UPHE COMMENTS ON PACIFICORP'S 2015

INTEGRATED RESOURCE MANAGEMENT PLAN

I. INTRODUCTION

PacifiCorp provides 8,412 Megawatts (MW) of electric power to portions of six northwestern states: Oregon, Washington, California, Wyoming, Utah and Idaho. It produces over 70% of that power (about 6,000 MW) by burning coal in 24 boilers scattered over five western states.[1]

Integrated resource planning is a process whereby regulated electric power utilities consider what mix of resources they will use to produce electricity in the future by evaluating alternative combinations of power-generation technologies and transmission system configurations to see which will incur the lowest overall cost and present the lowest overall risk—to its investors, its customers and the communities to which they belong.

PacifiCorp's obligation to produce formal integrated resource plans reflects the context in which it operates. It is a private company that is allowed to possess the economic power of a monopoly. It is granted that privilege because it is presumed to enjoy economies of scale, meaning that it is presumed to be able to produce, transmit, and distribute electric power more efficiently than multiple competing private companies could do it for the same customers. Having been granted the privilege to operate as a monopoly, PacifiCorp incurs the obligation to operate not just in the short-run interest of its investors, but in the long-run interests of its customers and of society at large. It is the long-run interests of society at large that have been badly overlooked in PacifiCorp's 2015 integrated resource plan.

Public service commissions in the six states where PacifiCorp provides retail electric power require it to produce formal integrated resource planning every two years.

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1 See the Bend Oregon Bulletin, June 13, 2015, Joseph Ditzler, PacifiCorp plans to reduce the use of coal, http://www.bendbulletin.com/business/3242700-151/pacificorp-plans-to-reduce-use-of-coal#.

PacifiCorp's integrated resource management planning process is intended to assure that adequate, reliable supplies of electricity are provided at reasonable cost in a manner that is "consistent with the long-run public interest."[2] According to the Utah Public Service Commission, the risk of "future internalization of environmental costs" is an issue that affects the long-run public interest, and, therefore, one that should be taken account when PacifiCorp, with the guidance of the Utah Public Service Commission, decides what resource mix should be pursued over the next 20 years.

"Future internalization" of the environmental costs of carbon-intensive electric power generation means that in the future, to greater or lesser degree, PacifiCorp may be required to bear them.[3] For reasons discussed below, PacifiCorp's 2015 Integrated Resource Management Plan (2015 IRP) falls well short of realistically assessing that risk. Consequently, the business strategy that its 2015 IRP attempts to validate consists of continuing to run nearly all of its legacy coal-fired power plants until they die of old age, and spending well over a billion dollars to retrofit them just enough to meet its minimum legal obligation to ease the environmental harm that they cause.

The preferred long-run mix of resources ("preferred portfolio") that the 2015 IRP endorses is essentially a plan to keep running PacifiCorp's legacy coal-fired plants until the bitter end, when their physically "useful lives" are over. Its preferred portfolio reflects PacifiCorp's forecast that growth in the demand for electric power over the next 20 years will be modest. It proposes to meet 85% of that modest increase in demand through investments in programs that incentivize energy efficiency, and when that becomes inadequate, to add new gas-fired turbine capacity. Currently, renewable energy plays a negligible role in the meeting PacifiCorp's total peak capacity (contributing only 3%). Under the 2015 IRP, the role of renewable power will remain negligible at the end of the 20-year planning period (still about 3% of its total peak capacity).

II. THE ASSUMPTION THAT RENEWABLES HAVE NO REAL VALUE TO PACIFICORP, NOW OR IN THE FUTURE, BECAUSE THEY ARE NOT A BASELOAD RESOURCE HAS BEEN DEMONSTRATED TO BE FALSE

2 See PacifiCorp's 2015 Integrated Resource Plan, Volume 1, n. 3.

3 Shifting the environmental cost of relying on coal to produce electric power onto the company that generates those costs rather than making society at large bear them is, of course, exactly what economists would prescribe, since that the main goal of regulation is to achieve the most efficient allocation of resources in the American economy. Shifting environmental costs to those that generate them would provide a market-based incentive to minimize them. The body that should be taking the lead in ensuring that PacifiCorp internalizes the environmental costs of burning coal for electric power, of course, is the Utah Public Service Commission itself, since the largest share of PacifiCorp's customers reside in Utah, and the damage from the CO2 and toxins generated by the coal-fired electric power plants in our region is born primarily by Utahns more than any other group. Under the current political climate, however, when it comes to internalizing the environmental cost of relying on coal for electric power, most of the heavy lifting has been left to the Federal government.

The 2015 IRP's "preferred portfolio," which maps out where PacifiCorp hopes to be getting its power over the next 20 years, is based on a key assumption on management's part—that fossil-fuel and nuclear power are the only technologies that will ever help it meet its need for base-load power generation. Quoting Michael Dunn, president of PacifiCorp,

> For baseload generation, it's either gas, coal or nuclear. There aren't a lot of other options out there, and we believe that retrofitting the coal units is the most economical option for our customers.[4]

All of PacifiCorp's resource selection analysis is based on this assumption. Having made the *a priori* assumption that renewable energy can never contribute to its need for base-load power generation, the only thing that makes sense is for PacifiCorp to dismiss the possibility that renewable power will ever play a significant role in its system design. In management's eyes, renewable forms of power only have value to the extent that they keep certain government-imposed renewable portfolio requirements at bay. It concludes that the only viable way that it can meet the mounting stream of emissions-restricting regulations being issued by Federal and state regulators is to spend lavishly on retrofitting its aging fleet of coal-fired plants.

