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BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1:

EXHIBIT _____ (DM-RT)

SUMAS ENERGY 2 GENERATION
FACILITY

APPLICANT'S PRE-FILED REBUTTAL TESTIMONY

WITNESS: DAVID MONTGOMERY

Q. Please re-introduce yourself to the Council.

A. My name is David Montgomery. I have a Ph.D. in economics from Harvard University and I am a Principal Lead Author of the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), mentioned in some of the testimony. I also attended many of the negotiating meetings leading to the Kyoto Protocol and made presentations to delegates at the Sixth Conference of the Parties (COP-6), which is also mentioned in some of the other testimony.

1 **Q. What issues will you be addressing in your testimony?**

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3 A. My testimony will focus on greenhouse gas mitigation issues. In particular, I have
4 reviewed the testimony of Richard Gammon, Nancy Hirsh, K.C. Golden and Peter
5 West, and I will be responding to some of the issues raised in that testimony.
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11 **Climate Change**

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13 **Q. In his prefiled testimony, Richard Gammon and Peter West mention a growing**
14 **scientific consensus about global warming. Do you agree with their statements**
15 **about the consensus?**
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19 A. No. There is a growing consensus concerning several issues about global warming,
20 but Mr. Gammon and Mr. West do not describe that consensus accurately or
21 completely. Dr. Gammon focuses on one point of growing consensus: that human
22 activity may be contributing to global climate change. I don't think SE2 ever disputed
23 that in these proceedings. There is no train of reasoning that leads from the
24 proposition that human activity is contributing to climate change to the conclusion
25 that requiring offsets of greenhouse gas emissions from new power plants above a
26 certain size in the State of Washington will reduce total greenhouse gas emissions.
27 As I have stated in my direct testimony, such a policy is more likely to increase
28 greenhouse gas emissions than decrease them.
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41 A second point of growing consensus, however, Dr. Gammon and Mr. West did not
42 mention. It is that all greenhouse gas emissions, wherever they occur in the world,
43 contribute equally to global warming, so that policies that shift emissions from one
44 jurisdiction or one source of emissions to another are of no help to the global climate.
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1 There has long been a recognition among serious analysts and the negotiators working
2 on the Kyoto Protocol that the solution to global warming is not simply to make all
3 new emitters fully offset their emissions. Rather, there is a growing consensus that in
4 the short term one of the most cost-effective ways to reduce greenhouse gas emissions
5 is to increase our reliance on high efficiency natural gas fired facilities to produce
6 electricity instead of existing facilities that are less efficient or rely upon fuels that
7 emit more greenhouse gases per unit of energy used (e.g. coal, oil).
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17 Dr. Gammon and the other witnesses also fail to mention the significant uncertainties
18 that remain in attempting to predict how much global warming may occur, and what
19 the consequences of any such warming might be, and they fail completely to mention
20 the long time scales on which climate change will occur and the opportunities for
21 design of cost-effective policies that those time scales provide.
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29 **Q. In your direct testimony you talked about natural gas facilities like SE2 being**
30 **more efficient and emitting less greenhouse gases than other existing facilities.**
31 **Mr. Gammon is willing to trade SE2 for these facilities, but he and others don't**
32 **think there is any reason to believe that other higher emitting facilities will**
33 **actually shut down if SE2 comes on line. Can you respond to their testimony?**
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38 **A.** Yes. There are two things I can state with absolute confidence about how a new
39 natural gas combined cycle power plant like SE2 would be utilized:
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45 1) SE2 will never be dispatched in a way that displaces generation with lower
46 emissions, and
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1 2) Whenever SE2 runs, it will be displacing generation with higher emissions.
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5 **Q. Can you explain why you are so confident of those two facts?**

