120V

MITSUBISHI ELECTRIC

COOLING & HEATING

JP SERIES 115 VOLT SYSTEMS

PRODUCT LAUNCH GUIDE

Product Overview

The new JP Series offers a 115 volt product perfect for replacement of window air conditioning units or existing 115 volt systems. This product comes standard with a remote controller and remote control holder.

RESIDENTIAL HEAT PUMP WATER HEATERS

Sanden CO2	**Rheem** Prestige Hybrid	**AO Smith** Voltex Hybrid	**Bradford White** AeroTherm	**Steilbel Eltron** Accelera
				
Split heat pump water heater	Hybrid (WIFI option adds $150/tank)	Hybrid	Hybrid	Hybrid

U.S. Government

Federal law prohibits removal of this label before consumer purchase.

ENERGYGUIDE

Water Heater – ELECTRIC

Tank Size (Storage Capacity): 59 gallons

Uniform Energy Factor: 3.7

Rheem Sales Company, Inc.

Model XE65T10HD50U1

B00150

Estimated Yearly Energy Cost

$161 ELECTRI

C

$225 — $732

Cost Range of Similar Models

The estimated yearly energy Cost of this model was not available at the time the range was published.

First Hour Rating

(How much hot water you get in the first hour of use)

very small	low	medium	high 75 Gallons

Estimated Yearly Electricity Use

- Your cost will depend on your utility rates and use.
- Cost range based only on models fueled by electricity with a high first hour rating (75 gallons and over)
- Estimated energy cost is based on a national average electricity cost of 12.00 cents per kWh.
- Estimated yearly energy use: 1341 kWh

ENERGY STAR

www.ftc.gov/energy.

Part No AX4258

U.S. Government

Federal law prohibits removal of this label before consumer purchase.

ENERGYGUIDE

Water Heater – Natural Gas

Tank Size (Storage Capacity): 46 gallons

Rheem Sales Company, Inc.

Modei ECORHE50

B00007

Estimated Yearly Energy Cost

$231 GA

S

$225 — $297

Cost Range of Similar Models

First Hour Rating

(How much hot water you get in the first hour of use)

very small	low	medium	high 87 Gallons

Estimated Yearly Energy Use

- Your cost will depend on your utility rates and use.
- Cost range based only on models fueled by natural gas with a high first hour rating (75 gallons and over)
- Estimated energy cost is based on a national average natural gas cost of $1.09 per therm.
- Estimated yearly energy use: 212 therms

ENERGY STAR

www.ftc.gov/energy.

Part No. AX4258

Load Sharing Between Dryers, Water Heaters and Cars with the Dryer Buddy and NeoCharge

CONDENSING WASHER/DRYERS 1400W AT 120V

Make And Model	**Magic Chef** MCSCWD20W3	**Haier** HLC1700AXW	**Summit** SPWD2201SS	**Deco** DC4400CV	**LG** WM3488HW	**Whirlpool** WFC8090GX
						
Price	$720	$1,000	$1,000	$1,200	$1,300	$1,500
kWh/year	85 kWh/year	65kWh/year	65kWh/year	96kWh/year	120 kWh/year	180kWh/year
Drum Capacity (cu. ft.)	-	2.0	2.0	3.5	2.3	2.8
Volts/Amps	-	120V/10A	115V/12A	110V/15A	120V/15A	240V/30A

EXISTING GREEN BUILDING PROGRAM

- Water Use Reduction
- Building Material Supply Chain Impacts Reduction
- Improves Occupant Health Outcomes
- Improves Building Longevity
- Reduces Maintenance Costs
- Improves Disaster Resiliency
- Increases Waste Diversion Rate
- Educates & Optimizes All-Electric Design
- Reduces Cost of Ownership
- Leads by Example

HYATT REGENCY

WAIKIKI BEACH RESORT AND SPA

Spa and Pool Heated with a Heat Pump

An All-Electric Resort

WHAT ARE OTHER JURISDICTIONS DOING?