By "lavishly," we mean spending $1.2 billion from 2005 to 2010 on environmental upgrades of its coal fleet, amounting to 40% of the total value of its fleet, and being obligated to spend another $1.3 billion since 2010 on environmental upgrades of its coal fleet by the end of this year,[5] unless the obligation to make those upgrades is modified or overturned by the courts. Altogether, PacifiCorp has spent, or in the near future will have to spend, $2.5 billion to reduce the many forms of pollution that its coal fleet emits in order to keep operating that fleet. *This investment is more than three-fourths of the value of that fleet.* Management's decision to double down on coal with practically every available investment dollar means that there will be no significant capital left to invest in renewable energy or energy efficiency programs.

Management's premise that the intermittent nature of renewable energy disqualifies it from ever contributing meaningfully to the system's need for baseload power is valid—so long as management makes no genuine effort to adapt its generation, transmission, and distribution facilities to accommodate its intermittent

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4 Quoted in Portland Mail Tribune, June 7, 2011, PacifiCorp sticks with coal despite the cost of retrofitting, Ted Sickinger, available at http://www.mailtribune.com/article/20110627/BIZ/106270305.

5 See Portland Mail Tribune, June 7, 2011, PacifiCorp sticks with coal despite the cost of retrofitting, Ted Sickinger, available at http://www.mailtribune.com/article/20110627/BIZ/106270305.

nature.[6] Other national and state level electric power systems are making a genuine effort to make the system modifications necessary to accommodate intermittent sources of clean energy, and they are succeeding. The direct system costs of making the necessary modifications to accommodate the intermittent nature of renewable power are modestly higher in the short run, but they are lower in the long run, as the generation of power with technologies whose fuel costs are low or zero eventually recoups the entire investment in renewable-friendly upgrades. As will be explained in more detail below, when the co-benefits to society of avoiding the CO2 and the wide variety of toxins that are unleashed by burning coal are included in the accounting, the costs of making the necessary system modifications to accommodate intermittent forms of renewable energy are far lower than the costs of not making them.

Germany is an example of a large, sophisticated economy that has made a genuine effort to modify its electric power system to accommodate intermittent forms of renewable energy and is succeeding. Rather than sit back and say "renewable forms of energy are intermittent, and, therefore we don't want anything to do with them," the German regulator sides with mainstream climate science and mainstream economic thought across the developed world. It recognizes that relying on fossil fuels to generate electric power is the high-risk, high-cost path for society in the long-run and so it is willing to pay a modest premium for energy in the short run in order to set the stage for transitioning to clean power.

The contrast between electric utilities in Germany and PacifiCorp on the question of whether they have a duty to do what is in the long-run interests of society as well as in the short-run interests of their investors and their customers, is instructive. Both Germany and the region served by PacifiCorp are rich in fossil fuels (in the case of Germany, coal and lignite, in the case of PacifiCorp, coal, oil, and natural gas). PacifiCorp sees fossil fuel as abundant and available, and therefore gives it priority in its resource planning, leaving to others to worry about whether that is in the long-run interests of the society that it serves.

Public utilities in Germany see fossil fuel as abundant and available, but recognize (as the German public does) that giving fossil fuel priority is trading short-run gain for long-run pain. Consequently, the German electrical utility system features a Feed-In Tariff (FIT) that guarantees that those who feed renewable energy into the system will be paid a price that is stable over the medium term, and competitive with fossil fuel. The FIT has resulted in the German electric power retail customer paying a

[6] It is important to recognize that while renewable sources of power are intermittent, so is fossil-fuel to a substantial degree. PacifiCorp has so far avoided any significant use of renewables in meeting its peak capacity requirements, holding them to a mere 3% share, yet it still needs a reserve capacity of 13%. The reason that PacifiCorp feels a need to maintain base-load capacity that is 13% above its coincident peak is that there is a significant risk that fossil-fuel-based power generation will require downtime of its own for maintenance, repair, and retrofitting.

premium for electricity that averages about 7%.[7] The German FIT is mainly responsible for the rapid growth of wind power in Germany, and made it, until recently, the world's leader in solar power installations. The modest FIT for renewables has insured that a substantial amount of renewable power is available.

Another feature of the German system is that renewable forms of energy have dispatch priority, meaning that they are always used first. Only when they cannot meet remaining demand does the system turn to power derived from fossil fuel. As a result of the FIT and giving renewables priority in the energy que, Germany meets almost 30% of its needs for electric power from clean energy, and is on track to meet its goal of 35% in 2020, and 50% in 2050.[8]

The German electrical power system is actually far more reliable than those in the United States despite the fact that, at times, renewable energy supplies up to 80% of the German system's peak capacity. Annual minutes when the system goes down are only tiny fraction of those in the United States, as seen in the graph below.

