Building Decarbonization Workforce Needs and Recommendations

Analysis of 100% building decarbonization goal in California
I. Market Analysis

II. Industries Affected
- Equipment Manufacturing
- Renewable Energy Construction
- Electricity Generation and Distribution
- Building Electrification
- Gas Distribution

III. Estimated Impact
- Increase in Direct Employment by Sector
- Job Quality

IV. Distribution of Impact
- Decrease in Direct Employment by Sector
- Worker Retention and Transition

V. Recommendations
Building Market Analysis

Number and size of buildings in California

- Residential
  - Single Family
  - Duplex
  - Mobile
  - Multifamily

- Commercial
  - Small & Medium
  - Large & MUSH
    (Municipal, University, School, Hospital)

Saturation of gas by end use

- Water Heating
- Space Heating
- Cooking
- Clothes Drying
- Pool/Spa/Other
Residential Gas Use by End Use

<table>
<thead>
<tr>
<th></th>
<th>single family detached</th>
<th>single family attached</th>
<th>2-4 units</th>
<th>5+ units</th>
<th>mobile homes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pool, Spa, Other</td>
<td>140.87</td>
<td>2.57</td>
<td>2.22</td>
<td>3.69</td>
<td>-</td>
</tr>
<tr>
<td>Cooking</td>
<td>187.83</td>
<td>17.28</td>
<td>21.73</td>
<td>48.25</td>
<td>8.70</td>
</tr>
<tr>
<td>Dryer</td>
<td>101.74</td>
<td>6.21</td>
<td>4.58</td>
<td>7.11</td>
<td>4.13</td>
</tr>
<tr>
<td>Hot Water</td>
<td>1,271.76</td>
<td>131.44</td>
<td>134.90</td>
<td>275.30</td>
<td>73.81</td>
</tr>
<tr>
<td>Space Heat</td>
<td>1,195.49</td>
<td>42.79</td>
<td>57.69</td>
<td>74.62</td>
<td>62.56</td>
</tr>
</tbody>
</table>
Building Retrofits and Manufacturing

Photo Credit: EESI.org

Photo credit: AssemblyMag.com
**Estimate Investment Required**

<table>
<thead>
<tr>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance Costs</td>
</tr>
<tr>
<td>Panel Upgrades</td>
</tr>
<tr>
<td>Energy Efficiency</td>
</tr>
<tr>
<td>Installation Labor</td>
</tr>
</tbody>
</table>

Calculate electrification retrofit costs by building market segment and by industry.

**Residential**
- Single Family
- Duplex
- Mobile

**Multifamily**

**Commercial**
- Small & Medium
- Large & MUSH (Municipal, University, School, Hospital)

**Stand-Alone**

**District Energy**

**IMPLAN**
Electricity Generation and Distribution

Photo credit: Energy Institute at Haas

Photo credit: Locus Energy
Estimate Increase in Demand for Electricity

- Estimate new electricity demand due to electrification
- Convert to new generation capacity required
  - Solar
  - Wind
  - Other
- Estimate rate impacts by category
  - Production
  - Distribution

IMPLAN
JEDI (IMPLAN)
Gas Job Loss
Estimate reduction in demand for gas

Estimate reduced residential and commercial gas demand

Estimate rate impacts by category
  - Production
  - Distribution

Number of all-electric new residential buildings

Estimate cost savings associated with all-electric new construction

IMPLAN
Workforce Needs

64,000 – 104,000 per year
Estimated Workforce Needs by Year (100% building electrification by 2045)
Distribution of Jobs by Job Quality

- Large Commercial + MUSH Construction
- Utility Employment
- Electricity Construction + Generation

- Residential + Small Commercial Construction
High Road
- Competition driven by skill, performance, qualifications
- Higher paying jobs
- More skilled workforce
- Higher compliance
- Career ladders

Low Road
- Competition driven by cost primarily
- Lower paying jobs
- Less skilled workforce
- More frequent labor law and code violations
- Low barriers to entry/High turnover
High-Road Workforce Development Recommendations

- Demand for Workers
- Training of Workers
- Worker Retention and Transition
Recommendations

1. Engage with the local building trades council
2. Lead with M.U.S.H.
3. Focus on aggregated community-scale efforts
4. Condition incentives and rebates on skill standards
5. Vet contractors based on qualifications and worker skill
6. Explore district energy pathways to building decarbonization

7. Focus training on stackable credentials available for workers (rather than contractors)
8. Support workforce partnerships aimed at increasing access to career-track jobs

9. Support a planned and orderly transition
10. Support a fund for worker retention and transition assistance
Distribution by Owner or Renter Occupied

- Single family homes:
  - Renter-occupied: 8 million
  - Owner-occupied: 6 million

- 2-4 unit apartments:
  - Renter-occupied: 1 million
  - Owner-occupied: 1 million

- 5-9 unit apartments:
  - Renter-occupied: 1 million
  - Owner-occupied: 1 million

- 10+ unit apartments:
  - Renter-occupied: 2 million
  - Owner-occupied: 2 million

- Mobile homes/other:
  - Renter-occupied: 1 million
  - Owner-occupied: 1 million

Total:
- Renter-occupied: 18 million
- Owner-occupied: 16 million

Axis Title:
- Million Homes
California Commercial Buildings by Floor Space

Million Square Feet

- Miscellaneous
- Large Office
- Health Care
- Colleges
- School
- Lodging
- Retail
- Warehouse
- Refrigerated Warehouse
- Small Office
- Restaurant
- Grocery

Floor Space:
- 0
- 200
- 400
- 600
- 800
- 1000
- 1200
- 1400
- 1600
- 1800