

**Bruce A. Measure**  
Chair  
Montana

**Rhonda Whiting**  
Montana

**W. Bill Booth**  
Idaho

**James A. Yost**  
Idaho



**Dick Wallace**  
Vice-Chair  
Washington

**Tom Karier**  
Washington

**Melinda S. Eden**  
Oregon

**Joan M. Dukes**  
Oregon

Wednesday, June 30, 2010

## MEMORANDUM

**TO:** Power Committee of the Council

**FROM:** Michael Schilmoeller

**SUBJECT:** Domestic Heating Fuel Choice Study

Two years ago, the Regional Technical Forum (RTF) decided to examine the question of economic efficiency of domestic space and water heating. Specifically, the RTF asked whether it made sense to convert some portion of existing electric space and water heating to – or from – the direct use of natural gas.

The Council's position to date has been that customers have sufficient information about available technologies to make that decision themselves. The Council has elected to let the market sort out the question. With recent changes in technology, however, and given increased concern about carbon production, it seemed re-examination of the issue was warranted.

The RTF contracted with Global Energy Partners, LLC (GEP) for the construction of an Excel<sup>®</sup> spreadsheet calculator that captures the economics of issues pertinent to conversion decisions for leading appliance alternatives. In September 2009, GEP completed its tasks. Among these tasks was producing, from the calculator, tables of data suitable for input to the Council's Regional Portfolio Model (RPM). The RPM permits consideration of costs and risks associated with a policy to encourage or discourage conversion, given the uncertainties about carbon emission penalties, electricity prices, and natural gas prices. Due to the priorities of the Sixth Power Plan, analysis using the new conversion data began only recently. We expect it will conclude some time after this summer.

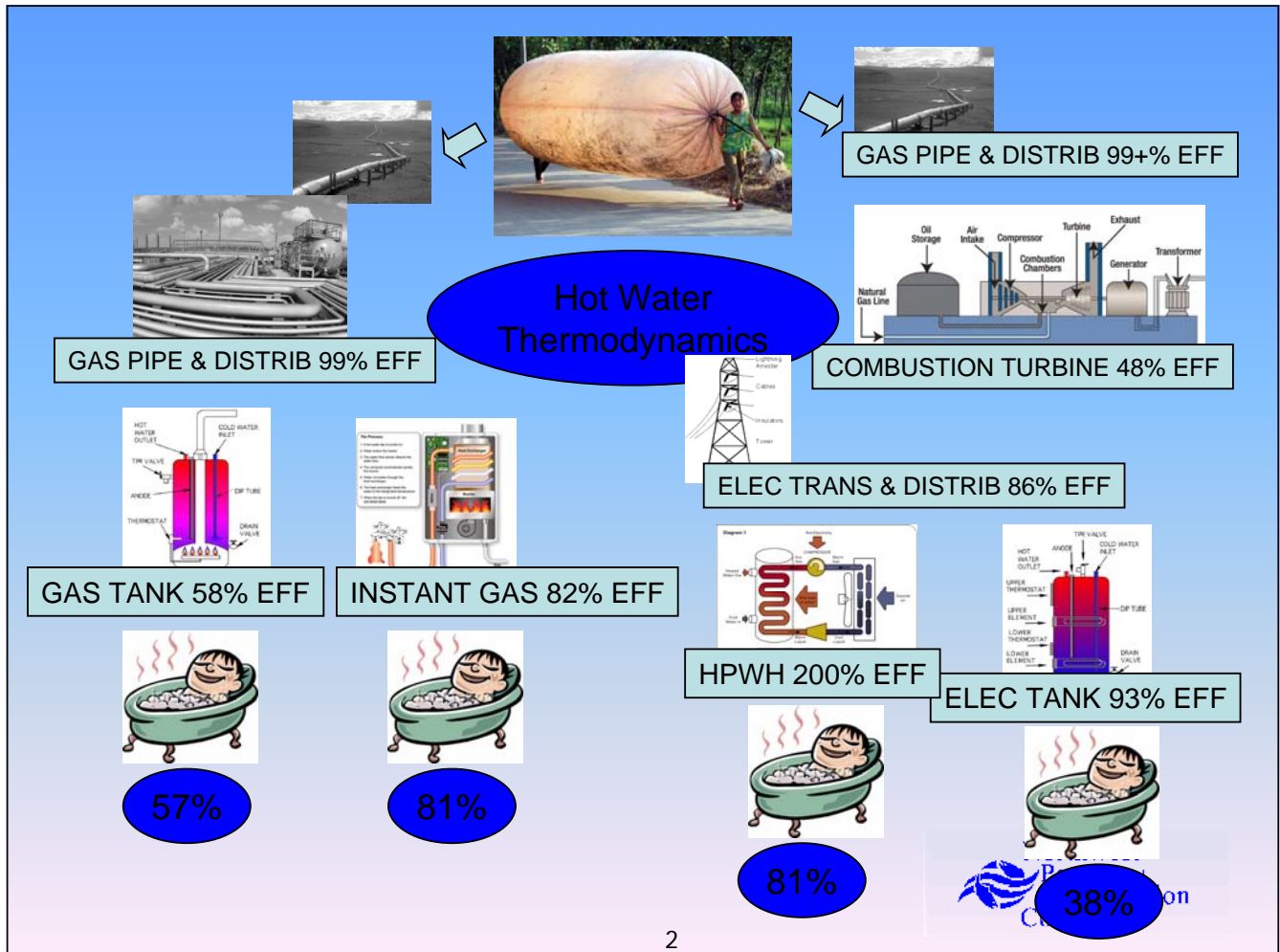
This presentation summarizes the status of the Domestic Heating Fuel Choice Study. A first RPM study is complete, and Council staff has developed tools for evaluating the results. Specific data and logic review is underway, with RTF participation. This presentation is informational and no decision by the Committee is necessary.