OTHER JURISDICTIONS HAVE ADDRESSED

1. Electric-preferred and All-electric buildings
2. All-electric retrofit ready buildings
3. Additional solar PV requirements and/or carbon in lieu of fees
4. Natural Gas prohibitions
5. Additional electric vehicle charging requirements

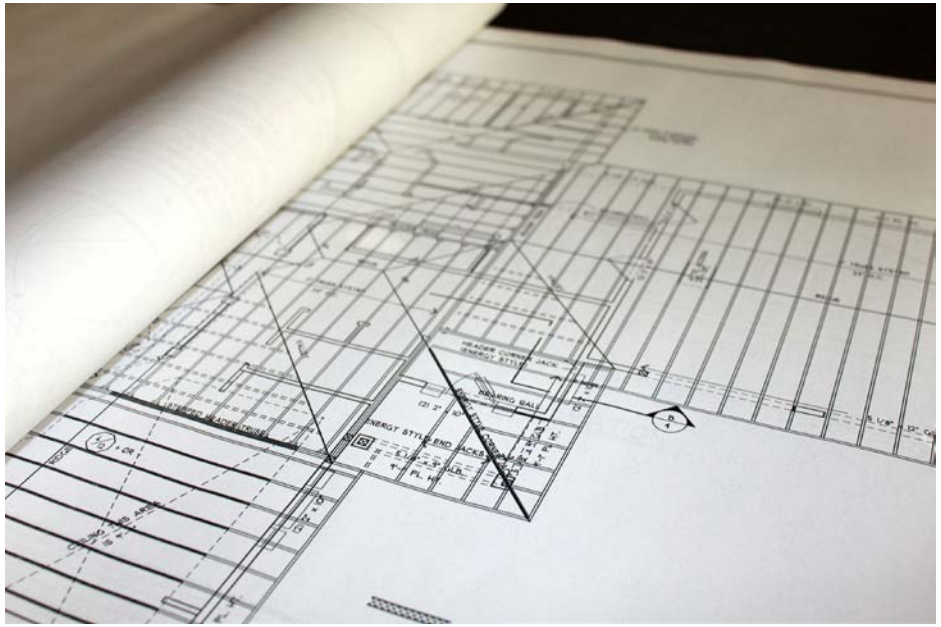
BERKELEY BANS GAS PIPING FROM BUILDING PERMITS FOR PUBLIC SAFETY AND CLIMATE CHANGE : AUGUST 6, 2019

OTHER JURISDICTIONS

Natural Gas Infrastructure Moratorium	Alameda, Berkeley, Carslbad, Morgan Hill, San Francisco, San Jose
All Electric Reach Code	Brisbane, Carlsbad, Cupertino, Healdsburg, Los Altos Hills, Los Gatos, Menlo Park, Mountain View, Pacifica, Palo Alto, Santa Rosa, Saratoga, Windsor
Electric Preferred	Berkeley, Davis, Marin County, Mill Valley, Milpitas, Palo Alto, San Francisco, San Jose, San Luis Obispo, San Mateo, Santa Monica

CHALLENGES TO ELECTRIFICATION

POTENTIAL BARRIERS



1. Availability of equipment
2. Training, experience and availability of qualified designers and installers
3. Potential high GWP factor of refrigerant in heat pumps
4. Environmental justice concerns over who pays for legacy natural gas infrastructure
5. Potential upgrades to the electricity distribution grid
6. Others?

WHAT ABOUT PUBLIC SAFETY POWER SHUTOFFS?

- New water heaters, stoves and heaters **all have electric ignitions since pilot lights are no longer legal.** As a result, they do not work when the electricity is off regardless of their primary fuel source.
- Gas stoves can sometimes be lit with a match during a power outage; however the **exhaust fan will not work** making the stove unsafe to operate.
- All-electric appliances can easily be set up to **use a backup power source** including generators or solar-powered batteries.
- Heat pump water heaters, like other tank-style water heaters **hold substantial amounts of hot water,** ready to use in case of service disruption.
- Gas negatively impacts disaster recovery time. Not only are gas lines and leaks a dangerous liability during fires, **gas service typically take longer to get operational again** after a safety shutoff or disaster-related inspection and repair, compared to electricity.

