Regional Technical Forum Meeting Notes

May 17, 2005
PNGC Offices
Portland, OR

DRAFT

1. Greetings and Introductions.

Today's meeting was chaired by Tom Eckman, who led a round of introductions and a review of today's agenda. The following is a summary (not a verbatim transcript) of the topics discussed and decisions made at today's meeting. Anyone with questions or comments about these notes should contact Eckman at 502/222-5161.

2. Proposed Process for Developing Prescriptive Specifications and Deemed Savings Values for New Small Commercial Offices.

Charlie Grist led this presentation, titled "Work Plan for Small New Commercial Buildings." He touched on the following topics:

- Objective – easy-to-use method to estimate energy savings for common new small commercial buildings; couple with program marketing and deployment, typical offices, retail, warehouse, other types; typical savings from package of measures, programmatically simple to apply; focus on design-build and contractor communities
- Regional conservation resource 2005-2009 acquisition targets 700 MWa total, 100 MWa lost opportunity (graph)
- Plan lost-opportunity assessment (new and replace on-burnout) (pie chart)
- Lost-opportunity potential in new commercial buildings by measure pie chart)
- Plus lighting is cheap – MWa potential in 2025 by measure vs. levelized cost (graph)
- Lighting equipment potential in new buildings by type (pie chart)
- New physical units – 40 to 80+ million s.f./yr, 2,000 to 4,000 new buildings/yr (graph)

- Issues – baseline (code and standard practice differ between areas), ownership and development patterns, methodology
- Work plan elements – convene volunteers for initial scoping, review best practices PNW and US, consider options, pick approach, choose the business types to target first, decide how to fund development
- Need volunteers – your name here

Is this not considered a market transformation issue? Eugene Roslie asked. It could be so construed, but this is a fertile field that, so far, in untapped by local utilities, Eckman replied. Grist noted that there is huge market overlap here and that reaching these buildings is not going to be successful without significant utility participation. Jim Lazar added that many of the measures shown in slide 3 are identical to the measures used during retrofits. True, Grist agreed.

Another participant noted that one of the difficulties with new construction is how to measure and what to measure against; it seems to me that it might make more sense to measure at the program level, he said. David Baylon replied that, at least for HVAC systems, it is very difficult to measure savings. However, this program would provide an opportunity for the RTF to get buildings built they way they think they should be built.

It was agreed to form an RTF subcommittee to look at this topic in more detail; this subcommittee will include Grist, Jack Callahan, Baylon (for review), Jeff Harris, and possibly a representatives from Snohomish PUD and Puget Sound Energy.

3. Consideration of Adding Wave/Tidal Energy Production to List of Eligible Renewable Resources.

Jeff King led this presentation; he distributed an excerpt from Chapter 5 of the 5th Power Plan covering ocean currents, tidal energy and wave energy and their potential use in generating electricity. The plan regards these as pre-commercial technologies, King said; there are various demonstration programs proposed for Oregon and Washington.

Has this been done anywhere? asked another participant. There was a lot of interest in this technology back in the 1980s, King replied; at that time, the leading design was a heaving buoy, anchored to the seafloor. A refinement of this design, the Palamus Device out of England, is now considered to be the technological leader. At least one prototype of this design has been deployed in the U.K. There is also a proposal to deploy an array of “current turbines” – essentially, underwater wind machines – in New York’s East River and San Francisco’s Golden gate.

Any objections to putting this on the list of eligible renewable resources, in case a utility wants to study it further? Eckman asked. None were offered; Bruce Cody moved that this measure be approved; Rosolie seconded the motion, and it was unanimously approved.

4. Request to Consider Modifications to PTCS Air Source Heat Pump Specifications to Permit Use of Staged Recovery Thermostats in Lieu of Outdoor Thermostats and Heat Pump Sizing.

