BEFORE THE PUBLIC UTILITY COMMISSION
OF OREGON

UM 1673

In the Matter of OREGON PUBLIC UTILITY COMMISSION Comments on "Draft Report to the Legislative Assembly: Investigation into the Effectiveness of Solar Programs in Oregon"	Comments of Chris Robertson

Introduction

The Oregon Legislature directed the Public Utility Commission of Oregon to "Recommend new programs or program modifications that encourage solar development in a way that is cost effective and protects ratepayers."

The PUC established docket UM-1673 to gather stakeholder comment, as a mechanism to respond to the Legislative mandate. The PUC's Draft Report to the Legislative Assembly was released on May 8, 2014 for comment by interveners.

Incentive and subsidy programs were established in Oregon and in many parts of the world to increase demand for solar technology. The strategic purpose was to drive solar energy costs down so that incentives and subsidies might be withdrawn in favor of more market-based approaches.

That policy goal – low solar energy costs – has been achieved[1], but the reality of that is not well known. Bloomberg New Energy Finance observed in 2012,

> "…[A]wareness of the current economics of solar power lags among many commentators, policy makers, energy users and even utilities… The challenge is to elegantly transition PV from a highly promising and previously expensive option, to a highly competitive player in electricity industries around the world."[2]

This awareness is not reflected in the Draft Report. My comments that follow are high-level observations, followed by specific chapter-by-chapter detailed comments that parallel the Draft Report.

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[1] For example, Austin Energy recently signed a 20-year contract with a 150 MW solar power plant to buy energy at about $50 per MWh. Two well-financed competitors were vying for the contract. Story published by GreenTech Media, May 19, 2014, accessed May 19, 2014 at http://reneweconomy.com.au/2014/austin-energy-switches-sunedison-recurrent-5-cent-solar-20943

[2] Morgan Bazilian, Ijeoma Onyeji, Michael Liebreich, Ian MacGill, Jennifer Chase, Jigar Shah, Dolf Gielen, Doug Arent, Doug Landfear, and Shi Zhengrong. *Re-considering the Economics of Photovoltaic Power*, Bloomberg New Energy Finance, 2012

The following comments are pointed and perhaps harsh. I urge your careful evaluation of these comments if the goal of this Draft Report is to be considered valid and valued among legislators, utility and solar stakeholders. They are intended to advance the discussion and improve the robustness of the analysis. Much is at stake, and time is short. Along with these comments I also offer my assistance to help "fill in the blanks" that I've identified. My goal is to help the staff meet the goals of the Report.

General Observations

The Draft Report fails in its most important task, to "Recommend new programs or program modifications that encourage solar development in a way that is cost effective and protects ratepayers." It uses out-of-date data, is too narrowly framed (which excludes promising approaches), and is internally contradictory. The Report's tone at times undermines its goal to *encourage* cost-effective solar development. Indeed, it never provides the analysis needed to answer the central issues: how to encourage cost-effective solar development and how to protect ratepayers. Unless extensively rewritten, the Legislature may find it of little use in forming policy aimed at the current situation.

How to Stimulate Cost-Effective Solar – Distributed and Utility-Scale

Distributed Generation Regarding the first part of the Legislative mandate, how to encourage the growth of cost-effective solar, the Draft Report never considers whether the existing Oregon solar programs are, or are not, adequate to the task of bringing cost-effective solar into the mainstream.

It does not present any relevant context to understand how the Oregon solar programs compare with best-practice programs and resource acquisition approaches. It never considers solar market structures that could produce low cost solar energy, as for example in Germany for distributed PV on buildings, or California for utility-scale solar plants. Nowhere does the Draft Report seriously consider that solar energy could become a low cost, zero carbon energy resource for the grid.

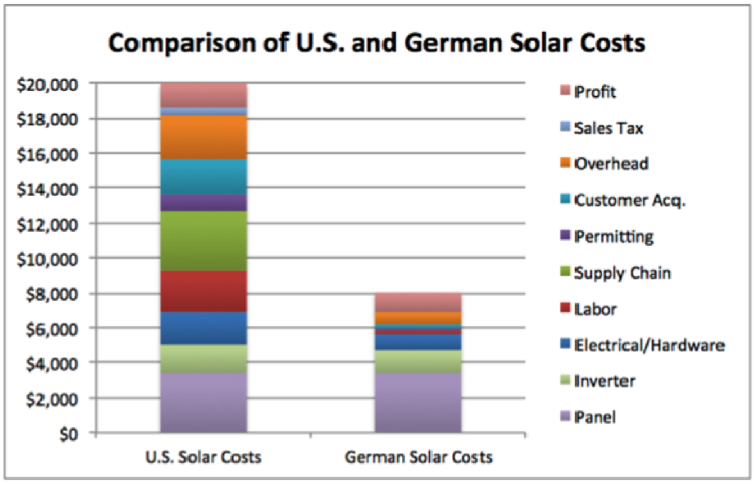
The Draft Report doesn't consider that installed costs for distributed PV on buildings might be higher or lower depending on the market structure, or that *Oregon's solar program designs may be the cause of high installed costs*. In my view this is an important opportunity the Draft Report completely misses.