TIMELINE TO ADOPTION

OUTREACH THRU FEBRUARY

Community Workshop 1: Building Electrification 101

>>Feb. 4 | City Council Chambers | 6 – 7:30 pm

City Council Study Session

>>Feb. 18 | City Council Chambers | 1 – 3:30 pm

Developer's Roundtable

>>Feb. 26 | Civic Auditorium Tony Hill A, B C Room | 3:30 – 5 pm

Community Workshop 2: Bldg Electrification Policy Options

>>Feb. 27 | Downtown Main Library Community Room | 6 – 7:30 pm

Electrification Coffee Talk with Trades, Vendors, Designers and Builders

>>Feb. 11 – March 10 | 11th Hour Coffee | 8:30-9:30 am

ADOPTION PROCESS

PLANNING COMMISSION

>>March 5 | City Council Chambers | 7 pm

CITY COUNCIL – FIRST ORDINANCE HEARING

>>March 24 | | TBD time

CITY COUNCIL – SECOND ORDINANCE HEARING

>>April 7 | City Council Chambers | TBD time

BUILDING ELECTRIFICATION EXPO AT EARTH DAY

>>April 18 | San Lorenzo Park | 11 am – 4 pm

CALIFORNIA ENERGY COMMISSION APPROVAL OF REACH CODES

>>April – June, 2020

IMPLEMENTATION = ???

OTHER RESOURCES

- FAQs
- BERKELEY'S HOME ELECRIFICATION FACT SHEET: ELECTRIC INDUCTION COOK TOPS
- BERKELEY'S HOME ELECRIFICATION FACT SHEET: ELECTRIC HEAT PUMP WATER HEATERS
- SANTA CRUZ ELECTRIFICATION RESOURCES (IN DEVELOPMENT)
- SANTA CRUZ BUILDING ELECTRIFICATION OPTIONS FACT SHEET (IN DEVELOPMENT)
- SANTA CRUZ BUILDING ELECTRIFICATION OPTIONS – GHG SAVINGS ESTIMATES (IN DEVELOPMENT)

FY 19-20 Building Electrification Program Options

Affordable Housing/Multi-Unit Dwelling Electrification Grants ($1.2M)

- **Goal:** Provide a grant for developers to build new, all-electric housing
- **Progress**: Collecting stakeholder feedback to influence program design
- **Anticipated Launch:** Early 2020

Heat Pump Hot Water Heater Rebates for residential customers ($60K)

- **Goal:** Incentivize homeowners to electrify their water heater
- **Anticipated launch:** Early Summer

Monterey Bay Community Power

Q & A

QUESTIONS

1. PLEASE PASS YOUR QUESTIONS TO THE FRONT FOR ANSWERING
2. IF WE DON'T KNOW THE ANSWER TO YOUR QUESTION, WE WILL ANSWER IT IN THE FUTURE AND UPDATE THE FREQUENTLY ASKED QUESTIONS LIST.

PLEASE DO NOT FORGET TO COMPLETE AND SUBMIT THE SHORT MEETING EVALUATION FORM

THANK YOU + QUESTIONS?

Kurt Hurley
Green Building Specialist
khurley@cityofsantacruz.com | 8.31.420.5124

Dr. Tiffany Wise-West
Sustainability and Climate Action Manager
twise-west@cityofsantacruz.com | 831.420.5433

https://www.facebook.com/SantaCruzClimateAction/

FY 19-20 Resiliency for Residential Customers

Provide back up storage to low-income homes and MUDs and pilot a virtual power plant for the homes above that are receiving storage. ($1M)

- **Goal:** support MBCP's most vulnerable customers
- **target customers**:~20k CARE, Medical Baseline, & solar in high fire risk areas
- **Process:**
  - Develop program criteria, structure, and turnkey process
  - Contract with VPP company
- **Anticipated launch:** Mid 2020

FY 19-20 Other Programs

SmartConnect Microgrids at Critical Facilities

- Goal: Provide $25M to support resiliency and back up generation at critical facilities