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7 A. Yes. My confidence is based upon how the electricity market operates, the relative
8
9 costs of different generation, and the greenhouse gas emissions per kilowatt hour of
10
11 electricity produced by different generating sources. First, electricity markets work on
12
13 the principle of economic dispatch, under which generators with the lowest variable
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15 cost are turned on before generators with higher variable costs. This principle applies
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17 whether we look at a control area, such as the area controlled by Puget Sound Energy,
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19 in which a central controller dispatches generators to minimize cost of energy, or we
20
21 look at a power pool, such as the Northwest Power Pool, in which there is a
22
23 competitive wholesale power market on which utilities can buy power from the
24
25 cheapest source. When more efficient power plants like SE2 are built, they push
26
27 older, less efficient units down in the so-called “merit order.” Exhibit DM-R1 is an
28
29 example of the “merit order” for the Northwest Power Pool for a particular set of fuel
30
31 prices. The vertical axis represents the cost of operating a specific generating unit,
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33 and the horizontal axis measures cumulative generating capacity. Each point on the
34
35 graph represents the cumulative amount of capacity that can be operated at less than
36
37 the indicated cost. Not all units that are dispatched within the NWPP are included
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39 here, only those on which we have been able to make estimates of operating costs and
40
41 capacity. Also, some units are “must run” and are used for reliability or voltage
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43 support even if they are not the most economic – these are included as if they have
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45 zero operating costs, since in the merit order they rank up with resources like
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47 hydropower that do have zero variable costs.

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Electricity demand varies over the course of a day and between seasons, and changes are based on weather and a number of other factors. The amount of generation that will occur during any hour depends on the level of electricity demand. As a result, electricity demand during most of the year is well below the peak capacity of the system. Exhibit DM-R2 shows that by month average hourly demand in the Northwest Power Pool has varied between 35 and 42 MW and monthly coincident peak demand has varied from approximately 42 to 57 GW over the past year. Thus during some hours, less than 35 MW of generation was required and in some hours as much as 57 GW was needed. With some exceptions due to reliability or operational considerations, power plants are ranked in order of their variable cost of generating electricity and, to meet demand, power plants are turned on in the order of rank from cheapest to most expensive (in addition to any *must run* units that are online.) (To determine exactly which units are likely to be run, it is also necessary to consider exactly where in the system electric loads are located, and which transmission links are congested. I leave out these considerations to keep my explanation of economic dispatch as simple as possible.)

If an additional natural gas combined cycle unit like SE2 is added to the system, its generation will displace generation from units located below it in the merit order – that is, units with higher variable costs. The primary difference between power plants that causes them to be located at different points in the merit order is a difference in heat rates – or energy efficiency. Therefore, generation from SE2 will displace generation from power plants that have higher carbon dioxide emissions per kilowatt

