REGIONAL TECHNICAL FORUM MEETING NOTES

February 7, 2005
Northwest Power & Conservation Council Offices
Portland, Oregon

DRAFT

1. Greetings and Introductions.

Today's Regional Technical Forum 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 items discussed and decisions made at this meeting. Anyone with questions about these notes should contact Eckman at 503/222-5161.

2. Presentation and Discussion of Proposed 2005 RTF Workplan.

The meeting began with a discussion of the RTF's work priorities for the coming year. Eckman distributed copies of a draft workplan covering the January-July, 2005 period, noting that it is subject to change as new issues arise. Eckman said the RTF's primary initial responsibility will be to translate the Council's analysis of conservation opportunities into measures that can be used in Bonneville's post-2006 conservation programs, and by utilities and others. We will be reviewing those measures, as well as the financial inputs that drive them, Eckman said. We will also be evaluating the results of the ongoing heat pump and irrigation scheduling research, he said. Eckman invited the other RTF participants to review the proposed RTF workplan and to provide any comments, particularly on items that should be included but have not been, directly to him. It's worth noting that it seems to be shaping up to be a very busy year for the RTF, Eckman said.

3. Presentation and Discussion of the Status of the Regional Air Source Heat Pump Research and Evaluation.

David Baylon led this presentation. Baylon reminded the group that there has been an ongoing effort to resolve the questions surrounding the performance of residential air source heat pumps. Early on in the process we determined that we knew practically nothing about the main determinants of heat pump efficiency in the heating mode, since nearly all of the work done to date focused on their cooling performance. This meant that there was a need for some serious work on what factors determine heat pumps heating performance. Ecotope, at the request and with the support of the RTF has been working for about two years on a heat pump simulation, to

enhance the region's analytical capacity. Unfortunately, other than anecdotal data there was very little information on the appropriate values for many of the parameters needed in the model. For example, there was very limited publicly available information on heating system capacity and performance as a function of refrigerant charge.

This presentation is a status report on an ongoing research project Baylon said; we expect to have the bulk of the project completed around the end of March. Nevertheless, we do have some results, or at least some promising directions, that should be of interest to this group. The most significant early results are deal with the impact of system commissioning, i.e., assuring proper refrigerant charge and airflow, on system performance. A second focus of the study was to ascertain how heat pumps are installed. The goal of this part of the study is to determine why performance varies so much from locality to locality. To get at that, we're doing both a field evaluation and interviews with market actors. Finally, he said, we're looking at the performance for these heat pumps installed in utility programs operating under Bonneville's C&RD program, Baylon said.

Baylon then moved into an overhead presentation (available via hotlink from today's agenda on the RTF website), and, with assistance from Bob Davis, David Robison and Howard Reichmuth, touched on the following major topics:

- Study goals
- Study components
- Laboratory testing
- Preliminary results – total variation of less than 2% COP over the range of tests; indications of fall-off but very small effect on COP; air flow can result in up to 10% reduction in capacity and up to a 4% reduction in COP; main effect at very low flows (under 300 CFM/ton)
- COP vs. charge mass (graph)
- Heating capacity vs. charge mass (graph)
- Impact of air flow (graph)
- Billing analysis – CheckMe! (graph) – pre- and post-installation
- The CheckMe! analysis – parameters
- CheckMe! program savings
- CheckMe! analysis results – gross savings average about 400 kWh/yr; savings distributed throughout the sample (both controls and charge-tested homes); no apparent benefit for refrigerant adjustment; savings primarily from 8% of cases; to do: verify savings estimate against control group.
- Field site monitoring
- Typical heat pump operation – watts vs. time (graph)
- Typical operation – temperature vs. time (graph)
- Frequent change of thermostat – The Dalles site (graph)
- Improvement with programmable thermostat – The Dalles site (graph)
- Typical operation – The Dalles site (graph)
- Typical operation – Sunriver site (graph)
- Excessive fan operation (graph)
- Fan and compressor stages not always compatible (graph)

- Overall site monitoring results (table)
- Regional billing and field review
- Recruitment results (table)
- Regional billing analysis
- Field reviews
- Market actor interviews – now approximately 75% complete

The increase in COP from, say, 1,000 to 1,500 CFM obviously requires additional fan energy, said Jim Lazar – is that being counted in the COP calculation? Yes, Baylon replied – the fly in this particular ointment isn't the fan energy; it is the discharge temperature at the coil, often in the mid-80s. You can live with it being a little bit off the manufacturer's rated flow, but you can't live with it being 20% off the manufacturer's rated flow.