The Draft Report implies solar contractors are responsible for high solar costs. It states, "…soft costs, such as supply chain costs, developer profits, transaction costs, installation labor and customer acquisition costs are part of the installers' business models." (Page 41)

These are costs of doing business. The *magnitudes* of these business model cost components are determined by the market structure in which the business is operating. Different market structures produce vast differences in these costs of doing business. For a clear example, consider Figure 1 on the following page. This chart appeared in Forbes in 2012 in an article by Barry Cinnamon, a noted US solar industry executive.[3]

[3] Barry Cinnamon, *Cut The Price Of Solar In Half By Cutting Red Tape*, Forbes, July 7, 2012

Figure 1. Comparison of the cost components of German and US installed residential 4 kW solar energy systems. (The US solar cost in the chart, $5.00/W, is slightly greater than average Oregon solar costs in 2013.)



The German market structure is very different from Oregon's. It is designed to eliminate market barriers and foster intense competition among contractors. Their Feed-in-Tariff drives a mature market. The utility buys the energy for the grid. Anyone with solar access can participate. Costs are driven down as the market scales up.

For a customer in Germany it can take as few as 8 days from the time she calls a contractor to when she starts to sell energy to the grid. A one-page form secures

- Interconnection to the electric grid
- Building permit
- Loan to pay for system
- Long-term contract to sell energy to grid, which pays off the loan, and a
- Reasonable return on investment to the PV system owner

The large German market enables contractor economies of scale. Supply chains can be more efficient in Germany and inventory costs lower. Contractor business risk is much less in the German market structure, so overheads and profits are much less in Germany than those required by contractors in Oregon.

German solar owners sell their energy into the grid. Their solar systems are not net-metered. This means contractors can cover the roof with panels. These larger installations spread the fixed installation costs over a larger panel area for each installation, reducing the cost of energy.

Customer acquisition is easy in the German market. The multiple repeat sales calls that are well known in the Oregon programs are unknown in Germany. Labor crews get fast and efficient. Contractors sharpen their pencils, and customers are incentivized to get the best deal possible.

To be complete, the Draft Report should review, analyze and discuss how a best-practice market structure for distributed solar energy on buildings similar to the German example might fit into Oregon[4]. This analysis ought to consider sensitivity cases in which solar costs fall along the price vector of the US DOE SunShot Initiative, and in which carbon is priced into energy markets. It would also be extremely helpful to identify any legal, policy, finance and electric utility business model issues that might inhibit the German approach, summarize the range of expert opinion on how to resolve these issues, and suggest practical, feasible and implementable possible solutions for the Legislature to consider.

Large utility-scale solar power plants These plants are cost-effective now in Oregon. Independent power producers can build, own and operate them profitably. For example, Idaho Power recently signed six contracts to buy the energy for twenty years from solar power plants that total 60 MW, enough to power about 24,000 homes annually. IPC's 60 MW of solar power contracts, with energy delivery starting in 2016, nearly doubles Oregon's installed solar base, and poses an important opportunity to advance cost-effective solar energy.

These Idaho Power type contracts can be done throughout PGE and most of Pacific Power (PAC) territories as well. Revenues for these solar plants are derived from the PURPA avoided cost rates.

The PURPA rates will be highly variable over the relevant future time scale. The reality of new profitable PURPA-based solar power plants will themselves drive down PURPA rates, and will likely suppress the long-term cost of energy from natural gas fired combined cycle turbines. This dampening of PURPA rates will inhibit solar development and cause fluctuations in cost-effectiveness analysis.

PURPA rate volatility will increase market uncertainty and risk, which will cause solar energy costs to be higher than if an efficient market structure was in effect.

The PURPA rate volatility and its attendant market instability pose a significant issue for the PUC and the Legislature. If the goal is to encourage cost-effective solar energy, then we should aim for a market structure that promotes sustained orderly development of the solar resource. An alternate market structure will likely be required.