1 hour of electricity produced, because carbon dioxide emissions are directly
2
3 proportional to heat rates. There will never be a situation in which SE2 is turned on
4 and displaces a more efficient (less emitting) facility. That means that, at any given
5
6 time, SE2 either doesn't operate and emits no greenhouse gases, or it does operate and
7
8 reduces greenhouse gas emissions by displacing (or preventing the operation of) a less
9
10 efficient (greater emitting) facility.
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14 **Q. Please use Exhibit DM-R1 to explain how building SE2 will displace generating**
15 **units with higher carbon dioxide emissions.**
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18 **A.** I can explain this with the dispatch order for plants in the NWPP , in relation to
19
20 demand levels observed over the past year.
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24 I assume natural gas prices such that a typical new natural gas combined cycle power
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26 plant has a dispatch price (fuel plus variable O&M) of about \$32/MWH.
27
28 Hydroelectric, wind and other renewable units are assigned a dispatch price of zero,
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30 because they are run whenever they are available, so they lie in the left hand (lowest)
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32 portion of the curve (Hydro capacity is set equal to actual capability used in 2000
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34 based on 100% load factor). Coal-fired power plants come in at prices between about
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36 \$10 and \$30/MWH. Small gas turbines and internal combustion engines operating on
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38 diesel fuel form the highest part of the curve, with prices above \$65/MWH. Typical
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40 gas turbine units and other older gas and fuel oil fired power plants have considerably
41
42 higher fuel costs than combined cycle units, because they have worse heat rates and
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44 require more fuel to generate the same amount of electricity. Their dispatch prices
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46 come in at \$40 - \$65 per MWH under the same assumptions. When demand falls in
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1 the gray band of approximately –44,000 – 48,000 MW, these older units are on the
2 margin. If SE2 had been in operation last winter, it would have been unnecessary on
3 many peak days to run 660 MW of these less efficient units. Generation from SE2
4 would have displaced their generation, because it would be less costly. The most
5 costly 660 MW of capacity being utilized would have been turned off.
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12 The group of combustion turbines that would be displaced when NWPP peak demand
13 was in the gray band could include Portland General Beaver 1 – 6, Transalta Big
14 Hannaford or PacifiCorp Klamath Falls. They have heat rates of 10000 – 11000
15 btu/kwh, and also burn natural gas. Their emissions would be approximately 50%
16 higher than SE2. That adds up to a reduction of over 100 tons of carbon dioxide
17 emissions per hour during the time that SE2 generation would be displacing
18 generation from units with heat rates equal to those of typical combustion turbines.
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29 **Q. How do you respond to the argument of other witnesses that very little new coal**
30 **fired capacity is planned in the NWPP.**
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33 A. Arguments about how much new coal is planned are largely irrelevant, because
34 whether or not new coal plants are planned, SE2 will displace generation from
35 existing natural gas power plants or oil-fired generators with higher carbon dioxide
36 emissions during many hours of the year. I do note, however, that in its most recent
37 Annual Energy Outlook, 2001 the Energy Information Administration (EIA) reports
38 that about 20% of the total generation capacity in the NWPP comes from coal (11.62
39 GW of coal out of 51.93 GW total capability). Coal also represents over 2/3 of total
40 fossil fuel generation in the NWPP. EIA also projects an increase of coal capacity in
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1 the WSCC/NWPP from 11.62 GW in 2000 to 12.99 GW in 2010, an increase of over
2
3 10%. That 1.3 GW increase will not happen if sufficient gas generating capacity is
4
5 built before those coal capacity additions are started.
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9 As an aside, I note that the NWPP is the relevant market for determining which
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11 generators will compete with SE2 over the life of the facility. Individual control areas
12
13 are clearly too small, because generation within one control area can easily be shipped
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15 to another control area and competes with generation within that area. Even though
16
17 the NWPP does not act as a formal power pool scheduling generation from each unit
18
19 in the region, the NWPP coordinates power supplies and Bonneville's transmission
20
21 grid interconnects large parts of the region. Other witnesses appear to agree with me
22
23 that the NWPP is the right area to look at in asking how SE2 will affect carbon
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25 emissions. From the point of view of the global climate, carbon emissions anywhere
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27 have exactly the same effect. So the State of Washington is not being "climate
28
29 friendly" if its choices to disallow new generation within the state result in larger
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31 emissions elsewhere.
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35 **Q. Does increasing concern about global warming justify the full offset**
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37 **requirements advocated by some of the witnesses in these proceedings?**

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39 A. No. What's absolutely clear is that preventing this project from being built will
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41 increase greenhouse gas emissions. People will continue to use electricity, and if this
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43 project and others like it aren't built, then people will continue to get their electricity
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45 from less efficient and greater emitting facilities. This project offers the best of both
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47 worlds because it produces electricity efficiently and at a very low greenhouse gas

1 emission rate relative to other facilities, and the developers are also volunteering to
2
3 fund millions of dollars worth of offset projects.
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7 **Q. Now you said that preventing this project from being built won't reduce**
8 **greenhouse gas emissions, but Dr. Gammon, Ms. Hirsh, Mr. Golden and Mr.**
9 **West aren't asking the Council to deny this project a permit, are they?**
10