You have field monitoring sites in The Dalles, Sunriver, Eugene and Ashland – shouldn't there be one more, at the coast? asked a participant. Yes, we did have a logger at the coast, but it failed, Baylon replied. The group discussed the results from the various locations; it was noted that these results varied from location to location, sometimes in puzzling ways. The bottom line is that all of these are interim results based on systems that have problems, and the intention is to get them fixed and working properly so that we can record what a heat pump should be doing, said Reichmuth.

You're trying to fix this, and take another look at the data, said Charlie Grist – couldn't it be that, once you do so, you'll find another set of secondary problems? What you've uncovered here is a multiplicity of ways things can go wrong – it seems to me that it could take several iterations before you resolve these issues, Grist said. It has taken several iterations, Baylon replied – in all of these cases, we identified problems at the time we did the installation and got them fixed then. Now we're finding a second set of problems that weren't immediately apparent. But that's the underlying problem; observed another participant – even well intentioned people can, through faulty installation, cause these problems.

The group discussed the role of accumulators in efficient heat pump use; Baylon noted that a memo from Carrier said it was a more important technology for maintaining equilibrium in charge than either correct charge or the TXE valve. John Proctor agreed, noting that the accumulator is crucially important to efficient heat pump operation in the heating mode.

We have a set of specifications out there, intended to backstop a lot of these failure modes, with accumulators, charge-and-flow requirements etc., said Eckman – given what you've seen so far, is there any hope? Also, are there some areas of the specification that we ought to address as soon as possible so that we actually see better-performing systems by this October 1? One thing that seems to hold considerable promise is the outdoor thermostat, and the ability to lock out resistance at higher-temperature bins, Reichmuth replied. That's not a feature that seems to be installed often in the base case, but when you run the heat pump model on it, it seems to suggest levels of savings that are equal to or greater than what we've been using for commissioning savings, even when we've been using the full 10% adjustment for CheckMe! There is some data to indicate that this would be a significant improvement in our spec, he said. Eckman noted that the RTF's specifications for heat pump installation recommend the use of an

outdoor thermostat and that the PTCS specifications require its use. He said, that RTF debated whether to require this measure in its "base" specifications, but was concerned that it might be disabled by contractors if consumers complained about "cold air flow."

What about sizing – more guidance, less guidance, different guidance? Eckman asked. I think that our current language, which sets 25 as a balance point, rather than a minimum sizing point, will hold up, Baylon replied – we may want to lower it for colder climates. It does look as though capacity limits are more likely to get us into trouble than extra capacity. But on the other side, we have the impact on efficiency of cycling the system as a result of duct losses, which, if large, could change the answer completely.

4. Presentation and Discussion of the 5th Power Plan Financial and Economic Assumptions and Baseline Market Price Forecast.

Eckman said the Council has just adopted the 5th plan, and said that, at today's meeting, he wanted to walk through some of the implications of the plan in terms of measure cost effectiveness, program cost effectiveness, etc. The reason for doing this is that, before they are presented to Bonneville, these recommendations must undergo RTF review, Eckman said – it's not a pro forma assumption that the RTF will buy into everything Council adopted in terms of a recommendation to Bonneville.

Eckman then provided a presentation, titled "5th Northwest Power and Conservation Plan Economic and Financial Assumptions and Market Price Forecasts – Implications for Post-FY'06 Bonneville Program Measure Cost Effectiveness" (available via hotlink from today's agenda on the RTF website), touching on the following major issues:

- The goal of the RTF process – establish the value to the region's power system of conservation and direct application renewable resources; requires numerous assumptions about future market prices, interest rates and carbon mitigation costs
- The 5th Plan differs from the RTF on three major input assumptions: 1) discount rate (4.75% - RTF) vs. 4.0% - Plan); 2) market price forecast (year 2000 forecast - RTF vs. year 2005 forecast - Plan); 3) externalities credit for reduced carbon emissions – $15/ton (RTF) vs, $7.50/ton (expected value in 2025, increasing from $0 today)
- Market price forecast comparison, 2005-2025 (graph)
- Average carbon cost comparison, 2005-2025 (graph)
- Sample 5th Plan assumption impact on cost effectiveness (graph)

Eckman then offered the following assessment of the overall impact of the 5th Plan assumptions:

- Lower discount rate increases the number of measures that are cost effective
- Higher market price forecast increases the number of measures that are cost effective
- Lower carbon cost decreases the number of measures that are cost effective
- Overall – more measures will be cost effective compared to existing RTF assumptions.