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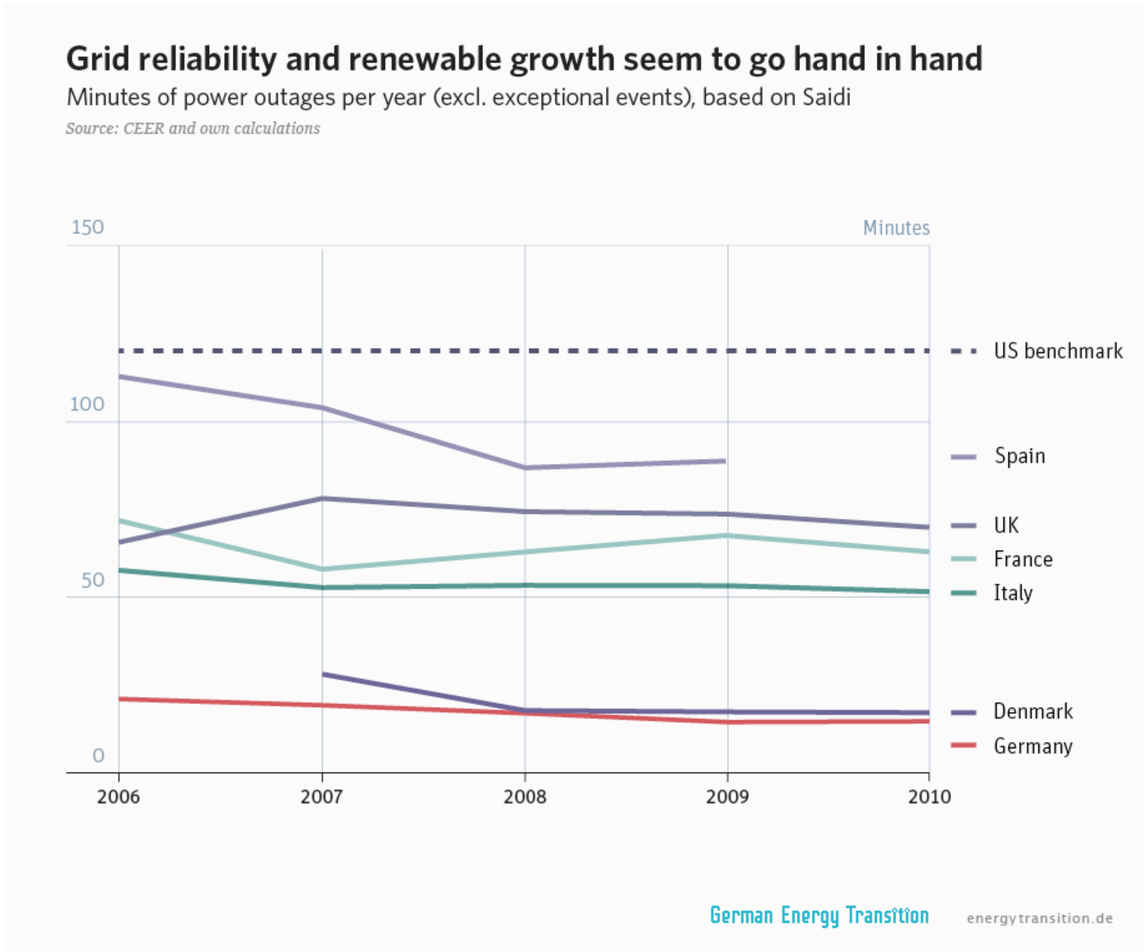
[7]. Although the German FIT imposes requires the customer to pay a modest premium for renewable energy in the short-run, the cost of green energy to the German consumer, on average, has been estimated to be four tenths of one percent of his household budget. Average power bills for German retail customers are lower than the average for retail customers in the United States, in part, because energy efficiency programs have been so effective. See Energy Transition: the German Energiewende, "German power bills are low compared to US average," May 26, 2025, by Craig Morris, available at http://energytransition.de/2015/05/german-power-bills-low-compared-to-us/.

8 Energy Transition: the German Energiewende, "How is Germany integrating and balancing renewable energy today?" Heinrich Böll Stiftung, 19 Feb 2015, available at http://energytransition.de/2015/02/how-germany-integrates-renewable-energy/.



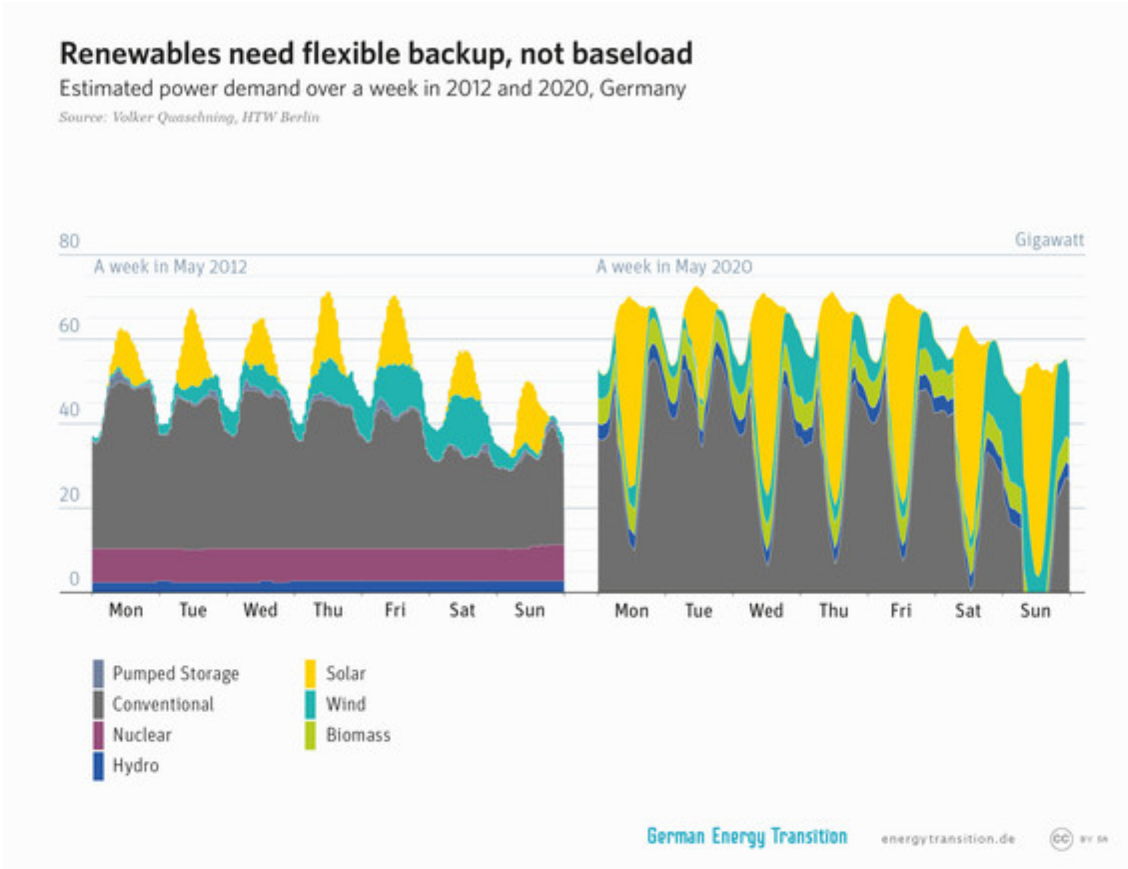
The German system achieves this level of reliability with virtually no curtailment of the peak output of its renewables.[9]

