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September 24, 2009

## MEMORANDUM

**TO:** Power Committee

**FROM:** Charles Grist, Gillian Charles

**SUBJECT:** Update on direct use of gas study and its implications in the plan

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 and the policy issues in a number of studies dating back to its very first plan. While the specific issues have changed somewhat over time, three central questions have remained:

1. Is the conversion from electricity to natural gas for residential space and water heating a lower cost and lower risk alternative for meeting the region's load growth when compared to other options?
2. If so, how much cost-effective "fuel-switching" potential is there in the region?
3. Are fuel choice markets working adequately?

During development of the Sixth Plan, a fourth question has been raised: How does the conversion from electricity to natural gas for space and water heating impact the region's carbon emissions?

### Current Policy

The Council has traditionally taken a laissez-faire approach to the issue of fuel conversion, whether it is economically efficient to use natural gas directly for space and water heating rather than using natural gas to generate electricity for these end-uses. The Council's current policy on the direct use of natural gas stems from the Fourth Power Plan and 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." Consistent with the Council's market-oriented approach, the Council supports efficient fuel decision making among the competing fuels and electricity in the regional energy market. The Council deemed that under the Act, direct use of gas was not conservation but

rather a fourth priority non-renewable resource. For more information regarding the Council's past approach, see the attached issue paper 2001-17.

### **2009 Study**

The 2009 study builds on the Council's 1994 fuel conversion and cost study in three significant ways. First, more market segments are identified and evaluated: primarily due to technology changes such as the emergence of instantaneous gas water heaters, heat pump water heaters and improved equipment efficiencies; and also because this study includes conversion from gas to electricity measures. Second, the analysis will evaluate the carbon consequences for each market segment. Third, the analysis will test the economic performance of each market segment against other generating alternatives and conservation in the regional portfolio model (RPM) under its range of gas and electric prices, loads and carbon futures.

Leading up to the development of the Sixth Power Plan, the Council contracted with Global Energy Partners (Global) to conduct an updated economic and market potential analysis of the direct use of natural gas for residential space and water heating in the Pacific Northwest. The study was sponsored by the Council, the Northwest Gas Association and Puget Sound Energy. The Regional Technical Forum is overseeing the project. The contract directed Global to develop a simulation model to perform an economic analysis on 91 agreed-upon fuel conservation market segments.

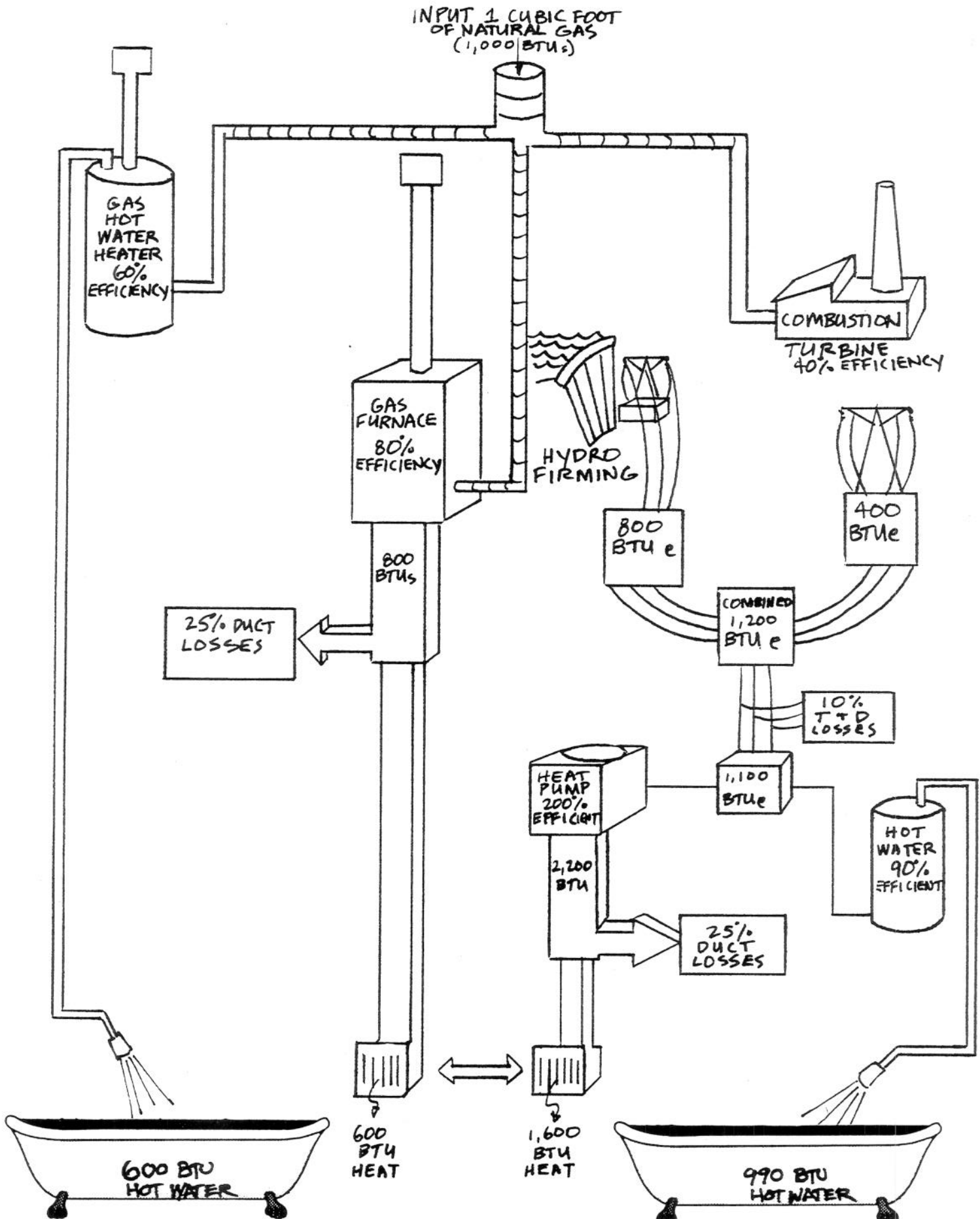
The fuel conversion model was developed by Global to calculate the changes in gas and electricity use resulting from each fuel conversion market segment and to determine the cost-effective and non cost-effective conversions under specific gas and electricity price combinations and equipment costs. These data are analogous to conservation supply curves. They indicate the amount and cost of electric or gas savings from each fuel conversion market segment given specific electric and gas price combinations.