Eckman then asked whether the RTF is willing to adopt the 5th Power Plan market price,

discount rate and carbon price assumptions. Is there a list of the measures that fell off the list because of the new calculations? Jay Himlie asked. No, because there are more measures that make the list because this is more beneficial to conservation than the prior sets of assumptions, except for the carbon tax assumptions, Eckman replied. There will be some items that drop off the list because they will become code in 2006, but there are other measures that will come on to supplant them – for example, heat pumps.

Is this real discount rate? asked another participant? Yes, Eckman replied – it was 4.75% in the last Plan, 3% in the previous Plans, and 4% in the current Plan. Does it matter? the participant asked. Yes, was the reply, particularly for long-life measures. Does the current Power Plan have a carbon cost built into it? another participant asked. The current Plan has this cost built into it; the prior plans had zero, Eckman replied. Lazar noted that the California Commission just ordered a range of $8 to $25 per ton for evaluation of fossil generation bids at the Mohave site.

Grist suggested that the RTF consider each of the three main parameters in the Council plan – discount rate, market price forecast, and externalities credit (carbon emissions) – separately. Lazar moved that the RTF accept the Council's 4% discount rate assumption; this motion was seconded by Ken Eklund. After a brief discussion, this motion passed unanimously.

Jeff Harris then moved that the RTF adopt the Council's market price forecast; no second was initially offered to this motion. In response to a question, Eckman said this estimate was developed based on Terry Morlan's forecast for natural gas prices, based on his review of the Natural Gas Advisory Committee's comments and many other forecasts. Is there a summary of the factors you considered in concluding that natural gas prices will decline? another participant asked. It's in the appendix to the Plan, Eckman replied. Mainly, it has to do with the assumption that higher prices will lead to more exploration, another participant observed.

Eckman noted that Council staff's intent, if they can get the requisite software up and running, is to be able to take 750 different futures and provide a distribution of benefit cost ratios. We'll be able to say that, in 75% of the expected cases, this works, and in 25% of the cases, it doesn't he said. It's not a point estimate – it's 750 different market price futures. The RTF current cost-effectiveness assessment is based on a single set of future conditions that assume "average" hydro conditions, medium economic growth, medium natural gas prices and other factors. This single market-price forecast also assumes "least cost" dispatch and development of resources – it hides multiple sins, Eckman said. So the fact is that what we're using today has a similar set of assumptions in it – they just result in a lower market price forecast.

After a few minutes of additional discussion, Lazar moved that the RTF agree to use this forecast until it is changed by the Council, and recommend that the Council update it on an annual basis. The motion was seconded and unanimously approved.

The next question is the carbon issue, said Eckman; the number we're using is substantially higher than the number being used as an expected value in the Plan. Eckman and Grist described the assumptions that went into staff's estimate of carbon mitigation costs. Ultimately, Lazar moved that the RTF accept this estimate subject to its being updated based on

actual numbers from markets where carbon is being traded. This motion carried unanimously.

5. Presentation of DRAFT Residential Measure Economics Using 5th Plan Assumptions.

Eckman noted that this analysis assumes a 4% discount rate and RTF endorsement of the Council-adopted market price forecast; I then translated that into a very conservative $2 per kWh add-on for carbon, he said. The number may be as high as $10, but I'm using $2, Eckman said. The numbers you're going to see represent what is likely to turn out to be OK, and some measures that are on the margin, or out right now, will likely move in as a result of moving this carbon level into the analysis. In other words, there are probably more things that are going to show up as B/C ratio 1, Eckman said.

Eckman then illustrated what is in the summary tables he had prepared using an overhead showing a sample of residential lighting measures. Six measures on the list had a B/C ratio less than 1.0. Under Bonneville's proposed PostFY06 policies there are six measures that fall off the list because they are not cost-effective, given the market price forecast estimate, the discount rate assumptions and carbon cost assumptions in the Plan. The group devoted a few minutes of discussion to this topic.

Lazar asked about including non-cost-effective measures within certain programs. Bonneville seems to have taken that to heart in the Record of Decision last week; Paul Norman's letter says "It is a given that only cost-effective programs and measures should be pursued." However, there are a fair number of utilities that are funding heat pumps and window replacements that, in the old C&RD scheme of things, were not cost-effective. Under the new Bonneville scheme of things, to my mind, at least, those things should come to an end, Lazar said. My understanding was that the Conservation group's discussion included the concept of packaging household retrofits – you're not just doing a heat pump, but you're doing a suite of measures, the cost effectiveness of which should be looked at as a package. We should probably talk about whether some of these non-cost-effective measures could meet the test if they were a part of a logical package that met the cost-effectiveness test, Lazar said. We could certainly consider that, said Eckman.