The remarkable success of German public utilities in accommodating renewable forms of energy is attributable not just to the willingness of German consumers to pay a modest premium for renewables in the short run, but to a commitment to finding ways that are practical and effective in integrating renewable energy into the system despite their intermittent nature. One of the most important reasons that Germany has succeeded in this objective is that it had already invested in a robust power grid with enough spare capacity engage in substantial load balancing both within and across its national border. Consequently, when the wind is up in Northern Europe, Germany can send substantially any surplus of wind-generated power to southern Germany, and

9 Energy Transition: the German Energiewende, "How is Germany integrating and balancing renewable energy today?" Heinrich Böll Stiftung, 19 Feb 2015, available at http://energytransition.de/2015/02/how-germany-integrates-renewable-energy/.

when the sun is out in southern Germany, the system can send virtually any surplus in sun-generated energy to Northern Germany. As the share of renewables grows, Germany realizes that it will need to expand some of its transmission lines and is planning for that need. It has made network planning with future renewables in mind a basic obligation of Germany's state regulator, BNetzA. Its annual analysis incorporates projections of where renewables will be developed over the next ten years.

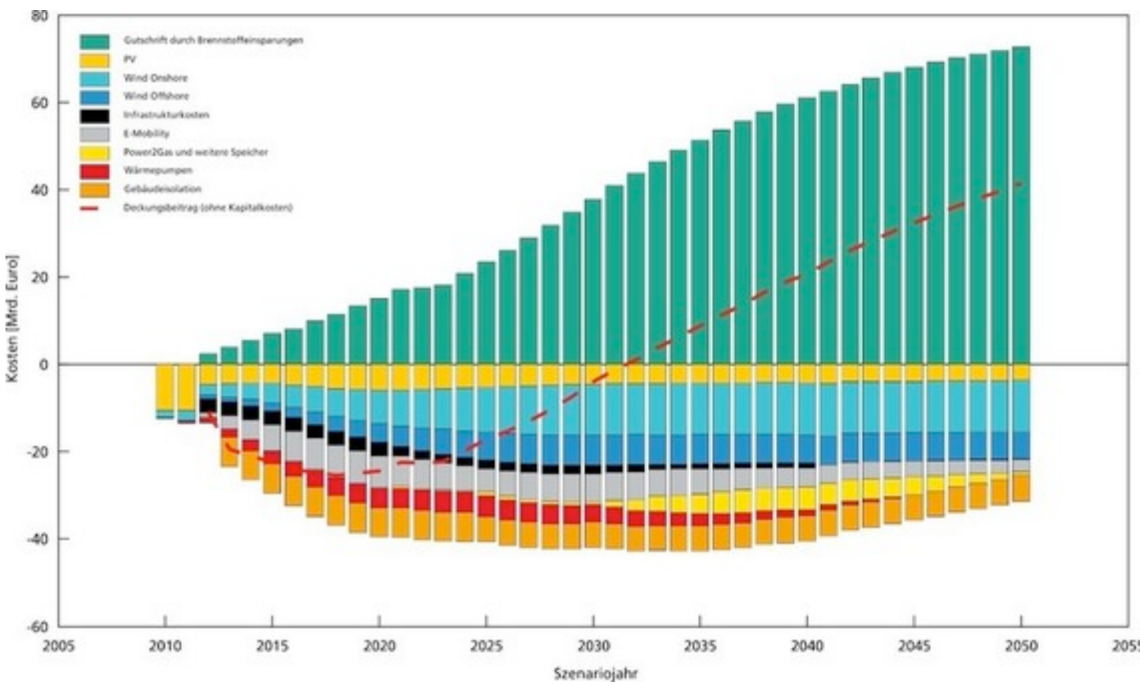
Another important reason that Germany has succeeded in integrating renewables into its power grid is that it has developed techniques for operating its non-renewable power plants (coal, nuclear, gas, and pumped hydro) as flexible backup energy sources for renewables, rather than have them function as suppliers of base load power. Largely because Germany's programs incentivizing energy efficiency and renewables have proved so successful, there is a surplus of legacy coal-fired generating capacity in Germany. Germany has engineered a significant share of that capacity to function as a balance wheel, filling in the valleys created by renewable energy production. Germany's coal plants can efficiently cycle on and off on a daily basis, and can efficiently ramp up on an hourly basis and efficiently operate indefinitely at much less than full output. Germany has engineered a significant share of its nuclear power plants to do the same. The output flexibility of Germany's coal plants and their ability to effectively play a backup role for wind and solar energy going forward is illustrated by the figure below.



In addition to flexible ramping capability, Germany's coal and nuclear plants can effectively support a power grid with a high share of renewables because they are adapted to participate in the "ancillary" power market. Since they have dispatch priority, wind and solar power supply most of the balancing power in the "day ahead" power market. But coal and nuclear plants can still sell their power in Germany's ancillary market.

The ancillary market is similar to the regional "imbalance" markets in which PacifiCorp is beginning to effectively participate. Ancillary markets are designed to reconcile regional fluctuations in supply with regional fluctuations in demand on an hour-by-hour basis and minute-by-minute basis. By selling their power in the "ancillary" market, coal plants recoup some of the revenue that they forego because they do not function as base load plants. While participating in the ancillary market, coal and nuclear plant operators have developed software to more efficiently ramp their plants' output, and better operating practices to reduce the stress of ramping on their equipment.[10]

In the figure below, Germany's Fraunhofer IWES,[11] estimates the total cost of Germany's transition to reliance on clean power. The dotted red line in middle shows the net impact of that investment. The estimate shows that this investment yields a negative return in the short run, but reaches breakeven in 2030, and then achieves a substantially positive return thereafter. Because investments in the energy sector are made for decades, this path actually represents the path of lowest long-run financial risk for Germany's electric utilities. For the hundreds of billions that Germany will have invested in converting its electric power sector to clean power, it will have, by 2050, a low-cost, future proof, sustainable energy supply.