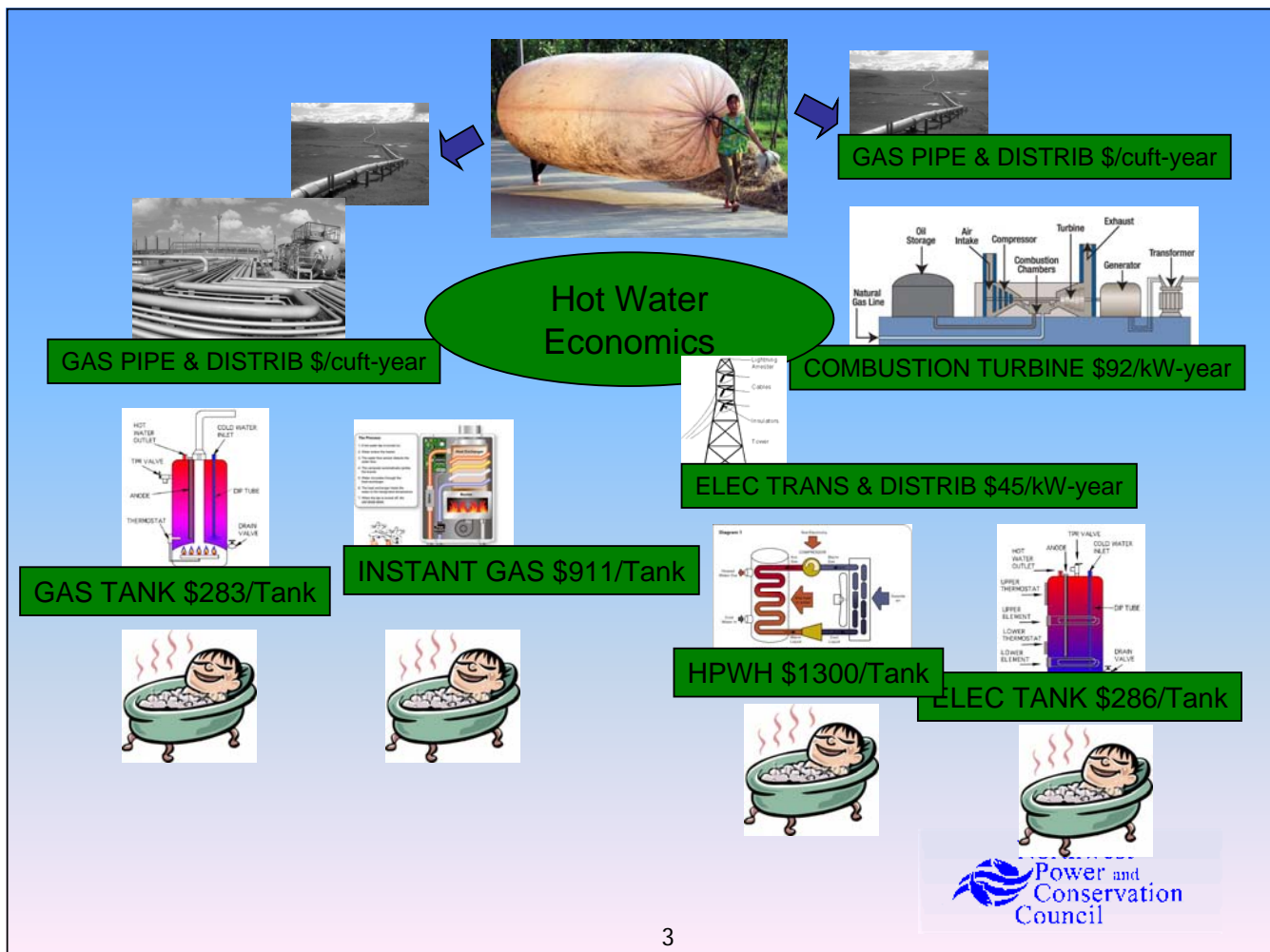
# Domestic Heating Fuel Choice Study

(aka The Direct Use of Gas)