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12 **A.** No, they aren't directly. They have instead ask the Council to condition the permit on
13 "full offset" of greenhouse gas emissions according to their assumptions. Mr. West
14 testified that offsets cost \$1.88 per ton, which means (using his emission numbers)
15 total offset would cost approximately \$136 million. Ms. Hirsh puts the cost of "full
16 offset" at about \$2 per ton, which would be a total offset cost of approximately \$145
17 million for this project. Mr. Golden puts the cost at \$5 per ton, which means "full
18 offset" would cost approximately \$ 360 million. And, of course, Mr. West argues that
19 the applicant should also pay a substantial additional premium to cover administrative
20 costs.
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32 The electricity market is competitive. It seems fairly obvious to me that if you add a
33 to 136 to 360 million dollar expense to this project, which is not added to any other
34 project in the region, no one is going to build this project. No one would invest in it
35 and no one would provide financing. Instead, people will decide to build a less than
36 350 MW project in Washington and pay nothing, or build a big project in Idaho or
37 Montana or Canada and pay nothing, or maybe even build a project in Oregon and pay
38 the amount due under Oregon's program. This kind of offset requirement will ensure
39 that this project is never built.
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3 **Q. But Mr. West provided a calculation in his testimony designed to show that a**
4 **\$118 million dollar offset expense would have what he calls "a relatively small**
5 **price impact" on the cost per kWh. How do you respond to that?**
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9 A. Mr. West claims that 0.346 cents per kwh is a small price impact. The price of power
10 at Mid Columbia and COB was \$21.75 - \$22.00 per MWH on October 9, 2001, which
11 translates to 2.175 – 2.2 cents per kwh. At these prices, the 0.346 cents Mr. West has
12 calculated is close to 15% of the current wholesale price of electricity in the
13 Northwest. It is absurd to claim that a cost increase equal to 15% of the market price
14 is “relatively small price.” Finally, Mr. West also ignores the risks that the investors
15 in SE2 are bearing. The cost of his mitigation proposal will only be 15% of the
16 current price under his assumption that SE2 achieves 82.4% load factor over its life.
17 There is not much upside for added generation that would lower the cost amortized
18 over all generation, but a great deal of down side that could increase cost per kwh
19 actually generated substantially.
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Offset Requirements

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35 **Q. In his prefiled testimony, Richard Gammon mentioned greenhouse gas reduction**
36 **programs in place or being drafted in Massachusetts, Oregon, New Jersey and**
37 **Vermont. Mr. West also mentioned registration programs in California, New**
38 **Hampshire, New Jersey and Wisconsin. How do those programs relate the**
39 **SE2’s mitigation proposal?**
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45 A. None of these programs are comparable to the proposals that EFSEC require SE2 to
46 fully offset its emissions. In fact, most of these programs focus more broadly on
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1 addressing greenhouse gas emissions and highlight the problem with proposals that
2 the EFSEC should require power plants under its jurisdiction to offset some or all of
3 their emissions. These state programs are described in greater detail in Exhibit DM-
4 R3.
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10 None of the other state programs impose a full offset requirement. The Council is
11 already familiar with the Oregon program, which is the most aggressive offset
12 requirement but at least applies to most power plants in the state. Massachusetts is
13 the only other state that imposes an offset requirement (of 1-3%) and it has also
14 enacted a limitation on greenhouse gas emissions from existing facilities (at a limit
15 that is much higher than SE2's emissions). California, New Jersey, New Hampshire,
16 Wisconsin and Vermont have developed broad greenhouse gas plans or strategies for
17 promoting the use of renewables and are encouraging voluntary reductions in
18 greenhouse gas emissions, but do not require new power plants to offset emissions.
19 Wisconsin, New Hampshire, New Jersey, New Hampshire, Massachusetts, and
20 California are establishing voluntary registries for greenhouse gas reductions and
21 offsets. These programs help businesses quantify baseline emissions and emissions
22 reductions by establishing consistent reporting procedures and independent
23 verification, but they do not impose any requirement on power plants to limit or offset
24 their emissions.
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42 Compared to these other state programs, Mr. Gammon and other witnesses are asking
43 EFSEC to impose a unique mitigation requirement on the SE2 project, because most
44 power generation facilities in Washington are not within EFSEC's jurisdiction, and
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1 EFSEC has never required any facility within its jurisdiction to do as much as SE2 is
2 offering. While these other states have made some effort to treat all electrical
3 generation equally – and essentially punish high greenhouse gas emitters relative to
4 low greenhouse gas emitters, the proposals before EFSEC don't do that. Moreover,
5 none of the state programs referenced require the “full offsets” of new power plants
6 that Mr. Gammon and other witnesses advocate. One program, Massachusetts,
7 requires a much smaller offset than even Oregon does at this point, and others single
8 out existing facilities for specific emission reductions, not new facilities.
9