There are other countries that have demonstrated that substantial shares of renewable energy can be integrated into power grids with very modest modifications of the system. Denmark is similar to Germany in that it has been able to integrate a high

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10 Gas turbine plants are inherently more flexible than coal or nuclear, but Europe generally does not use them this way, because the price of gas there is high relative to that of coal and nuclear.

11 Figure reprinted from Renewables International, "Energiewende doesn't translate as 'mess,' May 28, 2015, available at http://www.renewablesinternational.net/energiewende-doesnt-translate-as-energy-mess/150/537/87819/.

percentage of renewable energy into its power grid at a very modest cost. Wind energy supplied 39% of its total electric power needs in 2014, and Denmark is on track to meet its goals of obtaining 50% of its electric power needs from renewables by 2020, and 100% by 2050.[12] In the U.S., several states have succeeded in integrating a high share of renewable energy into their electric power systems at little additional cost relative to fossil fuel alternatives. For example, Iowa gets 27%, and South Dakota gets 26%, of their total electric power from wind and have yet to encounter significant problems integrating that supply with their energy grids.[13] California is still recovering from its mismanaged experiment with power market deregulation, but is coping successfully with integrating 25% renewables into its power grid. The techniques that it is using--so far with success—include having its Independent System Operator set up an imbalance market with adjacent power grids (including PacifiCorp) to facilitate regional load balancing, and requiring its regulated utilities to plan upgrades to its distribution network based on forecasts of where additional sources of distributed renewable energy generation are likely to be built.

If it had the interest, PacifiCorp is at least as well positioned to adapt its network to accommodate a substantial share of renewables in its portfolio as is Germany, Iowa, South Dakota, and California, using similar accommodation techniques.[14] As Germany has done, PacifiCorp could adapt coal and gas turbine plants that are currently used to meet baseload needs and engineer them to cycle and ramp efficiently enough to fill the supply gaps created by wind and solar power.

PacifiCorp has a greater opportunity to pursue regional load balancing than Germany, Iowa, or South Dakota enjoy. In the part of PacifiCorp's production area that borders the Great Plains, (known as its Eastern Imbalance Area) there are enormous potential wind resources—a resource that peaks in the winter, and at night. The Pacific Northwest (PacifiCorp's Western Imbalance Area) experiences peak demand for electric power in the winter, providing a market suited for receiving that wind resource. Taking full advantage of the opportunity to balance eastern supply with western demand

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12 Ecowatch, January 9, 2015, Tierney Smith, "5 Countries Leading the Way Toward 100% Renewable Energy."

13 See Midwest Wind Energy Center, State Fact Sheets http://www.midwestwindenergycenter.org/state_fact_sheets_2014?recruiter_id=3.

14 See PacifiCorp 2015 IRP, Vol. 1, Figure 8.32. The discussion accompanying this figure explains that the West Imbalance Authority area has a winter peak and that the East Imbalance Authority area has a summer peak. The discussion acknowledges that tying the two together would lower PacifiCorp's needed reserve margin, would allow renewables from the east to help the west to meet the carbon reduction requirements of President Obama's Clean Power Plan, would defer the need for a gas turbine peaking plant in the west, and would avoid the need to add Demand Side Management programs in the east. PacifiCorp thus acknowledges that expanding transmission interconnection capacity is an alternative to adding gas turbine plants toward the end of the study period.

requires adequate transmission capacity linking the Eastern Imbalance Area with the Western Imbalance Area.

The southern end of PacifiCorp's production area (southern Utah and Arizona) has large potential solar resources. Since the solar resource peaks in the summer and in the daytime, it could made to complement the wind resource in the north. Taking full advantage of the opportunity to balance solar supply with the potential demand for that resource would require adequate transmission capacity linking the northern and southern ends of PacifiCorp's service area.

If PacifiCorp were to invest in the transmission upgrades needed to fully integrate its considerable wind and solar resources with the market for those resources in the same or adjacent regions, it would not only facilitate seasonal and day-ahead load balancing but it would make the current intra-day load balancing market more robust. If PacifiCorp were to give renewables dispatch priority, as in Germany, a robust intra-day balancing market would allow PacifiCorp to assign a portion of its coal-fired units the role of back up to fill the valleys of supply that would be created by fully exploiting its wind and solar resources. If those repurposed coal-fired units could sell power in a robust intra-day imbalance market, they could remain active and earn a return on what would otherwise be obsolete infrastructure. Upgrading PacifiCorp's transmission system in the ways described above would go a long way toward overcoming the intermittent nature of its wind and solar resources, and allow their enormous potential to be fully exploited.

III. BY EXCLUDING RENEWABLES FROM ITS PREFERRED PORTFOLIO, PACIFICORP'S INCREASES ITS LONG-RUN FINANCIAL RISK

As noted, PacifiCorp's preferred portfolio begins in 2015 with renewables contributing a negligible share to its system's peak capacity (3%) and ends 20 years later, in 2034, with renewables contributing the same negligible share of its system's peak capacity (3%).[15] In discussing its 2015 IRP, PacifiCorp doesn't directly say why renewables are the big losers in its resource planning analysis, but its description of trends in the costs of renewables provides a clue.