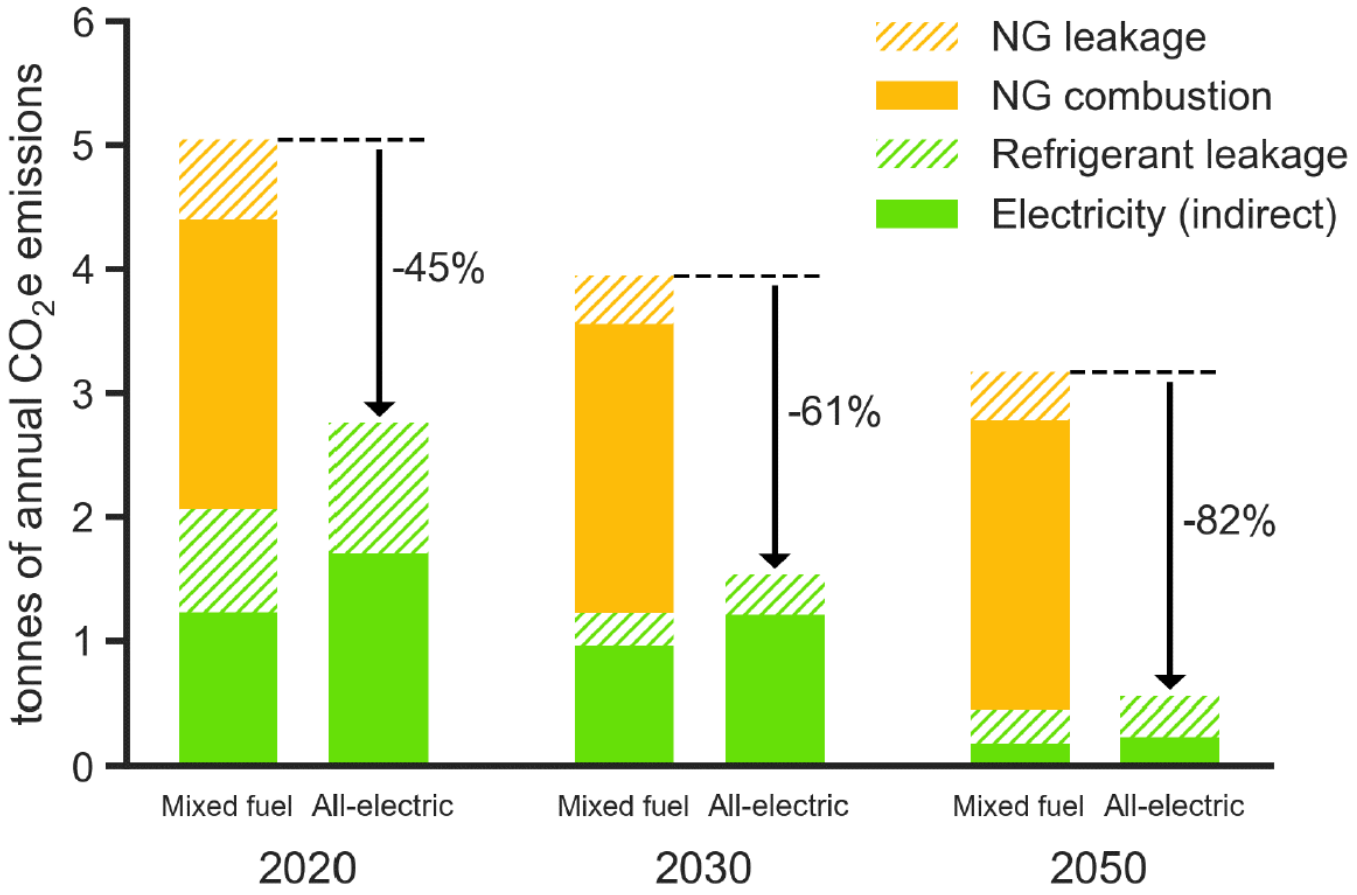
- Progress: Staff is currently working with emergency preparedness organizations, local public agencies, and other stakeholders in the above counties to identify critical facilities that are likely to be impacted by the PSPS.
- Anticipated Launch: Early 2020

Reach Code consulting

- Goal: Contract with a consultant team that will provide resources, education and assistance to jurisdictions interested in adopting Reach Code
- Anticipated launch: Early 2020

REFRIGERANT LEAKAGE

Figure 3-1: Annual GHG emissions from a 1990s vintage single family home for Sacramento



FY 19-20 Transportation Program Updates

Central Coast Incentive Program – CALeVIP ($7M)

- Goal: accelerate EV adoption through greater EV infrastructure across the tri-county region
- Launched October 30, 200+ Applications so far
- $5M Provisionally Reserved in Day 1
- **Monterey**: $2,167,000 provisionally reserved; 72% of total funds
- **Santa Cruz:** $3,317,00 provisionally reserved; 97% of total funds
- **San Benito:** $254,000 provisionally reserved; 45% of total funds

Fund Electric School Buses ($1.2M)