Adam Hadley led this presentation. titled "Proposed Heat Pump Specification Changes." Among the highlights:

- Heat pump specifications – Q: isn't there are moratorium on making changes to the heat pump specifications? A: Yes, but these proposed changes are either clarifications or "loosening" of the specifications. If approved, it may be wise to make the changes sooner (before 2006) rather than later (post-2006).
- Comments (from Kevin Howard) – summarized: 1) requiring duct leakage tests and blower door tests for sizing is unnecessary and a waste of resources, and 2) a microprocessor-controlled indoor thermostat with a "heat pump recovery" function can be as effective as an outdoor thermostat at reducing the energy use of supplemental heaters. In addition, the two should not be mixed.
- Comment 1 – current RTF and PTCS specifications

Hadley offered the following proposed specifications related to Comment 1:

Proposed RTF Specifications:

- 4.1.6 – An infiltration rate of 0.5 or 0.8 air changes per hour shall be used for houses built in or after 1985 or before 1985, respectively, in sizing calculations unless a house (de)pressurization test has been performed and an estimate is made using the result
- 4.1.7 – Where available, the results of duct pressurization testing shall be used to estimate the duct system efficiency used in sizing calculations. If a duct pressurization test has not been performed on the house, a default duct system efficiency of 85% shall be used for houses that will receive duct sealing in conjunction with the heat pump installation; a default duct system efficiency of 80% shall be used for all other houses. Exception: if the air handler and all ductwork are within the thermal envelope of the house, 100% shall be used as the duct system efficiency in sizing calculations.

Proposed PTCS Specifications

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The group devoted a few minutes of discussion to this proposed change; in particular, to the question of whether these changes represent a loosening or a tightening of the existing standard. Howard briefly clarified the reasoning behind his comments. Rosolie wondered if this is really worth doing for one year; he also wondered about the impact of this proposed change on costs in the next rate period. Stephens said he would support a default duct system efficiency of 75%, rather than 80%, for systems outside the house's thermal envelope. Howard said that, in his view, 90% would be a better number, based on the ASHRAE data.

Stephens moved that the RTF adopt these changes as modified at today's meeting, including the change to a break point of 1980, rather than 1985, and a default duct system efficiency of 75%. Mark Johnson noted that this change would go into effect this Oct.1. This motion was seconded and unanimously approved.

Hadley then moved on to Comment 2, touching on the definitions of "outdoor thermostat" and "heat pump recovery," as well as the history of outdoor thermostats in the specs. He also addressed:

- Can we really tell which is better (outdoor thermostat vs. heat pump recovery)?
- Comment 2 – current specifications
- Comment 2 – discussion: what's the intent of the specification? Definition of "unnecessary use of installed auxiliary heaters"

He then offered the following proposed specifications related to Comment 2:

RTF Specifications

- 4.5 – A control strategy that minimizes the unnecessary use of installed auxiliary heaters should be implemented. "Unnecessary use of installed auxiliary heaters" is defined as offsetting available heat output of the heat pump's refrigeration cycle with heat output from auxiliary heaters. One of the following control strategies may be used to accomplish this goal. a) A standard non-programmable or time-clock programmable indoor thermostat installed with an outdoor thermostat, or equivalent. The

outdoor thermostat shall be installed and set so that auxiliary heating does not engage above 35 degrees F, or that temperature required by the utility, except when supplemental or emergency heating is required during a defrost cycle or refrigeration cycle failure. b) A microprocessor-controlled indoor thermostat with an enabled heat pump recovery function. The installer and/or utility should instruct the homeowner on proper, efficient operation of the thermostat. If this option is used in conjunction with an outdoor thermostat (optional), the first stage auxiliary heat (about 5kW) shall be allowed to operate independently of the outdoor thermostat.

Proposed PTCS Specifications

- 4.5 – A control strategy that minimizes the unnecessary use of installed auxiliary heaters shall be implemented. “Unnecessary use of installed auxiliary heaters” is defined as offsetting available heat output of the heat pump’s refrigeration cycle with heat output from auxiliary heaters. One of the following control strategies may be used to accomplish this goal. a) A standard non-programmable or time-clock programmable indoor thermostat installed with an outdoor thermostat, or equivalent. The outdoor thermostat shall be installed and set so that auxiliary heating does not engage above 35 degrees F, or that temperature required by the utility, except when supplemental or emergency heating is required during a defrost cycle or refrigeration cycle failure. b) A microprocessor-controlled indoor thermostat with an enabled heat pump recovery function. The installer and/or utility should instruct the homeowner on proper, efficient operation of the thermostat. If this option is used in conjunction with an outdoor thermostat (optional), the first stage auxiliary heat (about 5kW) shall be allowed to operate independently of the outdoor thermostat.