Two mechanisms could fix this. First, set annual capacity construction goals for both distributed PV and utility-scale solar power plants. Second, use something like the California ERAM, a reverse auction mechanism, to buy the least-cost solar power plant capacity additions each year. This market structure would establish stability in the resource acquisition strategy and assure that least cost resources are procured.

Table 1 below illustrates the magnitude of costs and benefits from a 15-year solar construction program. Benefits exceed costs by nearly $2 billion in 2012 dollars. This profitable program would eventually produce as much as 20% of Oregon's electricity, and

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[4] I've written elsewhere that the existing Oregon solar programs are obsolete and should be replaced with modern, best-practice solar resource acquisition strategies. See Chris Robertson, *Vision to Integrate Solar in Oregon***,** April 2013, Oregon Solar Energy Industries Association, and Chris Robertson, *Solar Plan for Oregon,* December 2013 filed in Docket UM-1673, PUC of Oregon. Both are available at www.chrisrobertsonassociates.com on the publications page.

avoid production of more than 100 million tons of greenhouse gas emissions. It assumes 2013 PURPA rates extended at their compound annual growth rate.

Table 1: Potential Solar Costs and Benefits Assuming Best-in-Class Solar Market Structures

Cost and Benefit Results in 2012 $ (Billions)

Life Cycle Costs		
Distributed PV on Buildings		$3.87
Willamette Valley Utility Scale		$1.74
Sunny Oregon Utility Scale		$1.41
	Total Cost	$7.02
Benefits (Based on 2013 PGE & PAC Avoided Cost Rates)		
Distributed PV on Buildings		$4.21
Willamette Valley Utility Scale		$2.58
Sunny Oregon Utility Scale		$2.07
	Total Benefit	$8.86
Net Present Value in 2012 $ (Billions)		$1.84

While this study is sufficient to demonstrate cost-effectiveness, it could be improved with additional analytical resources.

The conclusion to be drawn from this is that both distributed generation and utility-scale solar energy can be produced cost effectively in Oregon, *if we implement best-in-class solar program designs and market structures*. The benefits to Oregon can start as soon as can be enabled by the 2015 Legislature.

How to Protect Ratepayers

Regarding how to protect ratepayers, the Draft Report assumes business as usual, and takes an extremely narrow position that electric utility ratepayers must be protected against increases in the (presently *de minimis*) non-participant rate impacts caused by Oregon's existing high cost solar programs.

This perspective exposes ratepayers and the State's economy to arguably more serious risks and costs. For example,

- First, the Draft Report's "solar business as usual" approach retards the State's ability to secure lower cost energy resources for everyone. Since the report did not consider that best practice solar programs could produce low-cost solar energy, it assumes that Oregon's existing programs will continue to be driven by solar subsidies paid for by non-participants. This assumption is unwarranted. The Report should suggest how State policy makers and stakeholders could learn from best practices, innovate, drive down solar implementation costs, and design strategies to reduce energy costs in Oregon.

- Second, solar technology costs are falling rapidly. These falling costs pose a classic disruptive technology threat to the electric utility business model that must be managed. If badly managed or ignored the disruption could produce dangers for all, with potential for intense political conflict over cost allocation, solar customers departing the system, stranded assets and higher costs for customers who can't depart the system. This is not in the interests of the State's economy. The Draft Report should propose a solar resource acquisition strategy that is broadly perceived as fair and effective, finesses the disruptive technology threat, and can reduce the cost of energy resources.

- Third, if we don't sharply reduce carbon emissions then all ratepayers face a high-probability threat in the form of carbon price sticker shock. The Legislative and Executive branches in Oregon are considering how to reduce carbon emissions in energy markets. As Table 1 above demonstrates, a large and growing cost-effective solar resource can profitably reduce the cost of the electric power system. A *free* byproduct of the solar investment in that scenario is that it offsets more than 100 million tons of carbon emissions from the electric power sector. The Report could be more useful to State policy makers if it helped them understand how large-scale best practice solar resource acquisition can mitigate the impact of carbon price risk.

It is also worth observing that Oregon is among the Nation's leading states in subscription to the utilities' green power programs. It would be interesting to see public opinion survey research data on the question of non-participant opinions about the rate impacts of the solar programs.

Conclusions and Next Steps

The solar resource can be built cost-effectively while protecting ratepayers. Utility-scale solar plants and small-scale PV systems in distributed settings on buildings in the urban fabric should be aggressively developed in Oregon. This can reduce the net present value of Oregon's electric utility system, protect Oregon's electric utility ratepayers and taxpayers, and sharply reduce greenhouse gas emissions.

