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April 30, 2008

MEMORANDUM

TO: Power Committee

FROM: Terry Morlan

SUBJECT: Direct Use of Natural Gas

An issue that the Council has addressed many times in the past is whether the Power Plan should encourage the direct use of natural gas for space and water heating. Advocates of such a policy argue that direct use of natural gas is more efficient than generating electricity with natural gas and using the electricity for space and water heat. Further, it has been argued that fuel switching from electricity to natural gas should be considered a conservation resource by the Council.

The Council did a comprehensive analysis of direct use of natural gas, sometimes called fuel switching, in 1994.¹ The issue was addressed again during development of the Fifth Power Plan.² The Council's policy on direct use of natural gas, or fuel switching, has been generally consistent over time. The Council stated in a settlement of a lawsuit by the natural gas companies following the first power plan, that its plan is intended to be fuel neutral. The current Council policy is included in the Fifth Power Plan.³ A copy of the current Council policy, and the preceding 1994 policy, is attached for your information.

There have been significant changes in natural gas and electricity prices since the Fifth Power Plan, and new climate change policies have added green house gas objectives to the policy arena and these may affect fuel conversion analysis. The Northwest Gas Association recently proposed undertaking a new analysis of direct natural gas use. The Council's Regional Technical Forum (RTF) has agreed to provide management and oversight for the study to ensure the quality and credibility of the analysis.

¹ Northwest Power Planning Council. *Direct Use of Natural Gas: Analysis and Policy Options*. Council Document 94-41. August 11, 1994.

² Northwest Power Planning Council. *Direct Use of Natural Gas Policy*. Council Document 2001-17. July 17, 2001.

³ Northwest Power and Conservation Council. *The Fifth Northwest Electric Power and Conservation Plan*. Executive Summary, page 23; and Volume 2, Chapter 3, pp. 3-44, 3-45.

Attachment: Past and Present Council Policy on Direct Use of Natural Gas

Council's 1994 Policy statement:

Council Policy Statement

The Council recognizes that there are applications in which it is more energy efficient to use natural gas directly than to generate electricity from natural gas and then use the electricity in the end-use application. The Council also recognizes that in many cases the direct use of natural gas can be more economically efficient. These potentially cost-effective reductions in electricity use, while not defined as conservation in the sense the Council uses the term, are nevertheless alternatives to be considered in planning for future electricity requirements.

The changing nature of energy markets, the substantial benefits that can accrue from healthy competition among natural gas, electricity and other fuels, and the desire to preserve individual energy source choices all support the Council taking a market-oriented approach to encouraging efficient fuel decisions in the region.

Fifth Power Plan policy statement:

COUNCIL POLICY ON FUEL SWITCHING

The appropriate role for the Council in promoting the direct use of natural gas for space and water heating has long been an issue in the region. The Council has analyzed the technical issues and the policy issues in a number of studies. The specific issues have changed somewhat over time and include: whether fuel conversions to natural gas should be considered conservation of electricity, whether incentives for electricity efficiency improvements will adversely affect natural gas markets, the cost-effectiveness and potential amount of fuel switching available to the region, whether fuel choice markets are working adequately or not, and the relative risks of price change for natural gas and electricity.

The Council policy on fuel choice has consistently been that fuel conversions, while they do reduce electricity use, are not conservation under the Northwest Power Act because they do not constitute a more efficient use of electricity. The Council has recognized, however that, if its conservation programs were to cause a reduction in the use of natural gas in favor of electricity, it would reduce the electricity savings expected from electricity conservation programs.

The Council's analysis has also recognized that in some cases it is more economically efficient to use natural gas directly for space and water heating than to use electricity generated by a gasfired generator. However, this is very case specific and depends on a number of factors including the proximity of natural gas distribution lines, the size and structure of the house, the climate and heating requirements in the area, and the desire for air conditioning and suitability for heat pump applications. In general, although direct use of natural gas is more thermodynamically efficient (except for the case of heat pumps), it is more costly to purchase and install. Therefore, its economic advantage depends on the ability to save enough in energy costs to pay for the higher initial cost. One particularly attractive opportunity for conversion to natural gas is in homes that have natural gas space heating systems, but electric water heaters. In many of these cases, it would be cost effective for consumers to install natural gas water heaters.

The Council has not included programs in its power plans to encourage the direct use of natural gas, or the promote conversion of electric space and water heat to natural gas. This policy is consistent with the Council's view of its legal mandate. In addition, the Council's analysis has indicated that fuel choice markets are working well. Since the large electricity price increases around 1980, the electric space heating share has stopped growing in the region while the natural gas space heat share in existing homes increased from 26 to 37 percent. A survey of new residential buildings conducted in 2000 for the Northwest Energy Efficiency Alliance found that nearly all new single-family homes constructed where natural gas was available had gas-fired forced air heating systems. The survey also found an increased penetration of natural gas heating in the traditionally electric heat dominated multi-family market, especially in larger units and in Washington. Fuel conversion of existing houses to natural gas has been an active market as well, often promoted by dual fuel utilities.

The Council's policy on fuel choice is a market-based approach. The Council will leave the choice of heating fuels to individual consumers. But at the same time, the Council will work to facilitate appropriate fuel choice through information and promoting efficient pricing of electricity.