Please note that the full text of Hadley’s presentation is available via hot-link from today’s agenda on the RTF homepage; please refer to this document for further details.

What happens if you have an intelligent recovery thermostat, and you do, say, a 10-degree setback at night? asked one participant. That setback doesn’t drop you below 35 degrees; if you have both an intelligent recovery thermostat and an outdoor thermostat, it won’t give you any resistance heat. The whole idea of intelligent recovery is to avoid using resistance heat, replied another participant. It’s not a good idea to set a heat pump back by 10 degrees at night, Baylon observed – it would be better to set it back by 10 degrees during the day, when no one is home. If you have adequate compressor capacity, this problem will be much smaller, he added.

Baylon suggested that the language in the first sentence of the proposed RTF specifications be changed from “should” to “shall.” Other participants disagreed.

Hadley offered the following discussion and decision points relative to Comment

2:

- Option 1: Keep specs as-is, continue to require ODT for PTCS
- Option 2: Accept the proposed changes; allow a “heat pump recovery” thermostat in lieu of an ODT for PTCS specs. Assume equal performance.
- Table the decision – study the difference in performance of ODTs and “heat pump recovery” thermostats

Stephens moved that the RTF accept Option 1. This motion was seconded and unanimously approved.

5. Update on the Impact of Refrigerant Charge and Airflow on Air Source Heat Pump Heating Performance Laboratory Testing Results.

Baylon led this presentation, titled “Laboratory Testing Results – Impacts of Air Flow and Charge on Heat Pump Performance.” He noted that all of the tests are now done; the following represents our best understanding of the results of the Purdue tests, he said. Baylon touched on the following topics:

- Testing goals – determine the effects of charge and air flow variations on heat pump performance in heating; assess the impact of TXV vs. fixed metering as a result of variation in charge and air flow; provide measures of cycling degradation on a typical heat pump over the range of testing; provide measure of defrost degradation factor over a range of testing.
- Review of testing results – difficulties of measurement resulted in corrections over previously-presented data; some measurement error on the results, perhaps 1-3% depending on flow conditions; much more problematic at low flows
- Capacity impacts: fixed metering (graphs)
- COP impacts: fixed metering (graphs)
- COP impacts: TXV (graphs)
- C_d
- HSPF: all metering
- Field-observed air handler flow

Finally, Baylon offered the following results from the Purdue lab studies:

- Impacts of refrigerant charge minimal, except at very reduced levels (70% of spec)
- Impacts of air flow also limited to cases with very low air handler flow
- Low air flow is endemic to current installation practice (perhaps 20% of homes have air flows in the range that significantly impact

performance)

- TXV improves overall performance but has minimal impacts on the effects of low charge and low air flow
- C_d iis higher than modeling assumptions for fixed orifice, lower than assumption for TXV
- Defrost degradation factors largely stable at values near the modeled and manufacturers' assumptions.

In the course of this presentation, the group offered a few clarifying questions and comments. One of the conclusions I see here is that, compared to the fixed orifice, I don't see a lot of value to the TXV, in terms of maintaining a flat profile relative to charge, observed one participant. That's correct, Baylon said – TXV does give you improved performance, but not relative to charge. The TXV is a mechanical device, and all mechanical devices increase the possibility of failure, observed another participant – to me, it would make sense not to require a TXV valve, but instead, to require a fixed orifice with a conditioner. That would likely be a consumer or installer decision, rather than a program condition, Baylon replied.

So in the heating mode, the TXV isn't really giving you any benefit over the fixed orifice, observed one participant. Not when it comes to charge, Baylon replied. What the Eugene study showed was that 15% of the cases – the catastrophic ones – produced 95% of the savings. The only real value of the TXV valve is in air flow. What this data suggests is that, if we're going to make a stand anywhere, in terms of how installers are behaving, we should do it on airflow. Can that be done without a third-party fee? asked the participant. Can we test it ourselves with our True-Flow plates? Absolutely, Baylon replied – I think that's what we need to do. I also think we need to look more closely at variable-speed fans, suggested another participant. This also suggests, at least to me, that our devotion to CheckMe! should, perhaps, not be our first choice, said Baylon – this is definitely an endorsement for flow testing. As long as we clearly define the protocols for that testing in the specs, another participant observed.