Michael Schilmoeller  
 NW Power and Conservation Council

web presentation for the  
 Council Power Committee  
 Thursday, July 8, 2010





3

## Study Objectives

- What's better economically?
  - Costs and decisions use total resource cost, with wholesale prices for electricity and gas
  - The study should consider carbon penalty costs and other sources of risks
  - Conversion can go *either way*: direct gas to electricity or electricity to direct gas
- Recognize uncertainty and imperfect foresight
- Determine if incentives or disincentives improve the outcome

4

## Analyze Customer Segments and Develop Model Data

- A Regional Technical Forum (RTF) advisory group scoped the study
  - e.g., study will consider residential conversions only
- Northwest Gas Association, Puget Sound Energy, and the RTF provided funding
- Global Energy Partners, LLC, (GEP) won the contract January 2009
- GEP completed their tasks September 2009
  - Completed 60+ large tables of RPM input data
  - Reduced to 87 the 212 customer conversion options that are available to 19 customer segments
  - Built an Excel® model to evaluate conversions



5

## Key Assumptions

- Limited to existing construction
- Assume that energy requirement per household for water and space heating is seasonal but insensitive to natural gas and electricity price
- Assume that a fixed portion of existing stock turns over each year, which determines the conversion potential



6

# Existing Segments

- Customer segments were determined primarily by existing circumstances
  - Single- or multi-family building
  - Existing space heating appliance
  - Existing water heating appliance
  - Whether or not a gas main is available, and if so, whether service already exists or an extension from the gas main is necessary



# Existing Segments

Market Segment	Existing Heat System	Existing DHW	Gas Extension
1m	FAF Electric	Electric Resistance	Main and Service Service Extension
	Heat Pump	Electric Resistance	Main and Service Service Extension
	Zonal Electric	Electric Resistance	Main and Service Service Extension
1s	FAF Electric	Electric Resistance	Main and Service Service Extension NA
	Heat Pump	Electric Resistance	Main and Service Service Extension
	Zonal Electric	Electric Resistance	Main and Service Service Extension
2m	Gas FAF	Electric Resistance	existing
2s	Gas FAF	Electric Resistance	existing
3m	Gas FAF	Electric Resistance	existing
3s	Gas FAF	Electric Resistance	existing
4m	Gas FAF	Gas Tank	existing
4s	Gas FAF	Gas Tank	existing

source: C:\Backups\Plan 6\Studies\Model Development\Direct Use of Gas\Gas Conversion Model (080509) MJS markup.xls, worksheet "table illus"

- Market segments include single- (s) and multi-family (m) homes
- FAF refers to *forced air furnaces*
- DHW refers to *domestic hot water*
- Conversion opportunities distinguish segments 2 and 3



# Conversion Options

Retrofit Heating System	Heat Pump					Gas					
	FAF Electric	Electric Resistance	Gas Tank	HPWH	Instant Gas	Gas FAF	Hydronic	Gas/HP Hybrid			
Retrofit DHW	HPWH	Electric Resistance	Gas Tank	HPWH	Instant Gas	Gas Tank	Instant Gas	Electric Resistance	Gas Tank	HPWH	Instant Gas

source: C:\Backups\Plan 6\Studies\Model Development\Direct Use of Gas\Gas Conversion Model (080509) MJS markup.xls, worksheet "table illus"

Note that there are only *four* choices for retrofit domestic hot water: heat pump water heats (HPWH), electric resistance, gas tank, and instant gas.



