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Beneficial Electrification: The Basics

EESE Board, Concord, New Hampshire

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Introduction

The Regulatory Assistance Project is a global, non-profit, non-advocacy team of veteran regulators advising current regulators on energy sector issues. (www.raponline.org)
Analysis of Consumer and Marginal Costs for Electric and Natural Gas Space and Water Heat in Single Family Residences in Puget Sound Power and Light Company Service Territory

Prepared Pursuant to inter-agency agreement between Public Counsel Section of the Office of the Attorney General of Washington State and Washington State Energy Office


September, 1989

DIRECT USE OF NATURAL GAS FOR RESIDENTIAL SPACE AND WATER HEAT COMPARED TO GAS-FIRED ELECTRIC GENERATION FOR HYDRO-FIRMING

THERMODYNAMIC, ECONOMIC, AND ENVIRONMENTAL IMPACTS

PREPARED FOR ASSOCIATION OF NORTHWEST GAS UTILITIES Portland, Oregon

Jim Lazar Consulting Economist Olympia, Washington
Fuel Choice – 1989

- Wind and solar were not viable economic resources
- Best heat pumps had a coefficient of about 2
- Heat pump water heaters were not commonly available
- Best natural gas generating plants had about 42% conversion efficiency
Fuel Choice Today

- Wind and solar are coming in at two and three cents per kWh
- Modern heat pumps and heat pump water heaters have COPs of 3 or better in mild climates, and improving results in cold climates
- New gas generation is as much as 62% efficient, converting gas to electricity when wind not blowing and sun not shining
- Modern technology enables load control
December 2017
Xcel bid median prices $/kWh

SOLAR

$.029

WIND

$.018
Existing plants vs. Excel bids

Existing Plant Average Fuel and O&M from USEIA Table 8.4 Electric Power Annual 2016

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Fuel</th>
<th>O&amp;M</th>
<th>Xcel Bids</th>
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<tbody>
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<td>Coal</td>
<td>$.037/kWh</td>
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<tr>
<td>Gas</td>
<td>$.030/kWh</td>
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<tr>
<td>Nuclear</td>
<td>$.025/kWh</td>
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<td>$.029/kWh</td>
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<td>Solar</td>
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<td>$.018/kWh</td>
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<td>Wind</td>
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Innovative & Efficient End Uses – Electrification Is Underway

Photo credits: EPA Energy Star / Cassandra Profita/OPB/EarthFix
Efficient Building Code
High-efficiency Heat Pump with Air Exchangers
Ice Storage
Grid-Integrated, Heat-pump Water Heater
Battery Storage
Smart Charging
Electric Vehicles
Still Connected to the Grid
What’s “Beneficial Electrification”? 
Isn’t ALL Electrification “Beneficial”?
Beneficial Electrification (BE) Better Positions Utilities for the Future

1. Saves Customers Money Long-Term; More Services
2. Reduces Environmental Impacts
3. Enables Better Grid Management
Operationalizing Beneficial Electrification
New RAP paper to help regulators:

Beneficial Electrification: Ensuring Electrification in the Public Interest

Sets out six principles for regulators to help ensure that electrification is beneficial to consumers, the environment, and the grid.

1. Put Efficiency First
Efficiency Across Fuel Types

2. Recognize the Value of Flexible Load for Grid Operations
Value of Flexibility for Integrating Renewable Energy

Avoid Home Charging during these hours

Workplace Charging

Source: California ISO
3. Understand the Emissions Effects of Changes in Load
The Grid Is Getting Cleaner

Marginal Units by Fuel

- Coal
- Gas
- Oil
- Wind
- Other
- Municipal Waste
- Uranium
- Demand Response
- Interface

4. Use *Emissions Efficiency* as One Measure of Beneficial Electrification

![Graph showing emissions efficiency comparison for different water heaters.](image)
5. Measure Life Matters

<table>
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<th>Product Type</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
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6. Design Rates to Encourage Beneficial Electrification

![Graph comparing Typical Rate Design and Time-of-Use Electric Rates](image-url)
TOU Rates Can Focus on System Peak

- Rate design should make customers’ choices to minimize their own bills…
- Consistent with the choices necessary to minimize system costs.

Source: Sacramento Municipal Utility District
https://www.smu.org/en/Rate-Information/Time-of-Day-Rates/Time-of-Day-5-8pm-Rate
Price Can Influence When EVs Are Charged

Dallas/Ft Worth (standard rates)

San Diego (time-of-use rates)

Adapted from: M.J. Bradley, 2017
Not All Smooth Sailing: Beneficial Electrification Will Encounter Policy Obstacles
Develop Your Policy Framework

- Set Goals
- Identify Barriers
- Adopt Metrics
- Recognize Timing
- Include Affected Participants
- Develop an Inclusive Process
Some Final Thoughts

• Given the innovations occurring in today’s electric sector, there are many opportunities for electrification.

• *Beneficial Electrification* sets out a framework and principles to help decision-makers ensure that electrification is beneficial to consumers, the environment and the grid.
If It’s Not Beneficial Then Don’t Do It

For electrification to be beneficial, it must satisfy at least one of the three following conditions, without adversely affecting the other two:

- Saves consumers money over the long run
- Enables better grid management
- Reduces negative environmental impacts
Beneficial Electrification Resources from RAP

- Beneficial Electrification: Ensuring Electrification in the Public Interest
- Utilities Can Get a “LEG” Up with Beneficial Electrification—But Regulators Also Have to be Ready
- Beneficial Electrification: A Growth Opportunity
- Beneficial Electrification: A Key to Better Grid Management
- Environmentally Beneficial Electrification: The Dawn of Emissions Efficiency (Electricity Journal)
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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