In its present form the PUC Draft Report does not provide constructive input to the 2015 Legislative debate - one that will be focused on initiating programs beginning in 2015. Parts of the Report should be extensively rewritten in consultation with experts in solar program design, specifically the German feed-in-tariff regime and the California ERAM mechanism, to assist in the next draft of the this report.

The Report should recommend that the 2015 Legislative session consider and enact the market structure changes that would enable large investments in solar energy over the next two decades. Hopefully, the next draft of the PUC report will provide solid grounding in how to move forward.

Irrespective of the details of the PUC Report, I recommend that the utilities, the business community, political leaders and the relevant stakeholders self-organize a collaborative program design and negotiation process. It should be tasked with framing a package of legislative proposals and the requisite legal and policy analysis. This should be completed by late September. There is some, but not very much, time available to achieve a consensus.

Chapter-by-Chapter Specific Comments

Chapter I – Introduction

This chapter recites the Legislative mandate for the Draft Report, and presents the outline of the Draft Report's contents. Its major objective is to "Recommend new programs or program modifications that encourage solar development in a way that is cost effective and protects ratepayers." As noted above, and in more detailed comments below, this two-part objective is not accomplished in the Draft Report.

Chapter II – Solar Energy Development in Oregon

At page 3 the report gives examples of 2013 average solar energy system prices for residential and commercial systems installed in Oregon, but omits any data on the cost of utility-scale systems. It would help the non-technical reader to include information on the range of installed costs in Oregon, which, at page 13 of the Draft Report, reportedly vary by about a factor 4 for both residential and commercial systems.

A brief amount of context would be valuable here to help the reader understand how the range of costs and average costs in Oregon compare to best-in-class solar programs and markets elsewhere. It would be helpful to include a comparison table that presents the $/Watt ($/W) and $/MWh (average and range, for residential, commercial and utility-scale), for Oregon systems, for systems installed in the US as a whole, and for systems installed in market leader countries and states such as Germany and California. These data are readily available.

The US data on $/W is in the Solar Energy Industries Association Quarterly Solar Market Insight Reports, published by GreenTech Media. An example of their data presentation is included in my study *Solar Plan for Oregon*, filed in this docket and available at www.chrisrobertsonassociates.com on the publications page.

California prices for utility-scale projects are probably available from the CPUC. These data would be valuable to show the very low cost $/W of large-scale systems. Their energy production and $/MWh could be easily calculated assuming various locations in Oregon.

Chapter III – Solar Programs

At page 10 the Draft Report presents the subsection, "Feed-in Tariff – Volumetric Incentive Rate (VIR) Pilot Program". This briefly describes the Oregon VIR program and its costs.

I think the discussion is much too brief. This would be a good place to compare program design details for the Oregon VIR with programs from other jurisdictions that use Feed in Tariffs. As mentioned earlier, the German experience is illustrative, and in my view compelling. Their residential solar costs are less than half the average cost in Oregon. Why is that? It has to do with program design and energy resource acquisition strategy. "What lessons could be learned?" is a question that the Draft Report never asks.

At page 12, the Draft Report presents what it describes as "Other Approaches Outside

Oregon". Only two mechanisms, the Value of Solar Tariff and Community Solar are briefly discussed. Regarding the Value of Solar Tariff, the Draft Report states, "The Value of Solar Tariff is based on an estimate of the value of the solar electricity to the utility, its customers, and society." My perspective stated in my comments in the PUC workshop is that the Value of Solar is in some segments, and soon will be in all market segments, significantly greater than the cost of solar. Hence using a Value of Solar tariff will likely overpay for the resource. This should be avoided. The Draft Report offers no insight into this issue or any recommendation of an appropriate cost-effectiveness measure to carefully and comprehensively value solar cost-effectiveness.

This would be another logical place to discuss the details of the German method to acquire solar energy resources for the grid, since it is appreciably different from the Oregon VIR program, and to discuss the California ERAM mechanism used to acquire large-scale solar resources.

Chapter IV – Solar Energy Cost Trends and Projections

The presentation of solar costs in Chapter IV is out of date, incorrect, incomplete and internally contradictory. It will be a disservice to policy makers and the broader debate over solar energy policy if not brought up to date and completed.