### **Next Steps**

Global has completed its work and delivered the economic and market potential analysis to Council staff. The next step is to analyze the data with the RPM to assess the value of the fuel conversion market segments under the full range of gas and electric prices, load and carbon futures used in the RPM. Staff plans to do this analysis within the next month. However, analyzing fuel choice with the RPM is new territory. Until the fuel conservation supply curve data have been evaluated with the RPM, it is unknown what the potential impact on the draft Sixth Plan may be. Should the results not be fully understood and finalized in time, further analysis may become an action item in the Sixth Power Plan.

### **Attachments**

- Fuel Conversion "Bathtub Diagram," courtesy of Jeff Harris
- Council Document 2001-7: Issue Paper on Direct Use of Natural Gas Policy



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July 20, 2001

Dear Interested Party:

The Northwest Power Planning Council has released for public review and comment an issue paper on the direct use of natural gas. Natural gas utilities suggested to the Council that a campaign to convert electric space and water heat to natural gas could help alleviate the current electricity supply shortage in the region.

The Council has addressed this issue before and adopted policies. In light of the proposal from the natural gas utilities and the predominance of natural gas-fired combustion turbines being used in new electricity generation, the Council is reviewing these earlier policy decisions.

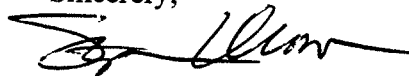
The attached issue paper (document 2001-17) revisits past Council analyses and policies on fuel conversion to natural gas, often referred to as direct use of natural gas. The issue is whether it is better to use natural gas directly for space and water heating, rather than using it to generate electricity for these end uses. Also in question is whether the Council should take a role in these fuel choice decisions, and if so, what that role should be. The issue paper lays out a number of possible Council actions and policies that may be combined to form Council policy. The paper is also available at the Council's website [www.nwpcouncil.org](http://www.nwpcouncil.org).

The Council is seeking regional opinion and guidance on the potential elements of a fuel conversion policy identified in the issue paper. Suggestions for additional policy elements are also welcome. Public comments will be accepted until September 15, 2001. Please send comments to Mark Walker, Director of Public Affairs, Northwest Power Planning Council, 851 SW Sixth Avenue, Suite 1100, Portland, Oregon 97204-1348. You may also send your comments via e-mail to [comments@nwppc.org](mailto:comments@nwppc.org).

The Council will convene a panel from the natural gas and electric industries and other interested parties at the Council work session in Portland, Oregon on August 28-29. The Council expects to make a decision on whether to change its fuel conversion policies at the September 26-27 Council meeting in Spokane, Washington.

Thank you for your interest and comments on this issue.

Sincerely,



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## **Issue Paper**

### **Direct Use of Natural Gas Policy**

**Document 2001-17**

**July 17, 2001**

The Cascade Natural Gas and Northwest Natural Gas companies have proposed to the Council that a program directed at converting electric space and water heating to natural gas could contribute to the solution of the current electricity shortage and accompanying high prices. This paper provides background and analysis on this issue. It is one the Council has addressed in the past, but this is a good time to review the Council's policy and consider whether it is still appropriate.

In their presentation to the Council, the natural gas distribution companies estimated that 81 percent of the region's residential water heating is electric and 47 percent of space heat is electric. They noted that, while about 20,000 homes have been converting to natural gas each year since 1994, the on peak savings each year amount to only 200 megawatts for space heat and 52 megawatts for water heat. They proposed that a regional partnership of natural gas and electric utilities develop a program to convert 175,000 homes to gas space heat and 225,000 home to gas water heat in the next year. They estimated that the electricity saving on peak from these conversions could be 2,250 megawatts.

