The Smart House of the Future

AEE West

Jim Lazar, Senior Advisor
The Regulatory Assistance Project (RAP)®
About RAP

- Global NGO
- Offices in US, Europe, China, India
- Training and technical assistance to utility regulators and policymakers
- Extensive publications available:
  - www.raponline.org
About Jim Lazar

- First rate case: 1974
- Expert in >100 dockets
- RAP Senior Advisor
- Author:
  - *Electricity Regulation in the US: A Guide*
  - *Smart Rate Design For A Smart Future*
  - *Teaching the Duck to Fly*
  - *Electric Cost Allocation for a New Era*
The Smart House
Efficient Building Code
High-efficiency Heat Pump with Air Exchangers
ICE STORAGE
Smart Charging Electric Vehicles

PEAK DEMAND (KW)

6.6
Grid-Integrated Heat Pump Water Heater

PEAK DEMAND (KW)

4.4
Smart Appliances

Major Appliances

Peak Demand (KW)

4.5
Uncontrolled Household Loads Could Add Up To A Lot

![Diagram showing peak demand in kW]

- Lights / Minor Appliances: 3 kW
- Major Appliances: 4.5 kW
- Water Heat: 4.4 kW
- EV: 6.6 kW
- Space Conditioning: 4 kW

Total Peak Demand: 22.5 kW
Flexibility Dramatically Cuts Peak Demand
Shift EV, Water Heat, Major Appliances, and Pre-Condition Spaces

![Graph showing peak demand reduction](https://electriqpower.com/powerpod/)

Image credit: https://electriqpower.com/powerpod/
Essential Changes Needed

- Utility rate design
- Smart storage plans
- Appliance standards
- Building codes
- Consumer education
Principle #1

- A customer should be allowed to connect to the grid for no more than the cost of connecting to the grid.
Principle #2

Customers should pay for power supply and grid services in proportion to how much they use, and when they use it.
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Customers should pay for power supply and grid services in proportion to how much they use, and when they use it.
Principle #3

Customers delivering power to the grid should receive full and fair value—no more and no less.
# Smart Rate Design

## Cost to Connect to the Grid

<table>
<thead>
<tr>
<th>Billing</th>
<th>$/mo</th>
<th>$</th>
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<tbody>
<tr>
<td></td>
<td>$ 4.00</td>
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</table>

<table>
<thead>
<tr>
<th>Line Transformer</th>
<th>$/kVA/Mo</th>
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<tbody>
<tr>
<td></td>
<td>$ 1.00</td>
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</table>

## Bi-Directional Grid and Power Supply

<table>
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<tr>
<th>Period</th>
<th>$/kWh</th>
<th>$</th>
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<tbody>
<tr>
<td>Off-Peak</td>
<td>$ 0.07</td>
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<tr>
<td>Mid-Peak</td>
<td>$ 0.09</td>
<td></td>
</tr>
<tr>
<td>On-Peak</td>
<td>$ 0.14</td>
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<tr>
<td>Critical Peak</td>
<td>$ 0.74</td>
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</table>
Smart Storage Plans

- Green Mountain Power Program
Appliance Standards

- Air conditioners / heat pumps
- Water heaters
- Laundry equipment
- Dishwashers
- Spas and pool pumps
Controlled Water Heaters

The CTA 2045 socket enables any control network to connect to any new water heater.
Laundry Equipment

- Already pretty smart:
  - Load size sensor
  - Wash time sensor
- Coming Soon:
  - “Economy” wash when energy rates are low.
Building Codes

- Higher Efficiency (IECC, 2021)
- On-site production required (California, 2020)
- Zero Net Energy (California, Commercial, 2030)
Consumer Education

- Understandable rates and policies
- Software enabled
- User-friendly
- Consumer protection
Summary

- The smart house is here.
- They will get smarter.
- We need to get smarter.
- The result will be lower costs, better reliability, and less environmental harm.
About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

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