For example, at page 16 the report repeats the discredited conventional wisdom that PV is "among the most expensive generating resources." Fig. 7 gives the cost of utility scale tracking installations at $3/W, and Fig. 8 states these plants would produce energy at $150/MWh. The Draft Report states, "On an energy basis – assuming no subsidies[5]- solar systems are among the highest cost generating resources." This statement is not correct. QF developers today are working with EPC bids well below $2/W, including 10% capacity in battery storage, which should be sufficient to integrate the plant into the grid. The recent Austin Energy contract to buy energy from a 150 MW solar plant at $50/MWh should be compelling evidence.

The Draft Report notes that Idaho Power (IPC) has recently contracted six PV QF plants totaling 60 MW. The 60 MW of IPC QFs will be profitable at the levelized IPC avoided cost rate strip, which is less than $150/MWh. QF plant owners would not go through the expense of finding and acquiring land, contracting with IPC, building and operating these plants if they expected them to be unprofitable. The IPC solar QF contracts demonstrate that solar energy at utility-scale is less expensive than avoided costs in Oregon.

At page 17 the Draft Report discusses the year 2020 installed cost targets of the US DOE SunShot initiative, and seems to discount the cost goals by using the phrase "ambitious targets". It is true that some commentators are bearish on these targets. Yet in February at the OSEIA annual meeting the President of SolarWorld stated that his company fully expects to meet the SunShot goals. At least two other manufacturers, First Solar and Sunpower will probably meet the goals early. The 150 MW Austin Energy contract at $50/MWh demonstrates that the SunShot goal for utility-scale plants can already been achieved. The

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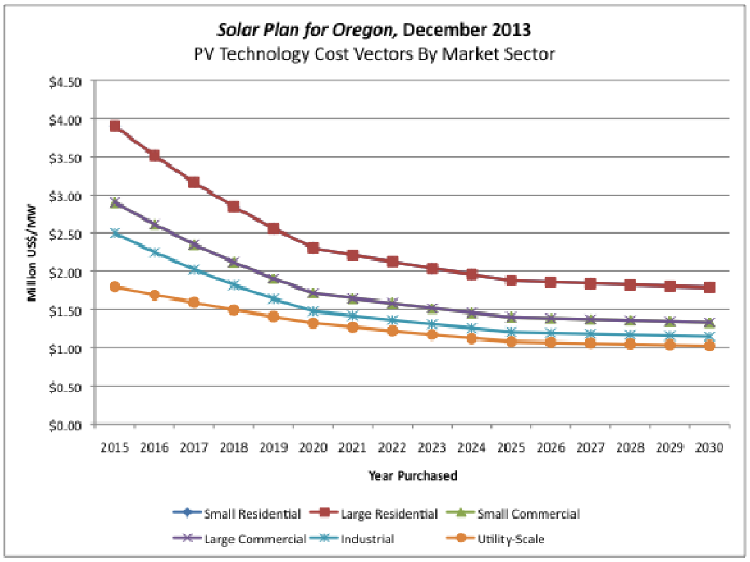
[5] The phrase in the above quote, "assuming no subsidies" is curious. It would be illuminating if the Draft Report compared all energy sources on an unsubsidized basis. Many in the solar industry would prefer to compete against all energy sources on an unsubsidized basis.

Draft Report's tone and conclusions would be materially different if the phrase "ambitious targets" was replaced by the phrase "likely achievable targets."

Further, as the analysis I submitted to this docket indicated, the SunShot goals can be missed by a wide margin and Oregon could still build a large cost-effective solar resource. Consider that QF plants are profitable *now* against present avoided cost rates, and that the SunShot targets will reduce costs of QF plants even further. Here are the cost-vectors I developed for distributed and utility-scale PV systems. They represent sectoral average costs year by year. Costs for each sector are about 40% greater than SunShot targets in the year 2020.

Figure 1: Solar Technology Cost Vectors



The Draft Report itself presents evidence that the 2020 Sunshot targets are becoming achievable.

- PURPA QF plants are being built at a profit
- Residential systems have been installed in Oregon for $2.25/W and
- Commercial systems have been installed in Oregon at $2.50/W.

At Fig. 9 and its discussion at page 18, the Draft Report states "…that the cost of residential solar installations could be reduced to about $3.00/Watt by 2017…" The report should be consistent with its earlier presentation that the low end of the residential solar cost range in Oregon is already well below $3.00/W.

Chapter V – Resource Value of Solar

This chapter uses the terms "hard" and "soft" to describe various benefits of solar. These terms should be replaced since they are used in Chapter IV already to describe hard costs and soft costs of solar installations. The terms used twice with different meanings could confuse non-technical readers.

