Beneficial Electrification: Electrification in the Public Interest

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Today’s Discussion: Beneficial Electrification (BE)

- Energy Trends: What is Changing?
- What Makes Electrification Beneficial?
- Some BE Principles
- Electrification in the Midwest
Energy Trends: What is Changing?
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

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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.

• The best heat pumps had a coefficient of about 2.

• Heat pump water heaters were not commonly available.

• The 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.
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
Grid-Integrated, Heat-pump Water Heater
Smart Charging
Electric Vehicles
Smart Appliances
What Makes Electrification Beneficial?

Beneficial Electrification
Ensuring Electrification in the Public Interest

By David Earnsworth, Jessica Shipley, Jim Lazar, and Nancy Seidman
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—See Any Opportunity?
Value of Flexibility for Integrating Renewable Energy

Avoid Charging during these hours

Over-night Charging

Source: Fresh Energy
Just *Some* Flexible Load Makes a Big Difference
3. Understand the Emissions Effects of Changes in Load
US and Midwest Power Sector Emissions

GPI Roadmap

MISO Region Emissions
As the Grid Gets Cleaner...
As The Grid Gets Cleaner, Electric Options Become More Beneficial

- Electric Resistance Water Heater
- Heat Pump Water Heater
- Gas Water Heater
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
Is Electrification Cost-Effective for Displacement of Natural Gas?

**Gas Heat**

*Average Midwest Price: $1.00/therm*

= ~ 87,000 btu of delivered heat per $

**Electric Heat @ 3.0 Coefficient of Performance**

*Average Midwest Price: $.12/kWh*

= ~ 87,000 btu of delivered heat per $
Heat Pumps Cost More At Average Rates

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<th>Midwest</th>
<th>Average Rate May, 2018</th>
<th>Cost-Effective at COP of 3.0?</th>
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With TOU Rates, Off-Peak Heat Pumps are Cost-Effective

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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.
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.
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