West End Library Electrification Project
• Built in 1936
• Designed by Carl Werner
• Funded by a WPA grant
• City of Alameda Historical Register
Goals of Electrification Project:

| Create a Cooling Center for community use during heat waves. |
| Address air quality issues resulting from fire and provide a Clean Air Center when needed. |
| Convert energy usage from gas to electric. |
Cooling Center Creation

• Mitsubishi Electric HVAC
• Two five-ton units with variable speed motors
• Provides continuous air circulation and filtration
• Removal of allergens, bacteria, and pollutants
<table>
<thead>
<tr>
<th>Clean Air Center Creation</th>
<th>13 MERV system installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filters smoke out of the air as it enters the library filtration center</td>
<td></td>
</tr>
<tr>
<td>Process: outside air to filter to ionizer to MERV system</td>
<td></td>
</tr>
</tbody>
</table>
Gas to Electric Conversion

- Gas furnace replaced with an electric plenum
- No fossil fuel is used to heat or cool the building
- AMP uses only non-hydrocarbonation fuel sources
<table>
<thead>
<tr>
<th>Final Steps</th>
<th>Window sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weather stripping of main entrance doors</td>
</tr>
<tr>
<td></td>
<td>Estimated completion March 18</td>
</tr>
</tbody>
</table>
Electrification 101

City of Alameda
March 16, 2022
Workshop Objectives

• What is the city doing and where are we going?
• What is building electrification?
• What technologies are available?
• What are the costs and available incentives?
• Real world examples
Alameda Climate Action and Resiliency Plan (CARP)

- Reduce emissions by 50% below 2005 levels by 2030
- Achieve net zero emissions as soon as possible, no later than 2030.
- Climate adaptation
  - flooding, sea level and groundwater rise, drought, extreme heat, hazardous air quality, and earthquakes/liquefaction.
Alameda’s Emissions

- Transportation: 70%
- Building Energy: 27%
- Other: 3%

100% Clean Energy
Alameda Building Electrification Efforts

• In 2019, City Council passed an ordinance limiting natural gas infrastructure in residential projects on city-owned land
• In 2020, City Council passed an ordinance requiring new development citywide to be all electric, with certain exceptions
• Published “Electrifying Existing Residential Buildings in Alameda” report in 2021
• In 2022, developing a roadmap to equitably electrify all existing buildings in Alameda
Electrification Technology

- Heat pump water heaters
- Heat pump heating/cooling
- Electric dryer
- Induction Stove
Other Steps for a Green Healthy Home

- **Solar and/or batteries**: Great opportunity to plan for electrification and increase resiliency.
- **Seismic retrofit**: Protect your investments and reduce damage to your home or business during an earthquake.
- **Electric vehicle and charging**: Reduce pollution from transportation & lifetime cost of driving.
- **Mold, asbestos, and lead paint removal**: Promote health and safety in the home.
Four Elements of Electrification Roadmap

<table>
<thead>
<tr>
<th>Alameda Municipal Power</th>
<th>Policymaking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing</td>
<td>Education &amp; Outreach</td>
</tr>
</tbody>
</table>
Roadmap Principles

- Everyone, especially low to moderate income households, should be able to affordably switch to modern electric equipment
- Electrification policy should also support housing and anti-displacement policy
- The electrification process should be as simple and seamless and possible
- Our timelines should be fast but be realistic about challenges and other priorities
Existing Building Electrification Workshop

Safer, healthier and more affordable buildings

Technology and Policy Considerations

March 16, 2022
Presentation Overview

Agenda

1. Technology and feasibility
2. Costs
Technology and Feasibility

The all-electric Integrated Genomics Laboratory, Lawrence Berkeley Labs.

Source: Rutherford + Chekene
Let’s define existing building electrification (a.k.a. electrofits)

<table>
<thead>
<tr>
<th>What</th>
<th>Why</th>
<th>How</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use electricity instead of fossil fuel</td>
<td>• Solar and wind power are GHG-free</td>
<td>• Electric appliances</td>
<td>• Local, state, federal government</td>
</tr>
<tr>
<td>• For all end uses</td>
<td>• Converting solar or wind power to other fuel types is inefficient</td>
<td>• Complimentary measures (e.g. efficiency, load management, low-GWP refrigerants)</td>
<td>• Utilities</td>
</tr>
<tr>
<td>• In residential, commercial, and some industrial</td>
<td>• Lower-cost, lower risk decarbonization pathway</td>
<td>• Minimizing electrical upgrades</td>
<td>• Air Quality management districts</td>
</tr>
</tbody>
</table>
Electrification, Compared to Fossil Fuels

- Carbon-free

### 2020 POWER CONTENT LABEL

**Alameda Municipal Power**

[https://www.alamedamp.com](https://www.alamedamp.com)