At the start, the chapter notes that some benefits are more difficult to quantify than others. The Draft Report should make that point directly to the Legislature. It is not a question of methodological difficulty. It is a question of sufficient resources to support the analysis that is required, and the Legislature is the appropriate body to make the necessary resources available. Hopefully the Oregon Department of Energy could get sufficient funding to do this work.

The Draft Report goes into a long discussion of the value of various attributes reported from studies around the county, without drawing any conclusions about what value the terms might have in Oregon. The Draft Report then uses a much more limited definition from the statute to say what solar resource value terms should be counted in Oregon. Legislators will likely find this limited statutory reference not helpful in crafting new approaches and programs. They asked the PUC to "Recommend *new* programs or program modifications that encourage solar development in a way that is cost effective and protects ratepayers." (Emphasis added.)

In my written input to the docket I provided a net present value calculation of the results of a 15-year solar construction program scenario. I reprise those results here. The assumptions used to produce these results are published in *Vision to Integrate Solar in Oregon*, and in *Solar Plan for Oregon* both available on the publications page of my site.

Table 1: Solar Plan for Oregon Costs and Benefits

Cost and Benefit Results in 2012 $ (Billions)		
Life Cycle Costs		
Distributed PV on Buildings		$3.87
Willamette Valley Utility Scale		$1.74
Sunny Oregon Utility Scale		$1.41
	Total Cost	$7.02
Benefits (Based on 2013 PGE & PAC Avoided Cost Rates)		
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	Total Benefit	$8.86
Net Present Value in 2012 $ (Billions)		$1.84

Each of the program components – distributed PV on buildings and utility-scale plants in the Valley and in Sunny Oregon – has benefits that exceed costs. This program would reduce the net present value of the utility system by about $2 billion.

While I am not a subject matter expert on cost-effectiveness evaluation protocols, I think it would be useful for Oregon adopt a comprehensive Total Resource Cost test, Societal Cost Test or other appropriate test, to be used for evaluating Solar Resource Value, and that the Legislature allocate sufficient funding to enable the TRC or other test to be developed and widely used.

This appropriate test (TRC or other) should be used to calculate total costs and benefits, which are the direct monetizable costs and benefits to the electric utility system, plus broader societal economic, health, and other costs and benefits. Policy-makers can then decide how the net monetizable benefits or costs should be allocated among the solar producers, ratepayers and utility shareholders.

Examples of terms that should be included include capacity (G, T & D), capitalized energy, load shape specific marginal losses, carbon risk, fuel price and hydro system risk, price suppression of traditional fuels, O&M, water, changes in river flows to benefit fish and farmers, environmental, NOx and other pollution reduction, and probably many others.

A primary test to protect ratepayers should be that the Present Value of Revenue Requirement be minimized by long-term, sustained, orderly implementation of solar resource acquisition strategies. Additional ratepayer protection tests could consider carbon price sticker shock, disruptive technology management effectiveness, and similar macro effects of a robust, fair and efficient solar development strategy.

Regarding carbon risk, at page 21 the Draft Report states, "estimating benefits from carbon emission reduction depends on the underlying assumption about whether or not Congress will enact a carbon tax." This should be revised to note that policy makers in Oregon are actively considering how to price and/or regulate carbon, whether or not Congress ever acts.

At Table 6.1, Total Cost of Solar Energy, the Draft Report omits the levelized cost calculation of the PURPA avoided cost strips. By definition the IPC PV QFs are cost effective to the utility, and the PURPA avoided costs are the actual acquisition costs for the solar energy these plants will produce. These data should be included in the table to make visible the actual cost to acquire QF solar energy. Similarly, in Table 6.2, the cost of Oregon incentives for the IPC PV QFs should be given as $0.

Chapter VI – Evaluation of Solar Programs

This chapter of the Draft Report is highly problematic. It is far too pessimistic, based on an obsolete perception and incorrect analysis of the solar resource. On its face this chapter fails in the principal mission of the exercise, which is to "Recommend new programs or program modifications that encourage solar development in a way that is cost effective and protects ratepayers."

Chapter VI reflects a paradigm that solar energy has been and for many years will be too costly, that expensive incentives and subsidies will long be required to the detriment of non-participants and taxpayers, that policy makers' primary role is to strictly limit non-participant rate impacts, and that not much more can be done by Oregon policy makers to "encourage solar development in a way that is cost-effective". It imagines that past experience with existing solar program designs will determine future performance. It implies the policy makers' role is to decide how much electric rate impact is acceptable and how much ratepayer and taxpayer subsidy should be allocated to continue business as usual. Here is the key language:

> "…no single (Oregon) incentive program appears to be more effective than others at lowering installation costs…" (Page 29).