# Selected Combinations

Retrofit Heating System				Heat Pump					Gas							
Market Segment	Existing Heat System	Existing DHW	Gas Extension	FAF Electric	Electric Resistance	Gas Tank	HPWH	Instant Gas	Gas FAF	Gas Hydronic	Gas/HP Hybrid					
				HPWH	Electric Resistance	Gas Tank	HPWH	Instant Gas	Gas Tank	Instant Gas	Electric Resistance	Gas Tank	HPWH	Instant Gas		
1m	FAF Electric	Electric Resistance	Main and Service Service Extension						1	1	1	1		1	1	6
	Heat Pump	Electric Resistance	Main and Service Service Extension			X		X	1	1	1	1		1	1	8
	Zonal Electric	Electric Resistance	Main and Service Service Extension			X		X	1	1	1	1		1	1	8
										1	1	1	1		1	1
1s	FAF Electric	Electric Resistance	Main and Service Service Extension						1	1	1	1		1	1	6
	Heat Pump	Electric Resistance	Main and Service Service Extension	X	X		1							1	1	4
	Zonal Electric	Electric Resistance	Main and Service Service Extension			X		X	1	1	1	1		1	1	4
										1	1	1		1	1	4
2m	Gas FAF	Electric Resistance	existing						X	X						2
2s	Gas FAF	Electric Resistance	existing						X	X						2
3m	Gas FAF	Electric Resistance	existing		X								X			2
3s	Gas FAF	Electric Resistance	existing		X								X			2
4m	Gas FAF	Gas Tank	existing		1		1						1		1	4
4s	Gas FAF	Gas Tank	existing		1		1						1		1	4
													Total	87		

source: C:\Backups\Plan 6\Studies\Model Development\Direct Use of Gas\Gas Conversion Model (080509) MJS markup.xls, worksheet "table illus"  
X - some appliance choice is the same as existing; 1 - both appliances change

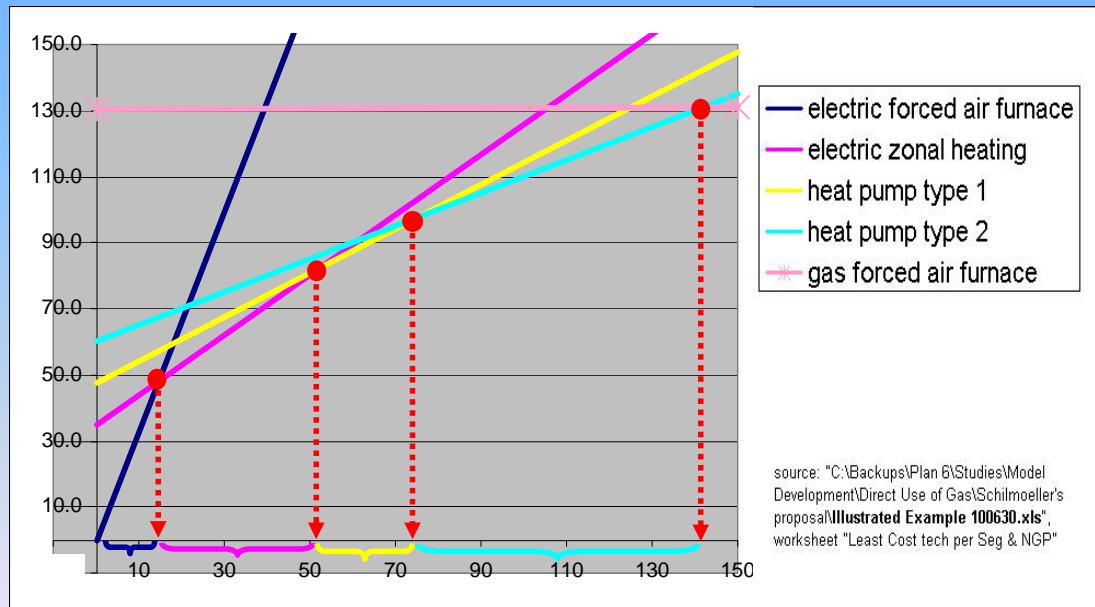
Only water heating conversion is available to segment 2; only space heating conversion is available to segment 3.



Total Cost (real levelized 2006\$/10<sup>3</sup> BTU)

# Least-Cost Solution

one market segment, fixed gas price



Electricity Price (2006\$/MWh)



11

## Schedule

- The RTF reviewed some of the early work on June 29
- RTF participants studying the assumptions
- Upcoming meetings
  - August 3 RTF meeting
  - Conservation Resource Advisory Committee (CRAC) meeting on policy implications in September?
  - Results to the Power Committee of the Council in September?



12

## 1994 Study

- Last Significant Technical Evaluation
  - Electric to gas conversion in single family
- Findings:
  - About 1100 MWa of Technical Potential
  - About 700 MWa of Economic Potential
  - Most of that will occur under market conditions
- Policy: Take a market-oriented approach



13

## Current Council Policy 5<sup>th</sup> Power Plan

- Conversions are not “Conservation”
  - but conversions can improve *economic* efficiency
- Technology, pricing and market transformation were not that different from 1994 study
- Policy: Take a market-oriented approach
  - but markets might benefit from more information about the alternatives



14



# 6th Power Plan

- Technology changes
  - Instant gas water heaters
  - Hybrid gas/heat pump
  - HP water heaters
  - Gas to electric heat pumps
- Changes to uncertainties
  - carbon and oxides of nitrogen control
  - natural gas and electricity prices
- Policy: ?