<table>
<thead>
<tr>
<th>Greenhouse Gas Emissions Intensity (lbs CO₂e/MWh)</th>
<th>Energy Resources</th>
<th>Standard</th>
<th>Alameda Green</th>
<th>2020 CA Utility Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Alameda Green</td>
<td>2020 CA Utility Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>95</td>
<td>466</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eligible Renewable¹</th>
<th>Standard</th>
<th>Alameda Green</th>
<th>2020 CA Power Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass &amp; Biowaste</td>
<td>21.5%</td>
<td>21.5%</td>
<td>33.1%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>42.9%</td>
<td>42.9%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Eligible Hydroelectric</td>
<td>3.4%</td>
<td>3.4%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Solar</td>
<td>0.1%</td>
<td>0.1%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Wind</td>
<td>5.3%</td>
<td>5.3%</td>
<td>11.1%</td>
</tr>
</tbody>
</table>

| Coal                | 0.0%     | 0.0%          | 2.7%              |
| Large Hydroelectric | 26.9%    | 26.9%         | 12.2%             |
| Natural Gas         | 0.0%     | 0.0%          | 37.1%             |
| Nuclear             | 0.0%     | 0.0%          | 9.3%              |
| Other               | 0.0%     | 0.0%          | 0.2%              |
| Unspecified Power²  | 0.0%     | 0.0%          | 5.4%              |

**TOTAL**

100.0% 100.0% 100.0%

**Percentage of Retail Sales Covered by Retired Unbundled RECs³:**

0% 100%

Source: [Alameda Municipal Power](https://www.alamedamp.com)

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Electrification, Compared to Fossil Fuels

- Carbon-free
- Lowest-cost, lowest-risk pathway

Sources: 1) AB3232 Decarbonization Assessment 2021 2) CA Energy Commission 2018 3) CPUC 2021
Electrification, Compared to Fossil Fuels

- Carbon-free
- Lowest-cost, lowest-risk pathway
- Healthier indoor air

Sources: RMI 2020, CEC 2019
Electrification, Compared to Fossil Fuels

- Carbon-free
- Lowest-cost, lowest-risk pathway
- Healthier indoor air
- Job creation

Sources: UCLA 2019, UMass 2021
California Buildings Gas Usage

Residential:
- Water Heating: 49%
- Space Heating: 37%
- Cooking: 7%
- Pool Heating: 4%
- Clothes Drying: 3%

Non-Residential:
- Water Heating: 32%
- Space Heating: 36%
- Misc: 9%
- Cooking: 23%

2009 Residential Appliance Saturation Survey
2006 California Commercial End Use Survey
Equipment

- Space Heating
- Water Heating
- Cooking
- Clothes Drying

Residential

Commercial
Low-Cost Options

Space Heating

Cooking
Equipment Efficiency

Energy Efficiency Comparison of Technology
Typical Energy Factors

- Natural Gas: 0.8
- Heat Pump: 3.5
- Resistance / Induction: 1

- Space heating, Water heating, Clothes drying
- Cooking, High-Intensity Industrial Processes
Electrifying Existing Single Family Homes in Alameda – The Cost Story

Capital and whole-building energy costs of thermal systems are based on Statewide Utility Codes and Standards Program report, using AMP D-1 and PG&E G1 rates (March 2022).

Rate escalation is based on May 2021 CPUC staff En-Banc analysis.

TECH incentives are based on https://energy-solution.com/tech-incentives/.


---

**Summary**

**All-Electric Home, No Incentives**
- **Capital:** $4,016 ↑
- **Energy:** $6/mo ↓

**All-Electric Home, With Incentives**
- **Capital:** $2,184 ↓
- **Energy:** $6/mo ↓

---

**Space Heater**
- **Capital:** $501 ↑, assuming air-conditioning also installed
- **+TECH:** $2,499 ↓

**Clothes Dryer**
- **Capital:** $313 ↑
- **+AMP:** $213 ↑

**Water Heater**
- **Capital:** $2,594 ↑
- **+TECH:** $506 ↓

**Range**
- **Capital:** $608 ↑

**Gas Meter & Service Not Needed**
- **Capital:** ? ↑
- **Energy:** ? ↓

**TECH Incentive of $3,100 for Heat Pump WH**

**TECH Incentive of $3,000 for Heat Pump SH**
Natural Gas Costs Climbing

CA residential natural gas prices increased 3x faster than electricity prices from 2012 to 2018

Trend expected to accelerate:

The AB3232 Report represents the most current CEC research supporting that Aggressive Electrification is the primary pathway to meeting GHG reduction targets.
Will I Need Larger Electrical Service?

What is the minimum panel size would you need to electrofit a 2,500 ft² home, including 240V 30A EV charging?

