Beneficial Electrification: Electrification in the Public Interest

Mass Climate Action, Grafton, MA

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Electrification: Why it Makes Sense and Can Be in the Public Interest
Beneficial Electrification (BE)

1. Energy Trends: What is Changing?
2. What Makes Electrification Beneficial?
3. Some BE Principles
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

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Prepared by:
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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 the wind is not blowing and the sun is not shining
- Modern technology enables load control
Wind Costs Dropped a Decade Ago

Wind Cost Per Kwh (US)

55 ¢ / kwh

22x Price Decline

2.5 ¢ / kwh
Solar Is Following Close Behind
This Year’s News Is the Battery Cost Slide

![Battery pack price (real 2018 $/kWh)]

Note: The data in this chart has been adjusted to be in real 2018 dollars.
Existing plants vs. Xcel bids

Existing Plant Average Fuel and O&M from USEIA Table 8.4 Electric Power Annual 2016
Nevada: Solar + Storage

- PV Energy Cost: $0.03
- Gas/Coal Operating Cost: $0.02
- Storage $/kW/month: $9.00
- Commercial Demand Charge: $8.00

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What Makes Electrification Beneficial?
Is All Electrification Created Equal?

- Brattle: “Utility sales could nearly double by 2050”!
- Is it all about load growth?
What Makes Electrification Beneficial?

Three Criteria: Achieve at Least One Without Adversely Impacting the Others

1. Saves Customers Money Long-Term; New Services
2. Reduces Environmental Impacts
3. Enables Better Grid Management
Some Principles for Operationalizing BE
1. Put Efficiency First
Efficiency Across Fuel Types

2. Recognize the Value of Flexible Load for Grid Operations
Water Heater Loads Are Easy to Spot
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
As the Grid Gets Cleaner, Electric Options Become More Beneficial

- Electric Resistance Water Heater
- Heat Pump Water Heater
- Gas Water Heater

Diagram showing emissions over time for different water heater options.
6. Design Rates to Encourage Beneficial Electrification
Rate Design

Rate design should make the choices that the customer makes to minimize an individual bill consistent with the choices the utility would make to minimize its system costs.
TOU Rates Can Focus On The System Peak Period

Price Can Influence When EVs Are Charged

Dallas/Ft Worth
(standard rates)

San Diego
(time-of-use rates)

Adapted from: M.J. Bradley, 2017
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:

1. Saves consumers money over the long run;
2. Enables better grid management; and
3. Reduces negative environmental impacts.
Things Can Change Quickly

5th Avenue, NYC, Easter 1900
See any automobiles?

Source: Tony Seba
Things Can Change Quickly

Park Avenue, NYC, Easter **1913**

*See any horses?*

Source: Tony Seba
Summary

- 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.
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
- Brewing up the Regulation of the Future
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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