In Volume 1 of the 2015 IRP, beginning at page 95, PacifiCorp estimates the current costs of the various sources of electric power generation that are currently available to its system, broken out by state. Table 6.2 compares the total cost of power

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15 For the current role of renewables in the preferred portfolio, see PacifiCorp 2015 Integrated Resource Plan at p. 62, Table 5.2, where system peak load for 2015 is met with only 3% with renewables and 3.7% with Demand Side Management programs. The tables from 5.2 through 5.7 show that almost 6,000 Megawatts peak capacity from coal, almost 3,000 Megawatts from gas, and a pittance from wind and solar. Figure 8.26 shows that the share of system peak capacity contributed by non-hydro renewables starts at 3% in 2015 and ends at 3% in 2034. (Hydro's share shrinks over that time as well.)

generated from the various fossil fuel sources with the total cost of the various renewable sources of power that are available to the system. Each total cost is weighted by a “capacity factor,” meaning the percentage of that sources total generating capacity that would be available to meet the system’s coincident peak load. These weighted costs, therefore, fully reflect the intermittent nature of the various renewable sources of power that are currently available to the system. PacifiCorp’s weighted total cost comparisons show that wind resources cited in Wyoming are already a good deal cheaper than the average cost of power that PacifiCorp can obtain from its cheapest fossil fuel technology (gas turbine) and that the cost of power obtained from wind in Washington, Oregon, and Utah are competitive with power that PacifiCorp can obtain from gas turbines. Its estimated the total cost of utility-scale solar power is already within the upper range of what PacifiCorp can obtain from gas turbine technology.[16]

Given that the total weighted costs of renewables are already competitive with the cheapest fossil fuel alternative that is available to PacifiCorp, and given the nearly unanimous consensus among electric power economists that the cost of wind and utility-scale solar will continue to decline over the next 20 years while the cost of coal- and gas-fired electric power will continue to rise over that period, it is puzzling why the 2015 IRP still rules out any significant role for renewable energy over that period in its preferred portfolio.

In describing recent trends in the costs of wind and solar, the 2015 IRP acknowledges that the costs of both wind and solar have been rapidly declining in recent years, but it describes those declines as having leveled off, or “stabilized” in 2014, and as “likely to rise with the general rate of inflation thereafter.”[17] Therefore, without explicitly saying so, the 2015 IRP appears to take what it identifies as an end to the trend of declining costs of power generated by renewables in 2014, and to assume a reversal of that trend end all the way through the 20-year study period. If that assumption is, in fact, what PacifiCorp has baked into the resource selection models that underlie its 2015 IRP, it conflicts with the nearly unanimous consensus of energy resource economists that the costs of wind and solar-generated power will continue to

16 The 2015 IRP, Vol. 1, beginning at p. 95 presents estimates of the total cost of power obtained from various sources, weighted by their estimated capacity factors. Table 6.2 shows that the following weighted total resource cost estimates:

Combined Combustion Cycle Gas Turbine ranges between 4.8 and 11.4 cents/kWh
(capacity factors between 12% and 78%)

Wind Turbine is 6.0 cents/kWh (Washington/Oregon) 5.7 (Utah), 3.7 (Wyoming)
(reflecting capacity factors ranging from 29% to 43%)

PV (utility scale) ranges between 8.8 cents/kWh and 10.2 cents/kWh
(reflecting capacity factors between 32% and 27%, respectively)

17 See 2015 IRP, Vol. 1, at pages 112-114.

fall, and the cost of fossil fuel-generated power will continue to rise over the next 20 years. Utah's Public Service Commission should take great care to verify whether PacifiCorp has, in fact, based its resource cost minimization and risk minimization modeling on this highly dubious assumption, and, if so to ask PacifiCorp for a detailed justification of that assumption.

Rather than conclude that it minimizes its financial risk by barring renewables from playing any meaningful role in its preferred portfolio, PacifiCorp should have concluded that its financial risk will increase if it disregards the rise in the cost of power generated by fossil fuel and the decline in the cost of power generated by renewables that nearly all resource economists forecast will occur over the study period. There is near unanimity among those economists that technology will continue to drive the costs of wind, solar, biomass, and other renewable technologies down, while the dwindling of fossil fuel deposits that are easily and cheaply recovered will continue to drive up the cost of fossil fuel over the next 20 years.

First, it should be noted PacifiCorp's apparent assumption that the cost of renewable energy will rise with inflation over the next 20 years directly conflicts with the detailed analysis of those costs contained in the EPA's Clean Power Plan. The EPA issued its proposed Clean Power Plan in June of 2014, basing its analysis on cost data through 2012. It issued its final rule on August 3 of this year, based on cost data through 2014. Over the brief period from 2012 to 2014, the EPA found that the cost of renewable energy had declined by 40%. As a result of these updated cost data, the EPA forecasts much faster growth in renewable power and much greater declines in carbon emissions through the year 2030 from implementing its Clean Power Plan.[18]

According to a 2014 study by the investment banking firm Lazard, the costs of generating electricity from all forms of utility-scale solar photovoltaic (PV) technology continue to decline dramatically. The study estimates that the Levelized Cost of Energy (LCOE) of leading PV technologies has fallen by nearly 20% in 2013, and nearly 80% since 2008. In many parts of the world, utility-scale solar PV continues to increase its cost advantage over conventional generation as a source of peak energy, without any subsidies (appreciating the important qualitative differences related to dispatch characteristics and other factors).

Land-based wind-generation costs also continue to decline dramatically. The study estimates that the levelized cost of leading technologies fell by more than 15% in 2013, and nearly 60% since. Battery storage technologies, a potential complement to intermittent energy resources such as wind or solar, continue to be very expensive and not cost-competitive without subsidies. However, the levelized cost of "next generation"

18 See SWITCHBOARD, Natural Resources Defense Council Blog, "Understanding the EPA's Clean Power Plan," August 11, 2015, David Doniger, available at http://switchboard.nrdc.org/blogs/ddoniger/understanding_the_epas_clean_p.html.

battery storage technologies could decline by as much as 40% by 2017, given expected reductions in capital costs, operation and maintenance costs, and improvements in efficiency. The cost of utility-scale solar energy is as low as 5.6 cents a kilowatt-hour, and wind is as low as 1.4 cents. In comparison, natural gas comes at 6.1 cents a kilowatt-hour on the low end and coal at 6.6 cents. Without subsidies, the firm’s analysis shows, solar costs about 7.2 cents a kilowatt-hour at the low end, with wind at 3.7 cents.[19]