This was an information item, said Eckman; we'll discuss this topic further at our June 7 meeting.

6. Proposed Approaches to Cost-Effectiveness Screening for Bonneville's Post-FY 2006 Programs.

Eckman began by noting that this is primarily an information and planning agenda item. The rules for C&RD are changing under the terms of BPA's post-FY'06 work plan, he said; my main purpose today is to apprize you of how those rules will be changing, and to provide an opportunity for the RTF to discuss our own work plans for 2006 and beyond.

Eckman described the new goal for the RTF process as follows:

- Original charge: establish the *value to the region's power system* of

conservation and direct-application renewable resources using the Council's methodology and RTF assumptions

- Revised charge: establish the *cost-effectiveness* of conservation and direct application renewable resources using the Council's 5th Plan methodology and assumptions.

Using the overhead projector, Eckman touched on the following major topics:

- Why is cost-effectiveness an issue? Because...
- BPA has stated that starting in Fiscal 2007 it will only fund those measures identified in the 5th Plan as *cost-effective*
- BPA's existing Conservation and Renewable Resource rate Discount Program (C&RD) does not include a cost-effectiveness constraint
- Some utilities are concerned that they will not be able to reach their conservation targets (ie: use all of the C&RD credits) if BPA only funds cost-effective measures
- Some utilities believe that BPA and/or the Council should use a different definition of cost-effectiveness, and/or apply the current definition lest restrictively
- The Council Plan and BPA policies **do not** restrict what measures utilities pay for with their own funds
- The Plan uses total resource cost (and benefits) perspective – best meets the requirement of the Regional Act, considers all quantifiable costs and benefits regardless of who accrues them; ensures that conservation expenditures are good for the power system, the customer and society; allows conservation to be compared to other resources considered for development by including all quantifiable costs and benefits; was strongly recommended by utilities in the first Council Plan
- Some utilities now recommend the use of utility cost test perspective – considers only those costs and benefits that accrue to the electric utility system; does not count customer costs or benefits; ensures that conservation is good for the utility; acts as the upper limit on utility incentives for measures with large non-electricity benefits; used as a measure of utility cost efficiency
- Why the Council uses TRC (example 1) – avoids potential double-counting of savings; utiliity invests $2,500 in an efficient motor to acquire 5,000 hWh/yr savings, at a levelized cost of 3.4 cents per kWh, with a B/C of 1.32; customer matches the $2,500 utility investment to save the same 5,000 kWh/yr, simple payback = 10 years, motor lasts 20; total of all direct cost is $5,000 for 5,000 kWh/yr of savings, levelized cost = 6.8 cents per kWh, with a B/C ratio of 0.66
- Why the Council uses TRC (example 2) – directs funds toward measures that optimize total utility and customer investments. Utility invests $600 toward cost of $6,000 solar PV system that saves 1,200

kWh/yr. Alternately, the utility and the customer could invest $160 in 40 CFLs to save 1,200 kWh/yr, saving $440, or invest $600 to buy 150 CFLs, saving 5,000 kWh/yr. This is especially important when budgets are limited.

- Why the Council uses TRC (example 3) – avoids promoting measures that may impose non-energy costs on others. The Act directs the Council to give second priority to the use of renewable resources. Analysis in the 1st Plan concluded that the cost of using wood stoves to offset the use of electric heat was below the cost of electricity from new generating facilities. The 1st Plan excluded the use of wood heat due to the "non-energy" cost (air pollution) imposed on the region.
- Why the Council uses TRC (example 4) – it expands the list of conservation options by considering quantifiable "non-energy" benefits. Energy Star clothes washer in homes with gas water heater and dryer, present value capital cost = $58/MWh. Present value to the power system = $17/MWh (B/C = 0.3). Value to region/society (includes natural gas, detergent and water savings) = $110/MWh (B/C = 2.0). Power system's "willingness to pay" for these savings should be limited to its present value benefits. Electric utility could provide incentive up to $17/MWh for washer in a home with gas water and dryer heat.
- Care must be used in applying the Plan's cost-effectiveness measure level results "prescriptively:" not all measures are in the Plan; Plan assumes administrative costs = 20% of capital cost; plan contains "point estimates" of measure cost-effectiveness; Plan's cost and savings estimates are "averages."
- What's the incremental cost of dishwasher energy efficiency improvements? – retail price and minimum retail price vs. energy factor (cycles/kWh/yr) – (graphs)
- What's the incremental cost of clothes washer energy efficiency improvements? – average retail price vs. modified energy factor (cu.ft/kWh/cycle) – (graphs)
- What does Tier 2 efficiency cost? Average retail price of Energy Star clothes washers (table)