The proposed program would treat natural gas conversions as equal to generating and conservation resources. Market intervention in the form of advertising, rate incentives, and direct financial incentives would be used to promote the conversions. The natural gas utilities are asking the Council to include natural gas conversions more directly in its plan and to promote an immediate program to achieve a large number of conversions as a partial solution to the current electricity shortages.

#### **Background**

Some background on Council positions regarding the direct use of natural gas is necessary before responding to the gas distribution companies' proposal. The most recent analysis of the issue by the

Council was done in 1994 leading up to the 4<sup>th</sup> Northwest Conservation and Electric Power Plan.<sup>1</sup> Appendix A of that paper described the history of Council policy on fuel conversions. That appendix is reproduced below. The 1994 analysis, and the policy adopted by the Council as a result, are described in a separate section of this paper.

### *SRC Study, 1982*

The Council contracted with Synergic Resources Corporation (SRC) during the development of the first Power Plan to examine potential reductions of electricity use in the Pacific Northwest through increased use of alternative fuels. The SRC study, completed in September 1982 is probably the most comprehensive study of fuel switching and choice potential that has been done for this region. It looked at the residential, commercial, and industrial sectors and estimated potential conversions for both private utility service areas and public utility service areas. The data for the residential study was built up from county level data, and 21 combinations of equipment, fuel, and housing characteristics were evaluated.

The SRC study identified 3,655 average megawatts of potential fuel switching by the year 2000, primarily in the residential sector. This was estimated to add 1,610 million therms to regional natural gas demand. Too many conditions have changed since the SRC study was done to make the numerical results applicable in today's market. However, the study addressed several issues that are still key to the debate.

The SRC study explored the effects that electric efficiency incentives might have on fuel choice. For example, incentives paid to improve the efficiency of electrically heated homes only, can cause more electrically heated homes to be built. This is because the cost of the improved efficiency would be partly paid by the utility while the consumer receives a lower cost of heating. This makes the electrically heated house economically more attractive to the consumer. The increased choice of electric heating would thus offset some of the anticipated electricity savings from such a program.

Another important finding of the SRC study was that it generally is more cost-effective to weatherize a home and maintain its current heating system than to convert to a different fuel. This result has appeared in several subsequent studies and is an important consideration in the debate about policies to encourage fuel conversions.

The SRC study established the link between historical fuel price patterns, the cost of heating, and the choice of fuels historically. It was clear from the SRC results that markets have responded significantly to changes in relative costs of heating. The efficiency with which fuel markets work is an important consideration when assessing the need for total energy-efficiency policies and is discussed later in this paper.

### *Staff Issue Paper, 1982*

The Council staff developed an issue paper in late 1982 to help the Council decide on the role that total energy-efficiency policies might play in the first regional Power Plan. With respect to fuel conversions in existing applications, the issue paper was concerned with whether to offer incentives for electric heating customers to convert to gas. The finding was that conservation was likely to be more cost-effective than fuel conversion. Hesitancy to encourage natural gas conversions was linked to concerns about future conversions of those inefficient homes back to electricity. The cost of natural gas was higher then. In addition, the outlook for natural gas price escalation was considerably higher and was viewed as even more uncertain than it is now. The

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

Council was reluctant to encourage consumers to shift to natural gas when it could subsequently turn out to be a very expensive choice.

The discussion of fuel choice for new homes centered around whether efficiency standards and incentives should apply to both electric and gas heated homes. There was concern about affecting the fuel choice of consumers and the possibility that inefficient gas heated homes could switch to electricity in the future. In addition, the Council heard comment that having multiple code levels for new construction would be administratively complex and costly. The fact that natural gas as an electricity generating resource did not look particularly attractive at the time was a further argument against the need to promote the end-use of natural gas instead of electricity.

The recommendation of the staff issue paper was that Council policy should neither encourage nor discourage particular fuel uses. For that reason, it was recommended that new energy-efficiency codes be applied equally to all new construction, regardless of heating fuel. It was decided that direct end-use of natural gas was not conservation, but rather a fourth priority (non-renewable) resource under the Act. The reluctance to encourage use of natural gas was related to the perception that future gas prices and availability were highly uncertain. In addition, it appeared that conservation was both cheaper and a higher priority resource under the Act. Since base-load natural gas generation was not expected to be a cost-effective resource in the plan, and was, in fact prohibited under the Power Plant and Industrial Fuel Use Act, the thermodynamic efficiency argument was not applicable. The decision about whether to give incentives for use of natural gas in new homes could be delayed.

#### ***1983 and 1986 Power Plans***

In the 1983 Power Plan, the Council stated that “conservation involves the more efficient use of electricity.”<sup>2</sup> The Council’s policy on fuel switching in the 1983 Power Plan, was to neither encourage nor discourage a consumer’s continued use of electricity compared to a nonrenewable fuel. Since there was no evidence of fuel switching to electricity, the Council deferred applying efficiency incentives to all homes regardless of heating fuel choice. The 1983 plan did, however, include a fuel conversion efficiency standard for homes that switch from natural gas to electricity.<sup>3</sup>

In settlement of a legal challenge to the 1983 Power Plan, the Council agreed that, if substantial fuel switching, as a result of the plan, were documented and made the plan not cost-effective, it would take action to limit further switching. Further, the Council agreed to clarify that the model conservation standards apply only to electrically heated homes.