Lazard’ estimates are corroborated by a recent study done in Texas where City-owned Austin Energy signed “a 25-year PPA [power purchase agreement] with Sun Edison for 150 megawatts of solar power at "just below" 5 cents per kilowatt-hour.” This is remarkable in that this “5- cent price falls below Austin Energy's estimates for natural gas at 7 cents, coal at 10 cents and nuclear at 13 cents.”[20]

Perhaps the most thorough recent study available of the trend in the levelized cost of renewable power over the next 10 years was completed in January of this year by the International Renewable Energy Agency (IRENA) of which the United States is a member.[21] With respect to the risk of ignoring recent trends in the cost of renewable energy, the final chapter of the IRENA study concludes, at p.143, that

> The virtuous cycle of policy support for renewable power generation technologies leading to accelerated deployment, technology improvements, and cost reductions, has had a profound effect on the power generation sector. . . . Renewables are now the economic solution offgrid and are increasingly the least-cost option for grid supply. This is changing the nature of electricity generation systems and how they are managed. The challenges faced by utilities, sometimes amplified by inflexible or outdated electricity markets, will only increase as renewable power generation costs continue to fall.

The IRENA study concludes that the cost of power generated by on-shore wind already has a competitive advantage with respect to fossil fuel, and its advantage will increase modestly through the year 2025. It concludes that the cost of power

19 Lazard, Levelized Cost of Energy v8 Abstract, September 14, 2014.

20 Reported by Wesoff, Eric, “Cheapest Solar Ever? Austin Energy Buys PV From SunEdison at 5 Cents per Kilowatt-Hour.” greentechsolar, March 10, 2014.

21 IRENA (2015), Renewable Power Generation Costs in 2014.

generated by grid-scale Photo Voltaic technology, by 2025, will also have a competitive advantage over fossil fuels in the United States and Europe.[22]

The 2015 IRP sees increased long-run financial risk in giving renewables any meaningful role in its preferred portfolio over the next 20 years, whereas the estimates in the authoritative studies described above strongly imply that it would increase PacifiCorp's long-run financial risk to exclude them. The difference may lie in PacifiCorp's apparent failure to consider that in the long run, the financial advantage of having a renewable rather than a carbon- or nuclear-based portfolio builds over time. Because the cost of fuel is zero, the revenue earned by fuel-free operation ultimately goes well beyond amortizing the initial capital investment. The International Energy Agency estimates that an additional investment in renewable energy of $ 44 trillion is

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22 Specifically with respect to wind, the IRENA study concludes, at p. 144, that

> The LCOE [levelized cost of energy] of wind has declined significantly, and wind power is now one of the most competitive renewable power generation options. This decline was driven by technology improvements and falls in wind turbine prices. Wind turbine prices have declined by as much as 30% since their peak in 2008/2009, with prices of between USD 930 and USD 1,376/kW in 2014 for project for which data are available.
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> By 2025 installed costs for wind farms in the United States could fall to around USD 1 450/kW from their preliminary estimates of around USD 1 780/ kW in 2014, assuming wind turbine prices stabilize at around USD 850/kW.
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> . . . . .
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> Average capacity factors for new wind farms may continue to rise, as the average size and hubheight of turbines grow. . . . As a result the LCOE of wind will continue to fall, but this may slow if, on average, poorer wind sites are being developed.

With respect to solar power, the IRENA study concludes, at pp. 144-45, that grid-scale solar PV will become highly competitive with energy derived from fossil fuel by 2025:

> Despite solar PV module prices that are now significantly below the learning curve, cost reductions are likely to resume in 2015 as the market continues to grow and innovations and economies of scale are exploited. With price reductions having been brought forward to some extent, future cost reductions will be lower in absolute terms. However, the continued growth in new capacity additions means that in percentage terms, cost reductions should not slow dramatically. By 2025, c-Si modules could be retailing for between USD 0.40 and USD 0.45/W with full recovery of capital costs.
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> Total installed costs for utility-scale projects could fall to between USD 1,100 to USD 1,200/kW by 2025 on average, although this will be heavily dependent on convergence of [Balance of System] costs to the most competitive levels. A similar dynamic could play out in the small-scale rooftop market. If Balance of System costs can be pushed down to very competitive levels, average installed costs could range from USD 1,600 to USD 2,000/kW by 2025.

With respect to Concentrated Solar Plants, the study concludes that costs will continue their rapid decline:

> [t]he overall capital cost reductions for parabolic trough plants by 2025 could be between 20% and 45%. [citations omitted] For solar towers the cost reduction potential could be as high as 28% on a like-for-like plant basis (Hinkley, 2011).

needed to remove carbon from the world's electric power generating systems by 2050, in line with the goal of limiting global warming by that time to 2°Centigrade. The IEA emphasizes, however, that such an investment would be offset by over $115 trillion in fuel savings--resulting in net savings of $71 trillion.[23] PacifiCorp has apparently concluded that this aspect of renewable energy's financial accounting does not apply to its system.

IV. PACIFICORP'S VIEW OF THE PUBLIC POLICY RISK THAT IT FACES IN BY EXCLUDING CLEAN ENERGY FROM A MEANINGFUL ROLE IN ITS PREFERRED PORTFOLIO

PacifiCorp's view of the public policy risk that it faces is seriously flawed because its definition of environmental costs is far too narrow. It views them as only the cost of complying with the EPA's Regional Haze Rule, its Clean Power Plan, other Federal clean air and clean water regulations, and state RPS mandates. These government regulations and mandates, however, don't purport to be full measures of the social cost of the emissions generated by coal-fired power plants and they fall well short of that amount.