Since those are the programs we have (and nothing to replace them is offered in the Draft), then more rate impacts and tax subsidies are needed if the existing programs are to persist or grow. At page 33,

> "The economic potential for solar growth in Oregon depends on the cost of solar, the impact on electric rates, *and the funds available for incentives*." (Emphasis added.)

These statements are discussed below in more detail.

The Draft Report evaluates the State's solar programs from the perspective of participant benefits and non-participant rate impacts. The effect of taxpayer subsidies is also presented.

Non-participants' electric rates were increased slightly by the solar programs. The "Non-participant Test" has long been used in energy efficiency program evaluation, and is also known as the Ratepayer Impact Measure, or RIM test, and also known as the No Losers Test.

It is no longer in Oregon's interest for the RIM test to be the primary evaluation tool for solar resource acquisition programs. The RIM test is no longer appropriate because we are in period of rapidly declining solar costs, and the objective should be to design programs and resource acquisition strategies that work to bring solar energy into the mainstream as a competitive player in electricity markets.

If non-participants are negatively affected in the next few years of solar resource acquisition, then policy-makers can consider specific remedies. The state's effort to promote the installation of large amounts of carbon-free solar energy should not be held hostage to this issue.

Noted in more detail in the general comments above, devotion to the RIM test exposes ratepayers to higher energy costs in general, to the disruptive technology risks that increase utility costs for some customers, and to carbon price sticker shock when carbon is priced into energy markets.

Participants in Oregon's solar programs invest more than they recoup in incentives and subsidies, which the Draft Report notes covers only about 90% of the total cost of installing a solar energy system in the current program and market structure. The participants are net losers in economic terms, but apparently invest in solar energy because of their values, relative wealth and education. By contrast, solar investors in Germany sell their energy directly to the grid at a price that provides a return on investment.

Taxpayer subsidies should be a thing of the past. A properly designed Feed in Tariff would have the utilities buy the energy as a resource for the grid[6]. Rapid solar growth will *add* substantially to tax revenues at the state and local level. Counties across Oregon would see more than $2 billion invested in utility-scale power plants in the scenario I presented. Their property tax revenues would benefit significantly. Similarly, Oregon personal income tax revenues would increase due to the employment required to build and operate the solar resource.

At page 29 the Draft Report states, "…no single (Oregon) incentive program appears to be more effective than others at lowering installation costs." Indeed. All the Oregon programs were designed for the previous era when solar was high cost. These programs were very

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[6] This is not to imply that utilities are banks or should function like banks. The issue of how to design debt facilities to support the investments, capital structure and related matters will require significant technical work and should include the State Treasurer's office.

useful in kick starting solar in Oregon, and helped many contractors build important businesses. They should be acknowledged for their important contribution to industry capacity building and the present state of the solar market.

Given the current and forecast solar energy markets the Oregon solar programs as they presently exist are suboptimal, subject to inherent market barriers and friction, and outdated. They should be replaced with modern resource acquisition strategies that are explicitly designed to advance Oregon's broader energy, climate and economic development goals.

The shift toward a cost-effective solar resource acquisition strategy can best be done with new-to-Oregon best-practice program designs that closely emulate the German experience for distributed energy resources, and the California ERAM mechanism for acquiring large, utility-scale resources.

In Germany, where a well-designed feed in tariff has been used for years, the cost of residential solar is less than half the average cost in Oregon. The SunShot goals will drive these costs even lower over the near term. Closer to home, the California ERAM mechanism is acquiring huge amounts of utility-scale solar energy at competitive prices. Separately, Palo Alto is buying solar on long-term contracts at about $70/MWh and Austin Energy at $50/MWh.

The Draft Report does not contain any discussion of, or comparative analysis of, best practice strategies and the empirical program differences, nor how they might be adapted to Oregon. This omission is glaring, considering the mission of the exercise.

At page 33 the Draft Report states, "The economic potential for solar growth in Oregon depends on the cost of solar, the impact on electric rates, and the funds available for incentives." This sentence-as-a-whole, written in a context of incorrect assertions that solar is too expensive, is only true in a world where solar costs are expected to exceed value for many years, and where the present generation of Oregon's solar incentive and subsidy programs persist over time.