The 1986 Power Plan did not change the Council conclusions on fuel choice. The 1986 plan did, however, contain two action items relating to fuel choice. The first called for Bonneville to develop and implement a method for monitoring the effects of incentives on the choice of heating systems by new home buyers. The second committed the Council to analyzing the costs of heating new homes with electricity and natural gas.<sup>4</sup>

#### ***Council Cost of Heating Study***

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<sup>2</sup>1983 Northwest Conservation and Electric Power Plan, Volume I, Page 7-1.

<sup>3</sup>1983 Northwest Conservation and Electric Power Plan, Volume I, Page 10-11.

<sup>4</sup>1986 Northwest Conservation and Electric Power Plan, Volume I, Page 9-8.

In response to both the action item described above in the 1986 plan, and to questions arising from the code adoption process, the Council did a study of the cost of heating new homes.<sup>5</sup> The study focused only on space heating in new homes, but considered an array of heating systems, fuel types, and building shell efficiency levels. Considering three different house sizes, the study evaluated costs from 4 different perspectives: first cost, annual energy costs, annual after tax cost of heating, and heating system life cycle costs. The study did not include the cost of gas service connections or main extension costs, factors that have been considered important in subsequent studies.

The conclusions varied widely depending on house efficiency levels, relative fuel costs, heating system, presence of air conditioning, climate zone, and house configuration. Therefore generalization from the results is very difficult. The clearest conclusion is that most of the options widely available and used in the market today can be competitive in some conditions. The overall costs of alternative options are sensitive to first costs, system efficiency, and shell efficiency.

The study clearly illustrated that simple energy efficiency arguments, or fuel price comparisons, are inadequate to draw conclusions about the cost-effectiveness of heating with different fuels. For example, zonal electric heating systems in homes built to the model conservation standards in the 1986 plan were found to be lower cost than natural gas heating systems built to then current practice or codes under current prices by most measures and in most climate zones. The finding reflects the low first cost of zonal electric heating systems, their low maintenance cost, and the high efficiency of the system with no conversion losses or duct and flue losses. However, in comparing gas and electric for forced-air heating systems the costs were very close at then current relative prices. In general, zonal electric systems were found to be less costly than either gas or electric forced-air systems, but the zonal electric advantage was less clear in a house with the furnace and ductwork in the heated space.

The study showed that one effect of building homes with higher thermal integrity is to significantly reduce the effect of price escalation on the cost of heating. Thus, thermal integrity of the house shell serves as a risk mitigation against fuel price uncertainty.

### ***1991 Power Plan***

The 1991 Power Plan did not contain a substantial change in the Council's policy on fuel choice or fuel switching. However, in response to falling natural gas prices, the role of natural gas for electricity generation in the Power Plan increased. The uses of natural gas were limited to cogeneration and hydro-firming combustion turbines. This increased use of natural gas did cause the Council some concern for total energy-efficiency. As a result, the Council expressed a strong preference for "thermally balanced" cogeneration. This is viewed as a high efficiency resource, whereas cogeneration that is primarily just a large electricity generating plant with insignificant thermal loads would raise issues of total fuel efficiency.

In recognition of the likelihood of growing reliance on gas-fired generation the Council called for the formation of a natural gas policy group to explore issues of coordination between the natural gas and electric industries.<sup>6</sup> The Council also formed a Natural Gas Advisory Committee to assist the Council with technical issues relating to natural gas.

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<sup>5</sup>Heating New Homes: A Comparison of the Cost of Heating with Electric, Natural Gas and Fuel Oil Heating Systems, Northwest Power Planning Council, Publication 88-11, June 22, 1988.

<sup>6</sup>1991 Northwest Conservation and Electric Power Plan, Volume I, page 47.



## Review of 1994 Analysis and Policy Statement

Changes in the natural gas market, and in the technology for burning natural gas to generate electricity, substantially changed the issue of direct use of natural gas as the Council approached the 4<sup>th</sup> power plan. Natural gas prices were no longer expected to escalate much faster than electricity prices and natural gas-fired combined cycle combustion turbines were becoming the most cost effective generation technology. As a result, the issue of whether it made more sense to use natural gas directly for heating than to generate electricity with it and then use electricity to heat homes and businesses became important.

Several issues were addressed by the 1994 study. These include:

- Thermal efficiency of alternative space and water heating systems;
- Economic efficiency of alternative space and water heating systems;
- Past and existing Council policy;
- Other regional analyses of fuel conversions;
- Fuel choices being made in the market place;
- Potential savings of electricity and natural gas from fuel conversions, including technically achievable, cost effective, and what could be acquired beyond market choices;
- Power system cost savings and environmental effects of fuel conversions.

The analysis of thermal efficiency confirmed that, with one exception, it requires less natural gas to heat homes and water directly with natural gas than with electricity generated from natural gas. The exception is electric heat pumps, which actually use less natural gas than required by direct use.