The reader can find a more thorough, fully-sourced discussion of the harms to public health and other social costs that are incurred when coal is burned to produce electric power in UPHE's December 1, 2014 comments on the Administration's Clean Power Plan. Those comments are available at http://uphe.org/wp-content/uploads/2015/05/Clean-Power-Rule-CommentsDec-2014-PDF.pdf. A short summary of those comments is provided below.

Full measures of the harm that coal-fired electric power does to public health and the integrity of the climate and ecosystems on which the public's physical and economic wellbeing depend, would triple the current price of coal-fired electric power. Although public policy over the next 20 years may not decide to force the electric power industry to price its power to reflect its full social cost, it is likely to move in that direction. The disruptive effects of climate change are becoming more obvious with each passing year. Superstorm Sandy is one example. The historically unprecedented drought in California is another. Almost all climatologists forecast that the disruptive effects of climate change will be increasingly severe over the next 20 years as the warming of the earth's surface accelerates.

For example, recent climate models consistently predict that there is an 80% probability that if CO2 concentrations in the atmosphere are allowed to increase at their

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23 International Energy Agency, Energy Technology Perspectives 2014, "Harnessing Electricity's Potential," available at http://www.iea.org/etp/etp2014/.

current rate through the rest of this century, a drought as severe as the dust bowl that devastated the Great Plains for a decade in the 1930s will grip the Western United States, but is likely to last three times as long. If this happens, public pressure to more effectively to address the problem before it becomes unsolvable will only grow over the 20-year planning horizon of the IRP. As droughts deepen and forest fires proliferate in the Western United States, current carbon emissions limits will be tightened, or a carbon tax will be imposed. The Monte-Carlo-based models of risk on which the 2015 IRP relies are not capable of taking such risks into account, and, consequently, the IRP shows almost no awareness that this risk will rise over the 20-year planning period that it analyzes.

Even if, by some miracle, there were no new and disturbing effects from climate disruption over the next 20 years, there is a substantial risk that air and water pollution limits that are based on protecting public health will become increasingly restrictive. Current ambient air standards for such pollutants as ozone, Polycyclic Aromatic Hydrocarbons (PAHS), fine particulates, lead, and mercury are all based on the assumption that there is a threshold below which exposure to these pollutants is safe. The latest scientific research, however, shows that safe thresholds are well below current allowable exposure standards for these pollutants, and that those standards—even those that have been revised in the past year or two--are already obsolete, and need to be tightened to reflect the current science. This is another kind of risk that Monte Carlo-based models of risk are not capable of taking into account. Consequently, the 2015 IRP shows almost no awareness that there is a substantial likelihood that public-health based air and water pollution restrictions on fossil fuel emissions will be tightened further over the planning period.

If PacifiCorp's 2015 IRP fully reflected the risk that over the next 20 years, CO2 emissions will be either further restricted, or taxed, and that public-health based air and water pollution limits will be tightened, it would conclude that the economically- and socially-useful lives of its coal-fired plants are considerably shorter than their physically-useful lives. It would adjust its "preferred portfolio" to provide for earlier retirements of those plants and take the billion-plus dollars that it currently has earmarked for retrofitting such plants and invest them in expanded Demand Side Management programs, expanded interconnection capacity, and expanded renewable power generation.

V. THE UTAH PUBLIC SERVICE COMMISSION HAS A SPECIAL RESPONSIBILITY TO REQUIRE PACIFICORP TO REVISE ITS 2015 IRP TO REFLECT THE SOCIAL COSTS OF RELYING ALMOST EXCLUSIVELY OF FOSSIL FUELS TO PROVIDE POWER TO ITS SYSTEM

As noted, PacifiCorp sells retail power in six western states. All of them have Public Service Commissions with some degree of authority to influence PacifiCorp's decisions about how it will allocate its resources in the future. Of them, Oregon has been the most active in trying to pressure PacifiCorp to reexamine whether it's *a priori* assumption that even in a future that promises rising fossil fuel costs, increasing restrictions on carbon and other fossil fuel emissions, and rapidly declining costs of renewables, only fossil fuel and nuclear technologies can meet the system's needs for base-load power.

The real risk of PacifiCorp's strategy is that a continuing stream of incremental investments to satisfy ongoing regulatory changes will commit PacifiCorp to run its coal plants long term in order to extract a rate of return from those investments for its investors. While each of those investments may make sense in isolation, PacifiCorp isn't seriously asking the question whether all these retrofits taken together constitute a cost effective strategy versus going with low-carbon sources of power.

Oregon's public utility commissioners have repeatedly upbraided PacifiCorp executives for dragging their feet and going ahead with expensive retrofits before they were fully vetted. Consequently, the Oregon PUC refused to allow PacifiCorp to charge Oregon ratepayers for some of its pollution control investments in its 2013 rate case. In 2014, they issued a final order on PacifiCorp's 2013 iteration of its integrated resource management plan that refused to approve of several more retrofits that are underway, or nearly complete, at coal plants in Wyoming and Utah.

Oregon's ability to bring more realism and objectivity to PacifiCorp's resource planning, however is limited. Under PacifiCorp's Multi-State Process (MSP) for allocating costs among the six states where it provides retail service, Oregon ratepayers shoulder only 26% of the costs of PacifiCorp's system. Under that same MSP process, Utah ratepayers shoulder 43% of PacifiCorp's costs. Together, Utah and Oregon ratepayers shoulder over two-thirds of the costs of PacifiCorp's system.[24] If these two public service commissions were to join in pressuring PacifiCorp to rethink its assumption that renewable sources of power and energy efficiency programs are inherently incapable of contributing to its base-load power needs, PacifiCorp would have to make a genuine effort to reexamine its approach.

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24 See the True Cost of Coal, Fully accounting for coal-fired electricity use in the 7th Northwest Power and Conservation Plan, Energy Strategies and NW Energy Coalition, contributing authors. July 2015, at 21. www.nwenergy.org/data/True-Cost-of-Coal-NWEC_0715.pdf.,