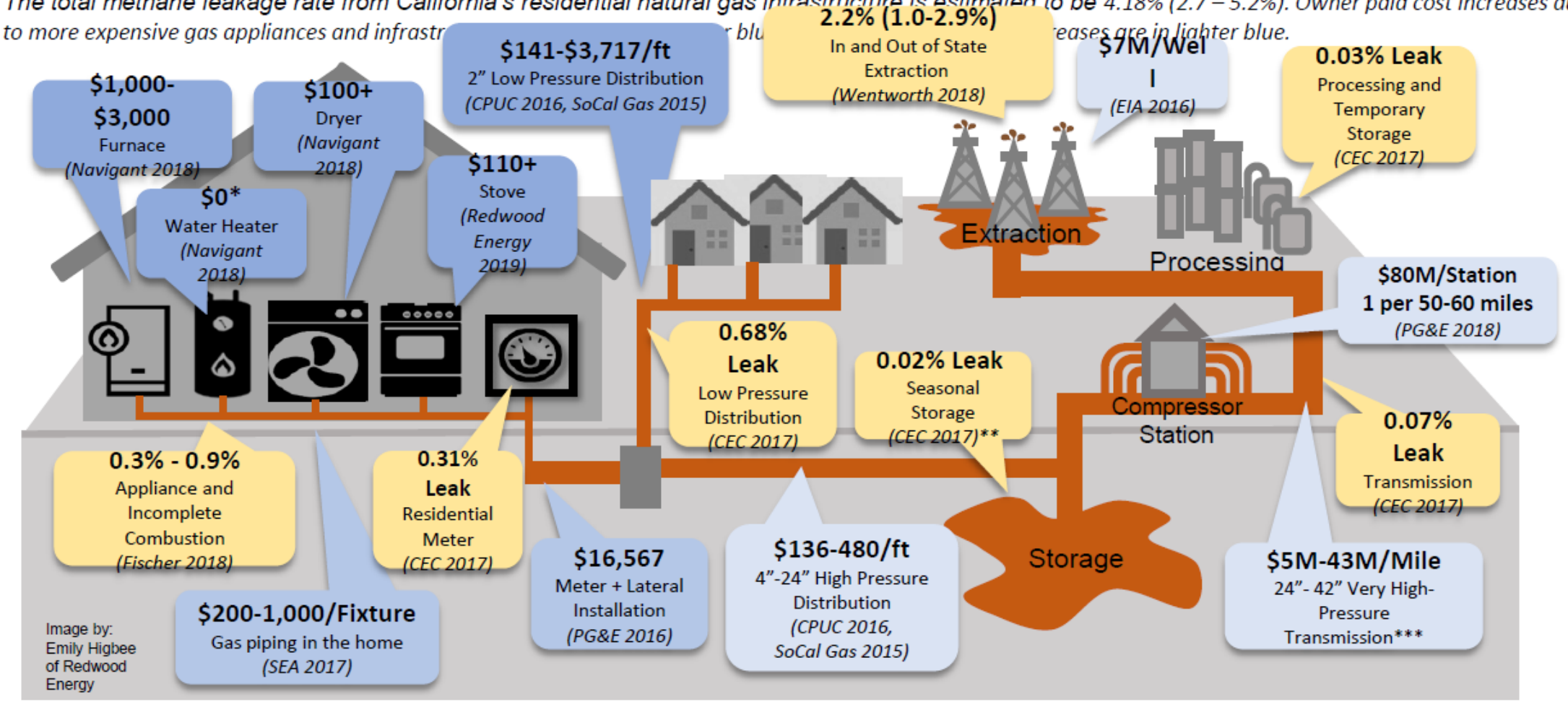
- Goal: replace fossil-fuel powered school buses with electric buses
- Funding distributed via MBARD's Zero Emissions School Bus Program
- Progress: Working on MOU with MBARD
- Anticipated Launch: Early 2020

Rebate for Home Chargers ($160K)

- Goal: Provide rebates to individuals for the purchase of a home charger as well as rebates for panel upgrades if needed
- Anticipated launch: Early Summer

Residential Natural Gas Infrastructure Costs and Methane Leakage: $25,000+ per home, 2.7%-5.2% leakage

The total methane leakage rate from California's residential natural gas infrastructure is estimated to be 4.18% (2.7 – 5.2%). Owner paid cost increases due to more expensive gas appliances and infrastr… blu… eases are in lighter blue.



Appliance costs are the marginal cost ($) of gas over all-electric
*heat pump water heater equal in cost to on demand gas water heating
**Aliso Canyon leaked 4.62 Billion cubic feet and alone cost $1.014 billion shared by 5.6 million meters - $181/meter cost (Reuters, Aug 6, 2018)
*** Average of various sources *(Cochran 2018, Lennon 2019, SoCalGas 2014, Nemec 2015, Nogueras 2011)*

Property Owner / Developer Costs in BLUE

Gas Leakage by Segment in YELLOW