However, the paper went on to point out that the Council's efficiency criterion is not thermal efficiency, but economic efficiency. The question then is whether it is cost effective to invest in fuel conversion compared to alternative investments to improve electricity efficiency or build new generating resources. The Council's analysis, and the analysis of others, showed that this is a much less clear-cut issue. It involves such factors as the cost required to convert heating equipment, costs of extending natural gas service, avoided costs in the electricity system, and relative prices of natural gas and electricity. Whether conversion to natural gas is cost effective or not depends on such factors, and turns out to be very sensitive to the amount of heating energy use in a home. That is, smaller and more efficient houses in mild climates are less likely to be cost-effective conversion opportunities.

The analysis showed that it was technically possible to save 1,164 average megawatts of electricity through fuel conversions in existing single family homes. 733 average megawatts of this potential was also found to be cost effective. 733 average megawatts would be the equivalent of about three combined cycle combustion turbines, such as the River Road plant in Vancouver, Washington. The analysis showed that it is always cost effective to convert an electric water heater to natural gas if the home is already heated by natural gas. Further, it is usually cost effective to convert forced air electric space heating to natural gas, especially if natural gas is already available along the street. Electric zonal space heat is much less cost effective for conversion to natural gas, although about one third of the cases could be cost effective if natural gas is available at the street.

Some of the cost-effective conversions would be expected to occur without policy intervention. In the 1994 analysis the Council estimated that between 302 and 563 average megawatts of the 733 cost effective conversions would occur due to natural market forces, leaving between 431 and 170 average megawatts to be targeted by possible fuel conversion programs.

Fuel conversions were estimated to reduce total natural gas use by 6 to 8 trillion Btu per year; less than 2 percent of recent annual natural gas consumption in the region. It was estimated that it would take 22 percent less natural gas if fuel conversions displaced an additional combined cycle combustion turbine. The effects on air emissions is complicated by the relative emissions of direct use versus environmentally controlled electricity generation emissions, and by other electricity system interactions relating to, for example, hydro availability in good water years and coal plant displacements. On net, fuel conversions were found to increase NOx and CO emissions while reducing SOx and CO2 emissions.

Based on the 1994 analysis, the Council adopted a policy statement, which remains the Council's current policy on fuel conversions. It is shown in the text box below.

#### **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.

The market-oriented approach reflected the fact that substantial fuel conversion activity appeared to be ongoing in the region. In particular, new single family home construction had moved substantially to natural gas fired-space and water heat in areas where natural gas was available.

Actions thought to be consistent with a market-based approach included:

- Providing information in the power plan on the cost-effectiveness of direct natural gas. This would include identification of possible synergy between fish and wildlife flows and the pattern of demand reductions from fuel conversions.
- Encouraging efficient pricing of energy to enable consumers to see the economic value of alternative choices.
- Working with electric utilities, public utility commissions, and others to ensure that policies regarding system expansion and new service connections, advertising, electric efficiency

incentives, zoning practices, building codes and other policies do not unnecessarily distort consumer decisions with regard to energy choices.

- Continuing the role of the Natural Gas Advisory Committee as a forum for coordination and discussion of issues that affect both gas and electric industries.
- Council staff participation in least cost planning efforts of both gas and electric utilities, possibly encouraging utilities to consider direct use of gas as an alternative in their own least cost plans.

### **Effects of Changing Energy Markets**

The question before the Council now is whether its current policy of supporting a market-based approach to fuel conversions should be changed to a more active policy of promoting fuel conversions to natural gas. One question that seems like a good starting place for considering this issue is whether conditions have changed significantly since the 1994 Council analysis and policy statement. And if conditions have changed significantly, do the changes argue for a more active approach to fuel conversions?

There are two kinds of changes to consider. First, whether market structures and conditions are significantly different than at the time the Council made its last policy statement. Second, whether any of the assumptions made in the underlying Council analysis have proven significantly wrong. For example, have the efficiencies of electric or natural gas heating equipment changed, are the relative prices of natural gas and electricity likely to be different from the assumptions made in 1994, or are market induced conversions significantly different than assumed in the analysis.

Electricity markets have clearly changed since 1994. Wholesale electricity markets have progressed significantly toward competitive structure, although there are still difficult issues to resolve. The opportunity for retail competition exists to varying extents in western states, although, as of yet, the great majority of retail consumers remain customers of the incumbent utility. Growing competition in energy markets seems to complement the Council's current policy of a market-based approach to fuel conversions. Electricity and natural gas prices are becoming more closely connected as natural gas becomes a primary source of electricity generation. Energy traders now make decisions about selling natural gas directly or generating electricity with it based on the so-called "spark spread"; the difference the price of natural gas and the price of electricity generated by natural gas. Generally, however, these price incentives do not yet effectively find their way to the end-use consumers in the residential and commercial sectors.

There have been no dramatic changes in the technical characteristics of natural gas or electricity equipment or of houses. Some trends have probably continued. For example, houses have most likely continued to increase in size, making natural gas more advantageous. However, houses are also increasing in thermal efficiency, as larger shares are newer homes built to improved energy efficiency codes. This tends to be more favorable to electricity especially for smaller homes. Technical efficiency of gas furnaces may have improved marginally since the 1994 study, but so has the efficiency of combined-cycle combustion turbines. The results of the 1994 study were sufficiently robust that these small technical changes are likely insignificant in terms of the general conclusions.