Eckman then moved on to the question of "Where does the RTF fit in?" The Council's recommendations include:

- The Plan's cost-effectiveness methodology should be used when "average" cost and savings assumptions inaccurately reflect specific conditions
- The RTF should assist Bonneville and the utilities to apply the Council's TRC methodology; identify measures and applications not in the 5th Plan that are cost-effective; to develop more "granular" measure cost-effectiveness estimates; to address "practical application" of TRC cost-effectiveness methodology; and to "bundle" measures to improve

marketing efficiency.

Moving on, Eckman touched on some potential technical issues, including

- Granularity – current deemed measure is too general (needs to be more granular); or it is too specific (needs to be bundled)
- How granularity" can impact measure cost-effectiveness – example: heat pump conversions (tables)
- Bundling – are there technical reasons cost-effectiveness should be determined at the "bundled" level?
- Administrative cost – where should administrative cost be applied in cost-effectiveness analysis?
- Deemed calculators and protocols – existing "deemed calculators" and "protocols" do not compute cost/benefit ratios. Should they be revised to do so? All 30+ deemed calculators will need to be revised to provide this data. Existing "deemed calculators" are designed to provide users with greater flexibility.
- Point estimates of future market prices – 5th Plan's targets are based on 750 possible "avoided cost" forecasts. ow should this be reflected in cost-effectiveness analysis? Option 1 (current approach): use point forecast as "expected value" (B/C ratio must be 1.0 or higher). Option 2: use range forecast to determine sensitivity of B/C ratio to differences in market price forecasts (accept B/C ratios less than 1.0 – how much lower?). Option 3: use 750 future market prices to establish "probability of B/C ratio 1.0" – accept X% or higher probability.

The group devoted an extensive discussion to Eckman's presentation, offering a variety of clarifying questions, comments and criticisms. One participant noted that one comment he has heard from utility company executives is that the C&RD program, as a whole, is extremely and needlessly complicated. If we could simplify the list of measures somewhat, perhaps through bundling, that would be a welcome change, he said.

The group discussed how best to simplify the program. Eckman then put up an example, his Energy Star room air conditioners deemed savings calculator, noting that he had taken the liberty of modifying this tool to address some of the RTF's likely concerns. He briefly demonstrated how the calculator works; in particular, how it calculates cost-effectiveness. The tool calculates annual site energy savings, annual bus bar energy savings, the C&RD credit, measure life, baseline model retail price, the cost-effectiveness limit for the Energy Star model's retail price, and whether or not the model is cost-effective (yes/no). The group discussed the considerable effort that will be necessary to modify all 30+ deemed savings calculators to reflect the RTF's new direction; it was observed that it makes little sense to expend this effort if BPA is unwilling to implement the RTF's new recommendations.

Eckman noted that there is clearly a great deal of work to be done between now

and the time the new goal for the RTF process takes effect, including the major decision about whether or not to modify the deemed savings calculators to perform a benefit-cost analysis. There has to be some way for us not to begin by going down into the weeds, Rosolie observed, to make some decisions early on about what is most important and what is least important. The supply curve is simply a placeholder for everything at that price, Eckman replied. For modeling purposes, all we need to concern ourselves with is how much savings we get for a given price. He added that, from his perspective, it is important to focus on the largest pieces of the pie – for example, lighting is 20% of the total potential savings; water heating is another major component of the savings equation. We've talked a lot about heat pumps and dishwashers today, he said, but together, they make up less than 5% of the total savings available.

7. Next RTF Meeting Date.

The next meeting of the Regional Technical Forum was set for Tuesday, June 7. Meeting summary prepared by Jeff Kuechle, NWPP&CC contractor.

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May 17, 2005

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