In the new world of low cost solar energy the Draft Report's sentence at page 33 is inaccurate. If solar can be procured at less than avoided costs, then we should figure out how much is worth buying each year going forward, how to pay for it, how the stakeholders can work together, and how to maximize and distribute the net benefits. We have compelling evidence to consider:

- Large-scale PURPA QFs are *already profitable*, and the cost to build QFs will decline substantially between now and 2020,
- Austin Energy contracted to buy solar energy for 20 years from a 150 MW independent power producer for about $50 per MWh
- Some Oregon solar contractors are installing distributed solar energy systems at a very low price; $2.25/W for residential and $2.50 for commercial systems (Draft Report at page 13)
- Distributed solar energy resource acquisition in Germany can already produce distributed PV at prices less than half of the average program price in Oregon, and less than the Oregon contractor best practice today
- Prices will continue to be driven down for a decade by industry and government

funded R&D, demand growth and other factors.
- Value will likely be increased as carbon is priced into energy markets.

The report states at pp 33-34, "…QF development in Oregon has the potential to create large projects in Eastern and Southern Oregon…" and omits consideration of QF development in the Willamette Valley. This omission should be corrected.

At page 34 the draft report finally begins to describe how incentives can be dialed down as the price of the resource declines, but it critically must include accurate and up-to-date analysis of solar costs if it is to be accepted as valid.

> "*Cost of Solar:* Chapter 4 of this report describes the downward trend in the cost of solar electricity, and compares the cost of solar with the cost of other energy sources. If the cost of solar decreases further, growth can be sustained with fewer incentives. Large scale solar will need to decrease in cost by about 25 to 30 percent to be cost competitive with other forms of renewable generation, such as wind. Residential solar will need to decrease in cost substantially to continue growth without incentives."

In reality, PURPA QF costs are already profitable against combined cycle gas generators, the proxy plant in avoided cost calculations. The statement that it needs to compete with wind is not helpful or relevant. Given the differences in generation resource shapes, technical attributes, geographic distribution, and economics among solar, wind, and other renewable resources, the electric grid system and utilities should be investigating and capitalizing on the synergies of a portfolio of diverse renewable resources as a whole, rather than demanding that one be cheaper as the sole evaluation criterion.

The Draft Report is completely silent about any details to answer the primary question; what "new programs or program modifications … (could) encourage solar development…"? Its sole contribution (at page 34) to the question is the following list of three general principles, only one of which is correct.

> "In summary, without further incentives, the (*incorrectly analyzed*) economic factors will limit solar growth over the next few years. The potential for solar growth is:
> - Greater for programs that emphasize projects with lower overall costs, such as larger projects in areas with more sunlight,
> - Greater for programs with less cost shifting from participants to non-participants, and
> - Greater for programs that can adjust incentives to changing solar costs."

These bullet points, which might be considered obvious, have issues embedded that should be unpacked. The first two are problematic, and the third is reasonable.

For example, consider the first bullet point "Greater for programs that emphasize projects with lower overall costs, such as larger projects in areas with more sunlight."

- Large low-cost projects in sunny areas are certainly to be prized. But the transmission constraints in the state will have to be factored into the analysis.

- Wheeling charges are significant cost adders if plants are interconnected to BPA and deliver power to investor owned utilities.
- Large projects in the Willamette Valley are cost effective against PURPA rates if interconnected directly to PGE, and valuable because they are near load centers.
- Distributed projects in the urban fabric are valuable in many ways besides their energy production costs
- Net value cannot properly be quantified without a TRC, Societal or other more comprehensive test for costs and benefits.

Consider the second bullet point, "Greater for programs with less cost shifting from participants to non-participants,"

- Major costs will likely be imposed on everyone if a robust solar program is not implemented (higher than needed energy costs, disruptive risks and carbon price shocks).
- If cost shifting is required in the near term it should not be considered an impediment to implementing a robust large-scale solar program, and the Legislature can consider remedies if necessary.
- The thesis of my input to this docket is that well designed solar programs will produce net benefits, not net costs. Non-participants should enjoy the distribution of net benefits, as well share the burden of near-term net costs if such costs are necessary as we ramp up the solar program. In my written input to this docket I described a scenario in which both distributed and utility scale solar are ramped up over a fifteen-year period. Without this kind of analysis and program planning one cannot know the magnitude of net costs or benefits.

The third bullet point, "Greater for programs that can adjust incentives to changing solar costs" is a great idea and I wholeheartedly support it. The German FIT and California ERAM are worthy examples of this principle.

Distributed and utility-scale solar can be produced cost-effectively using best practice program designs and resource acquisition strategies. We should learn from and adopt those best practices.

Respectfully Submitted, May 20, 2014

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