10 States that have broad programs, such as renewable portfolio standards or emission
11 portfolio standards, which require sellers of electricity in effect to give preference to
12 sources of electricity from renewable sources or with low emissions, provide more
13 even-handed incentives that generally favor replacement of existing, high-emitting
14 facilities with new, cleaner facilities like SE2. What these kinds of programs would
15 do, if implemented in Washington, is encourage building of units like SE2, and
16 discourage the operation of existing gas and coal fired units with higher emissions per
17 kwh generated. That is the sense in which facilities like new, clean facilities like SE2
18 will displace existing, higher-emitting facilities that currently have operating costs
19 lower than SE2. Causing that to happen requires a commitment, at the state or
20 national level, to limit emissions from all power plants and allow trading of emissions
21 offsets between new and existing facilities. Returning to the issue of growing
22 consensus mentioned by Mr. Gammon, there is indeed a growing consensus that such
23 comprehensive emission trading programs are the most efficient method of achieving
24 whatever limits on greenhouse gas emissions are adopted. Under these programs the
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1 offset to emissions from new gas combined cycle is the reduction in emissions from
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3 older, less efficient power plants that would occur because of the even-handed
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5 incentive to reduce emissions they would create.
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9 **Q. Both Mr. Gammon and K.C. Golden have testified about Seattle’s “climate-
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11 neutral pledge.” Does that commitment make requirements for SE2 to fully
12
13 offset its emissions appropriate?**

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15 A. No. You have to look at the entire system. I would argue that building a highly
16
17 efficient natural gas fired combined cycle facility is climate friendly, because the
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19 more this facility is used the less use will be made of capacity elsewhere that produces
20
21 more carbon emissions. Seattle City Light currently owns no significant capacity other
22
23 than hydro. It has one municipal solid waste cogenerator plant and according to the
24
25 NWPPC plans 50 MW of diesel engines for peaking, plus expansion of hydro
26
27 capacity. What a jurisdiction with that generating mix and those opportunities
28
29 chooses to do is so unique that it cannot be considered a model for anyone.
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33 **Q. Mr. Gammon also mentions several private corporations that have implemented
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35 greenhouse gas reduction plans. How do these programs relate to SE2’s
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37 mitigation proposal?**

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39 A. Well, the companies mentioned are typically large companies that have historically
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41 produced a lot of greenhouse gas. I believe that some have committed to offset future
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43 increases by decreases in their current emissions, others have committed to partial
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45 reductions in existing emissions. It would be very rare that a company promised to
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47 eliminate all greenhouse gas emissions or to fund offsets for all of their emissions.

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In thinking about the example set by such companies, we need to keep in mind that society is better off if we select the lowest cost ways to reduce CO2 emissions, than it is if low cost options are neglected and the highest cost options are pursued. There is no reason to believe that new facilities in any sense offer the lowest cost options – indeed, common sense would suggest the opposite, since new construction embodies the most advanced technologies and highest economically supportable efficiencies. Existing facilities can in many cases be replaced with new facilities at a considerable gain in efficiency and reduction in greenhouse gas emissions. The economic obstacle is the capital cost of building a new facility, which must be covered in addition to operating cost, whereas an existing facility only needs to cover operating cost to continue in operation. Almost all the coal, oil and natural gas generating units now in operation in the NWPP have higher emissions per kwh generated than SE2. A company that owned such facilities and promised to reduce its greenhouse gas emissions would find that one of the most attractive options might be to replace one of its existing units with a new unit just like SE2.