What's the difference between a package and a program? asked Eugene Rosolie – why would we make an exception for a non-cost-effective measure simply because it was included in a larger suite of measures? Excellent question, but please address it to Karen Meadows at Bonneville – we can't take it up here today, Eckman replied. The one clarification I would make to Jim's comment is that the Record of Decision does say that the design of any future C&RD program is going to be left up to the collaborative process, said one meeting participant. Also, since Bonneville states that they will seek to meet their conservation goals at the lowest possible cost to BPA, we'll see if there is any tension between Bonneville's desire to minimize its own costs in its pursuit of cost-effective conservation, he said. I've been in all of the meetings at which various regional entities have circled and sniffed that fire hydrant, and my kidneys are still full, Eckman observed. We can certainly put the packaging issue on a future agenda, said Lazar. I would also agree that Eugene's question about program vs. measure cost-effectiveness is a real issue, Eckman said.

If you look at some of the difficulties in implementing this, it's hard to say to a customer, just because you have a basement and he doesn't, or you have a house that was built in 1981, and he has one that was built in 1980, it's a different answer for you, because I'm trying to run something for you that satisfies customer needs, Eckman said. You have to look at the overall program effect – it's easy to line these up on a spreadsheet, but it's harder to make a program make sense out of it. You have to take more care in packaging things together so that someone can actually deliver them, and I am mindful of reality. Well said, observed one meeting participant.

6. Presentation, Discussion and Decision on Proposed Deemed Savings Calculation Process for Commercial Refrigerated Cooler Controls.

Grist noted that National Resource Management came to the RTF some time ago to get its technology approved as an RTF measure; Jack Callahan of BPA agreed to look at this as well as similar measures. Jack and I met with representatives from NRM and have now developed our recommendation, Grist said.

Grist and Callahan then led an overhead presentation titled "Review of Grocery Store Refrigeration Measures and Recommendations for NRM CoolTrol Proposal." Again, the full text of this presentation is available via hotlink from today's agenda on the RTF website. Among the highlights:

- Efficiency measures – controls
- Efficiency measures – equipment
- Efficiency measures – O&M
- Best candidates for deemed savings or calculators – refrigeration energy management systems, evaporator fan controls, anti-sweat heater controllers, fan motor replacement (ECM); self-contained beverage cooler controllers (time-controlled); case lighting upgrades.
- Evaporator fans
- Evaporator fan controls
- Evaporator fan controllers – sample products
- Evaporator fan controls – energy savings – up to 10%-60%
- Evaporators – fan controls, economics for 6 fans (table)
- Evaporator fan controllers – economics: cost: stand-alone controller, $100-$600; energy management system $3,000-$6,000; utility incentives: California Express Efficiency Rebates SCE – $75 per controller. NSTAR, 80% of cost plus financing; California SPC, $0.20 per kWh (typically 75%-100% of cost); National Grid,80% of cost plus financing; Oregon Trust, 35% of cost plus BETC

The concluded with the following evaporator fan controllers issues:

- Savings depend on compressor duty cycle, but compressor duty cycle varies greatly
- Savings vary by season, short-term test of compressor duty cycle may be seasonally biased
- Some methods of determining fan motor power (kW) my be unreliable

- Persistence of savings (owner acceptance, technical problems)

Grist noted that there is likely a minimum size threshold to these systems, because there is a significant first cost to the controller. It is unlikely to be cost-effective in small applications. There may be some ways to limit its application to places where it would be cost-effective, Grist said, through minimum total fan power, minimum controllable door heater watts, through a two-measure minimum, by requiring a minimum B/C ratio, by saying that ECM motors are only viable when post control fan hours are high. I think we can work with these guys to say that, if the savings aren't up to an acceptable level, then it doesn't qualify, Grist said. One participant noted that lighting in refrigerated spaces is something the RTF does not yet have covered, technically.

Charlie Stephens asked whether the output of the current transducer is power-factor corrected. It senses compressor run-time, another participant replied – it's a CT that tells you whether the compressor is on or not. But how did you get the compressor amp draw in the first place? Stephens asked. It's either name-plate or an estimate, another participant replied – often, the salesman can't climb up on the roof to tell what it is. It's also nameplate for the fan amps, another participant said. that's not always a valid assumption, said Stephens.

Stephens noted that all of the inductive loads measured in the field for heat pump and fan systems are coming in at 15-20% under their rated numbers. If you're basing your assumptions on rated numbers, he said, you're over-calculating your savings. That's a very valid point, said another participant, but in terms of the proposal as a whole, a much bigger assumption is compressor run-time.