A. 60A  
B. 100A  
C. 200A  
D. 400A

Source: Josie Gaillard, Courtney Beyer
Thank you!

Farhad Farahmand, PE
Senior Project Manager, TRC
Ffarahmand@trccompanies.com
Background- AMP

Manage and safely provide reliable, cost effective, and environmentally friendly electric services for a sustainable Alameda

AMP History:
- AMP was established in 1887
- Oldest municipal electric utility in CA
- Community owned
- Locally controlled

AMP Highlights:
- 100% clean electricity
- 20% lower rates than neighboring utilities
- Demonstrated leader in building and transportation electrification programs

The City of Alameda is a small island community in the heart of the San Francisco Bay Area

- 80,000 residents
- 22.8 square miles
- 36,000 total customer accounts
How will Building Electrification affect AMP?

The customer group that is predicted to have the largest load increase is **Residential**.
Building Electrification is also expected to contribute to an increase in Alameda’s **peak demand** from 62 MW to over 80 MW in 2045.
Benefits of Building Electrification

**Customer overall utility costs**
- Lower net gas and electric bills when switching from gas to electric heat pump for space & water heating

**AMP electric bills**
- Customers eligible for expanded Tier 1 allowance on D1H rate
- Potential Time-of-Use rate for all-electric homes

**Health & safety risks from gas**
- NOx indoors (asthma) & outside (smog)
- Carbon monoxide poisoning
- Explosions in pipelines and homes

**Environmental impact of gas**
- Global warming from CO₂ in exhaust
- Methane (GHG) leaks
- Fracking impacts
AMP’s Rebates and Incentives
Residential Rebates

Building Electrification Rebates
• Electric Clothes Dryer - $100
• Heat Pump Water Heater - $1,500
• Smart Thermostats- $50
• LED Bulbs - $2
• Electric Panel Upgrade- $2500

AMP Marketplace
User-friendly online shopping for energy-efficient electric appliances, equipment, and devices
Panel Upgrade

- Up to $2500
- Covers permit, installation, labor costs
- Must be electrifying at least one appliance in the home (water heater, dryer, or space heating)
- AND installing an additional electrical appliance
  - EV charger can count as the second appliance
- Must be permitted
- Must work with engineering department
- Must be from 100amps to 200amps
Other Incentives

- **TECH Clean California**
  - Rebate paid to contractor and then passed to customer
  - Gas to HPWH:
    - HPWH < 55 gallons: $1,600
    - HPWH < 55 Gallons: $2,300
    - ERWH to HPWH: $1,500
    - Panel upgrade incentive: $0
  - Current TECH contractors:
    https://switchison.cleanenergyconnection.org/tech-clean-california-contractors

Bay Area Regional Energy Network (BayREN):
  - Energy Efficiency Rebates before you electrify
    - Attic and wall insulation
    - Duct sealing and insulation
    - Air sealing
  - Free Consultation With a Home Energy Advisor
    - Call (866) 878 - 6008
  - BayREN Contractor Database
    - Submit rebate applications for you!
    - includes Tech Clean California Partner Contractors
All about the EVs

• Level 2 EV Charger: $800
  – Permit, installation, cost of the charger
• Used EV: $2000 and $3000 for income qualified
  – Rebate for Used EV’s up to $22,000
• State and Federal Incentives: https://www.alamedamp.com/349/Electric-Vehicles

• Interested in learning more about EVs?
  - Upcoming webinar April 19th about EV and EV charging
Abbe-Patterson Project
Electrification of Existing Single-Family Home Built in 1903

Existing home had:

3 bedrooms/2 bath
1,550 square feet

Solar panels
Electric stove/oven
Electric car charger

Gas furnace circa 1950s
Gas dryer
Gas water heater
New Project – ADU + All Electric Conversion

500 square foot accessory dwelling unit
- Induction stove/oven

Chiltrix – Air to Water Heat Pump
- Electric furnace & water heater

Electric dryer
Unfinished Basement
Old Furnace + Water Heater
New Furnace + Water Heater
New Dryer
New Panel, Induction Stove
Project Contractors

Norman Sanchez Architect
Monterey Energy Group
Sunrise Construction
TEC Electric
AT Weber Plumbing
Next Steps

- Visit www.alamedaca.gov/BuildingElectrification
- Take our survey!
- Attend more workshops and give your input to the roadmap
Workshop Series

- Electrification 101
  - April 6 @ Main Library

- Roadmap Brainstorm
  - March 28: For Renter
  - March 30: For Property Owners & Management
  - April 4: For Single Family Home Owners

- Draft Roadmap + Ordinance
  - April 27: Draft Roadmap + Ordinance Review
  - May 4: Draft Roadmap + Ordinance Review @ Main Library
  - April 3-15: Interactive brainstorming poster board @ Library
Thank you! Questions?