Therefore, no matter what some companies commit to in terms of their overall greenhouse gas emissions it makes no sense to require new facilities to satisfy a zero emission standard, while existing facilities are allowed to do what they please. A corporation that owns many existing facilities may have a great deal more opportunity to find cost-effective ways of reducing emissions than a corporation that owns one new facility. Indeed, reductions in emissions from existing facilities are one of the most attractive and cost effective sources of offsets for emissions from new facilities.

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3 If a facility has emissions that are as low as practicable with current technology, and
4 building that facility can be shown to reduce overall emissions, no useful purpose is
5 served by requiring offsets from that facility.
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11 **Q. Dr. Gammon also testified that in his opinion the Kyoto Protocol will eventually**
12 **be ratified by the U.S. and in the meantime, Congress is considering other forms**
13 **of domestic greenhouse gas regulation. What does this mean for EFSEC?**
14
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17 A. First, I don't think anyone is in a position to predict at this point what will happen to
18 the Kyoto Protocol, or any of these other pieces of legislation. But even if Dr.
19 Gammon is right in prognosticating on politics, his predictions do not imply that
20 EFSEC should adopt offset requirements for new power plants. Indeed, the most
21 important lesson I take from these other proposals is that they would all create
22 universal requirements to limit emissions, and none would impose the requirement
23 that only new emitters offset emissions. The only reason I can see that the bills are
24 relevant to EFSEC's decisions is that if any of them is passed, coal generation will be
25 reduced, and the shortfall will need to be made up from natural gas units. All the
26 mentioned proposals allow greenhouse gas emission permit trading. At even modest
27 permit prices, studies I have done indicate that coal fired generation will no longer be
28 economic relative to existing combined cycle units using natural gas – which will be
29 used fully – and even to new gas combined cycle units.
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44 Therefore, passage of any of these bills, which include carbon emissions trading,
45 would lead to a flood of applications to build more natural gas combined cycle power
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1 plants. They would lead directly to reduced operation of existing coal-fired units and
2 inefficient gas units serving the NWPP, which would be replaced first by maximum
3 operation of all combined cycle units in service. Furthermore, it is quite likely that
4 they would provide no retroactive credit for the expenditures made before their
5 passage to purchase offsets.
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13 **Past EFSEC Decisions**
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15 **Q. Ms. Hirsh's testimony she refers to the Council's decision in February 2001**
16 **regarding the Chehalis power plant. Are you familiar with that decision?**
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19 A. I am aware of the decision and its general provisions, but I have not been involved in
20 the details since I appeared before you last.
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25 **Q. Ms. Hirsh testifies that the Council required full mitigation of the additional**
26 **CO2 emissions that would be produced by the Chehalis plant and therefore SE2**
27 **should be required to offset 100% of its CO2 emissions. Does that make sense to**
28 **you?**
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33 A. No. The Chehalis facility was originally permitted for a capacity of 460 MW. They
34 sought to increase the capacity to 520 MW and to make some other changes in the
35 project, largely due to advances in technology that made it possible to improve heat
36 rates (and reduce carbon dioxide emissions per kwh) by using larger turbine units.
37 EFSEC required Chehalis to offset 8% of the CO2 emissions from the facility.
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39 Logically, I don't see why EFSEC would require one project to offset 8% and another
40 to offset 100%. This difference points out the absurdity of adopting an offset
41 requirement unilaterally and at this point in time. It creates differences in incentives
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based entirely on where a unit stands in the regulatory process, and elevates grandfathering to the primary determinant of public policy. Saying that EFSEC should require offsets of whatever it has jurisdiction over is shortsighted and legalistic. It pays no attention to either the economic or environmental consequences. Differences in regulatory requirements should reflect basic environmental impacts of facilities, if the regulations are to provide any effective incentives for improved environmental performance. EFSEC is so constrained in what it can do, that imposing offset requirements is almost guaranteed to have perverse effects. Even in the case of Chehalis, the offset decision penalized the investors for adopting a more efficient design than was included in their approved application.

END OF TESTIMONY