## **Policy Issues and Alternatives**

There are perhaps two issues to consider with regard to the Council's fuel conversion policy. First, can an immediate and aggressive fuel conversion program be an effective and desirable contribution to solving the current electricity shortage? Second, should the Council take a more active position regarding fuel conversions in the long term as part of its ongoing policies to be included in a revised power plan?

### ***Fuel Conversion as a Response to the Current Electricity Shortage***

The Council's policies toward solving the current electricity shortage are focused on several fronts. The Council has recognized that the current shortage is due to near record poor water conditions combined with a failure to build adequate generation capacity in the West. Further, the extremely high prices were exacerbated by poorly structured wholesale markets and constrained demand-side response to the shortage.

The problem is being addressed by a combination of improved hydroelectric generation through emergency operations, rapid response in building new temporary and permanent generation capacity, and by significant load reductions. The Council and the Northwest Energy Efficiency Alliance have also launched an initiative to achieve some rapid improvements in electricity efficiency during the rest of this year and next. This initiative is known as the "plug and play" conservation program. As a result of these efforts and improvements in the structure of California's wholesale electricity markets, the crisis is not expected to last beyond the coming winter. Last week wholesale electricity prices had fallen to levels significantly below \$100 per megawatt-hour for the first time in a year. These are not expected to continue when hot weather hits the Southwest this summer, but they are an indication that the market and policy-makers have made some progress toward resolving the electricity shortage.

The natural gas distribution companies that addressed the Council proposed that some form of joint program be launched in time to create significant electricity savings through conversions of electric space and water heating to natural gas. As a practical matter, it would be very difficult to get a new joint program of that scale and controversy in place in time to have any significant effect on the current crisis. It would require program design, negotiation of joint funding agreements, regulatory approvals, and mobilizing suppliers and installers to achieve far more than the current levels of conversions. If the Council decided that it was desirable to aggressively pursue fuel conversions to help with the current electricity shortage, it might be best accomplished as an add-on to the current "plug and play" program. However, the plug and play initiative has a difficult task to mobilize extensive conservation activities in such a short time frame. Making such a significant change to plug and play at this point may jeopardize the achievement of the electricity conservation objectives. Nevertheless, if the Council wanted to try to accomplish significantly more fuel conversions in the next 12 to 18 months, exploring a link with the plug and play initiative might be the most practical approach.

Another possibility for implementing fuel conversions quickly might be to tie it into Bonneville's requests for load reductions from its subscribing customer utilities. Bonneville has requested such reductions to help keep its rate increase down. Some of the commitments from utilities may have involved fuel conversions, but that is up to individual utilities.

### ***Alternative Elements of a Long-Term Council Policy***

The practical options for a more aggressive Council stance on fuel conversions are probably greater in the long term, than as a response to the current electricity shortage. The natural gas distribution companies are requesting a significant change in Council policy regarding conversions to natural gas. The Council is interested in exploring appropriate responses.

A number of possible elements of a Council fuel choice policy are described below for consideration and discussion. These elements are not all mutually exclusive options. The Council could mix various elements to form a fuel conversion policy. The Council invites your comments and perspectives on these ideas as well as other suggested responses.

#### *Hands off*

Careful consideration of the fuel conversion, or direct use of natural gas, issue by the Council during the 1980s led to the conclusion that natural gas use falls largely outside the Council's sphere of influence. Legal analysis of the Northwest Power Act concluded that fuel conversion is not conservation under the Act, nor is it a resource under the Act. At the same time the Council recognized that in some situations it was more efficient from a total energy perspective to use natural gas for heating. As a result of these facts, the Council took a "hands-off" approach to fuel conversions. Council policy was that its electricity efficiency programs were intended to be fuel neutral, but otherwise the Council took no actions to encourage the direct use of natural gas in applications where it might be more efficient than direct electricity use.

Would this be an appropriate and legal position for the Council to take now that natural gas-fired electricity generation is the most common new form of electricity supply?

#### *Analysis and Information Source*

In the past, the Council has undertaken detailed analyses of the direct use of natural gas. These analyses have addressed relative energy efficiency, cost effectiveness, and environmental effects of the direct use of natural gas compared to electricity use. These studies have primarily affected Council policy decisions regarding the role of fuel conversions in the Council's power planning. While the studies have been done in public with opportunities for comments and discussion, the results have not been aggressively disseminated in the media with the objective of providing consumer information to the region.

Is this type of analysis an appropriate activity for the Council? Should past analyses be expanded and updated, to include capacity effects as well as energy effects? Should the findings be aggressively disseminated to the region with an eye to encouraging cost effective fuel conversions?

#### *Included in Power Plan*

Fuel conversion discussions have not been a part of the Council's past regional power plans. Analysis of fuel conversion and proposed regional actions toward it could be included as part of the Council's power plan. Although fuel conversion is neither electricity conservation nor an electricity resource, it may nevertheless be a rational part of the regional energy strategy. The natural gas distribution companies characterized fuel conversion as a third leg of an energy policy stool; the other two legs being conservation and generation.