Review of Council Direct Use of Natural Gas Policy

Power Committee

May 13, 2008

Walla Walla, WA



Aliases

- Direct use of natural gas
 - Fuel conversions
 - Fuel switching
 - Fuel choice
 - Total energy efficiency
- All relate to using natural gas directly for end-use energy service rather than generating electricity from natural gas



History: Issues About Direct Use of Natural Gas

- Are Council's electricity efficiency incentives influencing fuel choice?
- Is conversion to natural gas "conservation"?
- Thermal efficiency
- Economic efficiency or "cost effectiveness"
- Potential savings estimates
- Need for Council policy or utility programs?



History: Council Fuel Choice Policy

- Plan is intended to be fuel neutral
 - Monitor effect of incentives on fuel choice
- Efficiency standards for conversion to electricity
- Fuel conversion is not conservation and not a resource
- Preference for thermally balanced cogeneration
- Market based approach



1994 Study

- Growing attractiveness of natural gas-fired combined cycle combustion turbines motivated the Council to take another look at “fuel switching” or “total energy efficiency”.



1994 Study Addressed

- Thermal efficiency of residential end-use technologies
- Cost effectiveness of fuel switching
- Assessed recent trends in fuel choice
- Reviewed Council history on fuel choice
- Proposed a Council policy statement on fuel choice



Thermodynamic Efficiency

Electricity → **Natural Gas**

Gas to Generate Electricity
45 % Efficient

Electricity to Heat Home
100 - 200 % Efficient
75 % Duct Efficiency

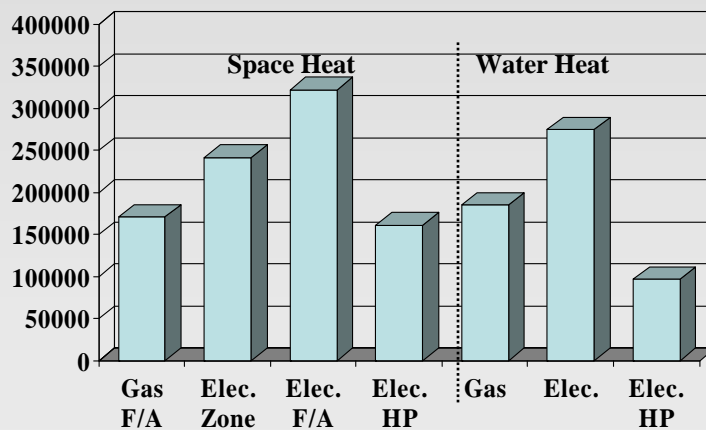
T&D Losses
10 % Loss

Gas to Heat Home
80-90 % Efficient
75 % Duct Efficiency

Pipeline and Distribution Losses
98 % Efficient



Gas Required For 100,000 Btu of End Use Energy



What Studies Show

- Thermodynamic efficiency is not same as economic efficiency
- Economic efficiency depends on:
 - Amount of Energy Used
 - House size
 - Thermal efficiency of shell and equipment
 - Climate zone
 - Energy prices and escalation assumptions
 - Conversion costs
 - Gas service extension
 - Equipment conversion costs
 - Avoided capacity costs



Environmental Considerations

- The 1994 study showed that increased direct use of natural gas would:
 - Increase nitrous oxide and carbon monoxide emissions
 - Reduce carbon dioxide emissions
 - Reduce sulfur oxide emissions
 - Insignificant effects on suspended particulates and VOCs



Summary of Analysis Results

	Technical Potential (MWa)	Percent Cost Effective	Achievable Economic Potential (MWa)	Resource Potential		Average Cost (Mills/Kwh) (1990 dollars)	
				Low Mkt. (MWa)	High Mkt. (MWa)	Tech.	C/E
Water Heat Only	156	100.0%	140	119	46	22.1	22.1
Forced-Air- Service	245	99.4%	220	94	9	23.6	23.5
Forced-Air - Main	167	96.8%	148	71	19	25.9	25.5
Zonal - Service	347	33.7%	148	96	62	39.0	32.0
Zonal - Main	249	22.2%	77	51	34	42.3	32.4
Total	1,164		733	431	170	32.3	26.3



Adopted Council Policy

- Analyze direct use of gas as alternative to conservation and generation alternatives
- Market-based approach to achieving cost-effective direct gas use
- Actions consistent with market-based approach
 - Provide information and analysis
 - Encourage efficient pricing of electricity
 - Help remove other market distortions
 - Natural Gas Advisory Committee
 - Participation in gas and electric IRP processes



Fuel Conversion Policy Issues

- Gas companies' proposal
- Council Issue Paper 2001-17
 - Review past analysis and policy
 - Pose alternative components of Council policy
- Response:
 - Power Committee panel
 - Written comments - 17
 - Discussion with PNUCC Board



Summary of Comments

- Most prefer a “market-based” approach.
- But - people mean different things by “market-based”
 - Some mean “hands off”
 - Some mean make the market work better, some aggressively and some more passively
- There is some support for acquiring fuel conversions as if they were an electricity resource.



Recommendation

- Retain current policy of market-based approach
 - “Market-based” may include some utilities voluntarily subsidizing fuel conversion as an individual business decision
- Decide during power plan development how aggressively to implement Council policy



An Updated Analysis

- Many changes require a new look at issue
 - Fuel prices
 - Conversions and programs
 - Climate change issues and policies
- Proposed and funded by Northwest Gas Association
- Management and oversight by the Regional Technical Forum