I'm not arguing that we should be doing this for every project, said Stephens – I'm talking about getting the numbers right in the first place. You're talking about deeming things over a long period of time, based on numbers we're not getting full verification on – I would prefer to see a little bit more verifications on the assumptions that go into this before I'm ready to buy off on this measure. Otherwise, I'm not sure we've done all of the up-front homework necessary to just let this thing run, said Stephens.

Grist asked whether the RTF feels as if this is a reasonable approach for getting started. He said that, based on the discussion he head heard today, a 10-year measure life is a reasonable assumption, and that sizing is an issue. Ken Eklund moved that the RTF accept this recommendation, with the exception that an 8-year measure be changed to a 10-year measure life. The motion was seconded. After a few minutes of further discussion, the motion was revised to accept the proposed calculation procedures to do the first 10 projects, including pre-authorization of some testing of measured fan power for the evaporator coil units, with a 10-year measure life. The motion was seconded and passed unanimously.

7. Presentation, Discussion and Decision on Proposed Revised Deemed Savings Calculator for Commercial Lighting Measures.

Grist noted that this calculator applies to retrofit commercial lighting measures only, on a fixture-for-fixture basis only – a lamp-and-ballast system of a certain lumen output would be

replaced by a system of a similar lumen output. I am proposing that we use the existing, and recently-updated, Bonneville drop-down wattage reduction tool calculator to identify which measures to deem, Grist said. He then provided a presentation (please refer to the RTF website for full text), touching on the following major topics:

- Deemed savings (definition)
- Default lighting hours (graph)
- Lighting savings yield
- Default lighting savings yield factors (various parameters)

Grist then offered the following number of retrofit fixture measures to deem:

- Number of combinations is unmanageable unless we limit to "common" systems
- Propose to use BPA list from drop down wattage reduction calculator to limit list
- "Existing lamp-ballast" systems that have a suggested retrofit
- Add series of measures to replace standard T8 with high-performance T8

Moving on, Grist touched on

- Existing system lamp/ballast combo with suggested retrofits – N = 116
- Review common systems – link to BPA sheet, eligible common systems can be amended
- The calculation
- Next steps: build and populate measure list, address existing measures on list – clean up lexicon, remove duds (ballast only), remove standard T8 as measure by 2006 (?)

After a brief discussion, it was agreed that that the RTF will accept the finalized suggested retrofit list, the deemed savings table with the interactive, building type and hours assumptions in the Power Plan, and the list of deemed savings measures that would be so created.

8. Next RTF Meeting Date.

The next meeting of the Regional Technical Forum was set for March 8. Meeting summary prepared by Jeff Kuechle.

Regional Technical Forum Meeting Participant List
February 7, 2005

Name	**Affiliation**	**email**
Bruce Cody	BPA	bwcody@bpa.gov
Eric Brateng	PSE	eric.brateng@pse.com
Lori Sanders	EII	lsanders@ci.richland.wa.us
Jim Dolan	PacifiCo PUD	jim@pacificpud.org

Charlie Stephens	ODOE	charles.m.stephens@state.or.us
Ken Eklund	IED	ken.eklund@idwn.idaho.gov
David Hales	WSU	halesd@energy.wsu.edu
Jay Himlie	Mason County PUD	jayh@masonpud3.org
Bill Drumheller	ODOE	bill.drumheller@state.or.us
Dave Robison	Stellar Processes	drobison@ezsim.com
Howard Reichmuth	Stellar Processes	howdy@gorge.net
Tom Eckman	NWPCC	teckman@nwcouncil.org
Shelly Stand	Ecotope	shelly@ecotope.com
Bob Davis	Ecotope	bdavis@ecotope.com
Jim Lazar	Public member	Jimlaz@callatg.com
Kevin O'Meara	PPC	kpom@well.com
David Baylon	Ecotope	davis@ecotope.com
Mark Ralston	BPA	mdralston@bpa.gov
Ulrike Mengeberg	Itron	ulrike.mengeberg@itron.com
Lavelle Perin	Climate Crafters	lavelle@climatecrafters.org
Jeff Harris	NWEEA	jharris@nwalliance.org
Kevin Smit	Snohomish PUD	klsmit@snopud.com
Brent Barclay	Columbia River PUD	bbarclay@crpud.org
Adam Hadley	BPA	arhadley@bpa.gov
Philipp Degens	NW Energy Efficiency Alliance	pdegens@nwalliance.org
Chas Grist	NWPCC	cgrist@nwcouncil.org
John Proctor	Proctor Engineering	