Does fuel conversion have a place in the Council's power plan? Is that place a chapter, or a section, or a footnote?

### *Actively facilitate cost effective fuel choices*

The Council could take an active role in promoting cost effective fuel choices in new buildings and conversions in existing buildings. The principle in this approach would be to encourage cost effective fuel choices without providing financial incentives or reimbursements to alter choices. This could involve a number of activities. In some cases regulatory or legal impediments to expanded natural gas direct use may exist. By working with electric and natural gas utilities, the Council could identify which policies and laws might restrict fuel conversions and seek changes that would reduce such impediments.

This strategy would also include using media to advertise and promote cost effective fuel choices and conversions. The very effective approach could be a joint marketing effort between electric and natural gas utilities. Consumers are probably somewhat skeptical about advertising from gas companies encouraging them to switch. However, joint advertising from the gas and electric utilities could have greater credibility. Such advertising could emphasize ‘the right fuel for the right job,’ and the situations and applications where conversion is most likely to make sense. (Is there gas on your street? Does your house have forced air heating? Can the water heater be vented to the outside relatively easily?)

Should the Council take an advocacy position to encourage fuel conversions and the use of natural gas in new buildings where they make economic and energy sense for the region? Is such a use of Council resources necessary in today’s market, or is the market already responding adequately?

### *Working More Closely with Natural Gas Industry*

During the development of the Council’s fourth power plan, the Council worked closely with the natural gas industry. A natural gas policy committee was formed to help coordinate policies of the electricity and natural gas industries, and a Natural Gas Advisory Committee helped the Council develop its technical assumptions regarding natural gas supplies and prices. Both committees have lapsed since the power plan was completed. These committees could be recreated and maintained on an ongoing basis to provide better coordination and cooperation between the natural gas and electric industries. There are many issues that arise including the availability and cost of natural gas for electricity generation, the demand that new gas-fired generation plants will add for natural gas supplies and pipeline capacity, and operational coordination between the industries.

Should the Council play a role in facilitating coordination and information flow between the natural gas and electric industries in the region? Is this a role that it is necessary for the Council to play or are there other organizations that are more appropriate?

### *Joint Efforts to Promote Efficiency and Market Transformations*

Electric utilities in the region have formed the Northwest Energy Efficiency Alliance (NEEA) to help move the standard practices in appliances and buildings toward greater electrical efficiency. The Council has formed the Regional Technical Forum (RTF) to identify and certify cost effective conservation actions. There may be an opportunity to expand the membership of these organizations to include participation by the region’s natural gas distribution companies.

Should the Council encourage joint efforts to improve the efficiency of both natural gas and electricity use? Is there industry support for such efforts in both the electric and natural gas industries? Are there potential efficiencies in such joint efforts, or would they just dilute and confuse the already successful efforts underway?

*A Short-Term Fuel Conversion Program to Help with the Current Energy Crisis*

Cascade Natural Gas and Northwest Natural Gas have proposed that the Council aggressively pursue fuel conversion over the next year to help alleviate the current electricity shortage. This would involve mobilizing a joint program to pursue cost effective fuel conversions. The natural gas companies have suggested that the region might be able to achieve 175,000 space heat and 225,000 water heat conversions in the next year.

Is an aggressive conversion program likely to contribute substantially to alleviating the electricity shortage? Should the Council recommend that Bonneville and the region's electric utilities pay for conversion to natural gas as a way to reduce the current electricity shortage? Could the "Plug and Play" initiative be broadened to include fuel conversions without jeopardizing the already ambitious goals of that program?

*Promotion of More Efficient Electricity Pricing*

Current electricity pricing to retail customers does not reflect the marginal value of electricity. For many utilities the average cost of electricity reflects low cost of existing hydroelectric resources rather than the cost of additional generation required to meet new load growth. Current retail electricity pricing also does not reflect the value of electricity during peak hours. Better reflection of electricity values in retail prices may lead to different fuel choices by consumers.

Is more effective pricing of electricity potentially an alternative to direct market intervention in the fuel choice market? Should the Council evaluate recent pricing changes in the region and investigate other methods of sending better price signals to consumers?

*Acquire Fuel Conversion as if it were a Resource*

A more aggressive approach to fuel conversions as an ongoing policy would be to acquire fuel conversions as if they were conservation or a resource in the power plan. In this case, cost-effective levels of fuel conversion would be identified in the power plan and its acquisition would be the subject of Council action with goals for the amounts and timing of acquisition. The Council would encourage Bonneville to include fuel conversions in their rate incentive and conservation augmentation programs. The region's investor-owned utilities would be encouraged to include fuel conversions in their integrated resource plans.

Should the Council venture into this new area of planning for fuel choice? Is it legal for the Council to promote, and Bonneville and the region's utilities to pay for, fuel conversion programs? If it is not legal, as earlier Council legal analysis determined, should the Council devote resources to effect changes to current law?

The Council is seeking regional opinions on the potential elements of a fuel conversion policy that are identified above. We expect to convene a panel from the natural gas and electric industries and other interested parties at the Council work session in Portland on August 28-29. The Council will accept comments until September 15, 2001 and expects to make a decision whether to make changes to its fuel conversion policies at the September 26-27 Council meeting in Spokane.

# Update: Direct Use of Gas Study

## Implications for the 6<sup>th</sup> Power Plan

Power Committee  
October 7, 2009



## Direct Use of Gas Issues

- What's better economically & from a risk management perspective?
  - Use gas directly for space or water heat, or
  - Use gas to make electricity for space or water heat?
- If there is a winner
  - How much cost-effective potential from switching?
- Are markets working adequately?
- What if we consider carbon impacts





# Hot Water Thermodynamics

GAS PIPE & DISTRIB 99% EFF

GAS PIPE & DISTRIB 99+% EFF

COMBUSTION TURBINE 48% EFF

GAS TANK 58% EFF

INSTANT GAS 82% EFF

ELEC TRANS & DISTRIB 86% EFF

HPWH 200% EFF

ELEC TANK 93% EFF



57%



81%



81%



38%

# Hot Water Economics

GAS PIPE & DISTRIB \$/cuft-year

GAS PIPE & DISTRIB \$/cuft-year

COMBUSTION TURBINE \$92/kW-year

GAS TANK \$283/Tank

INSTANT GAS \$911/Tank

ELEC TRANS & DISTRIB \$45/kW-year

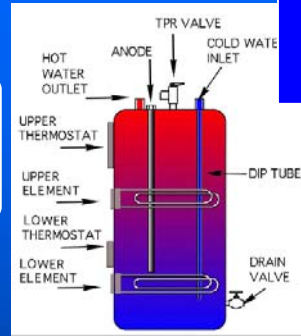
HPWH \$1300/Tank

ELEC TANK \$286/Tank



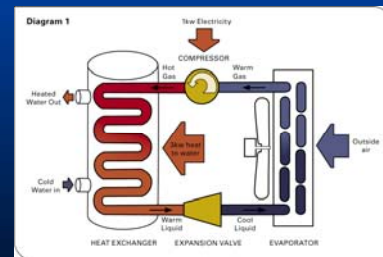
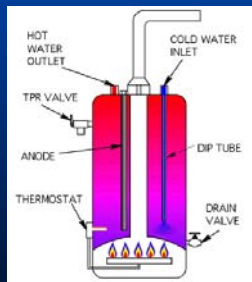
# Existing Electric Water Heater

- Is Gas Available?
- Tank Cost
- Installation Cost
- May Require Gas Line Extension Cost
- May Require Flue Venting Cost



2.7 Million Electric Water Heaters

- Suitable Location?
- Tank Cost
- Installation Cost



slide 5

Northwest Power and Conservation Council

## 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
  - About \$30/MWh
  - Most of that will occur under market conditions
- Policy: Take a market-oriented approach

slide 6

Northwest Power and Conservation Council

# Current Council Policy

## 5<sup>th</sup> Power Plan

- Electric to Gas Conversions not “Conservation”
- But conversions can be economically efficient
- Analyze conversion as alternative to conservation & generation
- Technology, pricing & market changes not that different from 1994 study
- Markets are working well to guide cost-effective fuel conversions
- So no market intervention necessary
  - Information & Efficient Pricing

slide 7



## 6th Plan Update

- More Technology
  - New Options
    - » Instant Gas WH
    - » Hybrid Gas/HP
    - » HP Water Heat
    - » Gas to ELEC HP
  - New Pricing
  - New Efficiencies
- Carbon and NOx Emissions
  - Physical & Economic
- Resource Portfolio Model
  - Fuel & Electric Price Uncertainty

slide 8



# Part 1: Analyze Fuel Conversion Segments & Develop Supply Curves

- Under Contract
  - RFP: Global Energy Partners
  - Funded by Gas Association, Puget Sound Energy & RTF
- Residential Only
  - RTF Advisory Group Scoped the Study
- Total of 91 Fuel Conversion Segments Analyzed
  - Completed “Supply Curves” in September
  - Staff & RTF Digesting it Now

slide 9



## Variations Included in 6<sup>th</sup> Plan Analysis

- House size
- Energy usage given a house size
  - Insulation, climate, family size
- Space heat system type
- Water heat system type
- Capital & installation costs of conversion
  - Configuration of house, ducts, ventilation
- Gas main extension & service connection
  - Distance, density of service, soil type, pipe size
- Gas & electric prices
- Cost of carbon emissions
- Cost of NO<sub>x</sub> emissions

slide 10



## Part 2:

### Fuel Choice Supply Curves into RPM

- Relative prices drive the economics
  - Gas, Electricity, Carbon & NO<sub>x</sub> Emissions
  - Conversion Costs & Pace
- Evaluate Using Resource Portfolio Model
  - Array of Gas, Elec, & Carbon Prices, Plus Loads
  - Evaluate Cost & Risk
- Work is Ongoing
- This is New Territory, Not Sure How Far We Will Get
  - Significant review & interpretation of RPM results required
  - Interaction between fuel conversion & efficiency supply
- Unknown Impact at this time