RECLAMATION

Managing Water in the West

Klamath Comprehensive Agricultural Power Plan

Status and Next Steps to Reduce Basin Power Costs

Prepared by

United States Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
Klamath Basin Area Office

U.S. Department of the Interior
Bureau of Reclamation
Klamath Basin

December 2016

This page left blank intentionally.

Contents

Tables

Figures

Appendices

Abbreviations and Acronyms

¢/kWh	cents per kilowatt-hour
$/kW	dollars per kilowatt
BAA	Balancing Authority Area
Basin	Klamath Basin
CAPP	Comprehensive Agricultural Power Plan
CPUC	California Public Utilities Commission
CSIP	California Solar Incentive Program
D&S	Directive and Standard
DOI	United States Department of the Interior
EIM	energy imbalance market
Energy Trust	Energy Trust of Oregon
Enhancement Act	Klamath Basin Water Supply Enhancement Act of 2000
FERC	Federal Energy Regulatory Commission
hydro	hydropower
Hp	horsepower
IAIR	Initial Alternatives Information Report
ISO	California Independent System Operator
ITC	Investment Tax Credit
KBRA	Klamath Basin Restoration Agreement
kW	kilowatt
kWh	kilowatt-hours
MW	megawatt
OPUC	Oregon Public Utility Commission
PPA	power purchase agreement
PV	photovoltaic
PWMP	Power for Water Management Program
R&T	Reserved and Transferred
Reclamation	Bureau of Reclamation
RES-BCT	Local Government Renewable Energy Self-Generation Bill Credit Transfer Program
SB	Senate Bill
Secretary	Secretary of the Interior
TOU	Time of Use

This page left blank intentionally.

Comprehensive Agricultural Power Plan Status and Next Steps to Reduce Basin Power Costs

This report provides an update to the alternatives identified in the Comprehensive Agricultural Power Plan (CAPP) Initial Alternatives Information Report (IAIR) following its completion in January 2016 and the expiration of the Klamath Basin Restoration Agreement (KBRA), which would have provided the policy foundation to reduce irrigation power costs through implementation of the CAPP.

Introduction

The Bureau of Reclamation (Reclamation), on behalf of the Secretary of the Interior (Secretary), initiated a process to develop the Klamath CAPP to identify and evaluate alternatives with the potential to reduce power costs to approximately 1,900 power meters on Reclamation's Klamath Project in California and Oregon (On-Project users) and 600 power meters in Oregon not associated with the Klamath Project (Off-Project users). Together these meters serve more than 1,000 individual or corporate farms (See Figure 1).

The need for the CAPP resulted from the 2006 expiration of PacifiCorp's Federal Energy Regulatory Commission (FERC) license for its Klamath River hydroelectric project and a 50-year power contract that served Klamath Basin On- and Off-Project irrigators. In 2010, cooperating entities finalized the KBRA, which sought to resolve years of conflict in the Klamath Basin over water, power, and the environment. In the Power for Water Management Program (PWMP), the KBRA outlined provisions to provide affordable power to agricultural water users affected by the transition to PacifiCorp's higher power rates. Reclamation, on behalf of the Secretary, developed the CAPP process to identify and evaluate potential alternatives to reduce Basin irrigator power costs.

It was Reclamation's intent to have the CAPP function as a candidate financial and engineering plan required by the PWMP (subject to the irrigation community's approval) to reduce irrigator power costs in the event that Congress authorized the KBRA, or other authorizing legislation. On January 1, 2016, Congress failed to pass legislation authorizing the KBRA and the agreement expired along with provisions in the PWMP section that would have required affordable power development. Throughout the course of 2016, Klamath Basin entities, led by the Klamath Water Users Association, advanced legislation in Senate Bill (SB) 2012 – The North American Energy Security and Infrastructure Act of 2016 – that would authorize and direct the Department of the Interior

(DOI) to deliver an affordable power benefit to the On-Project and Off-Project irrigators. The provision in SB-2012 would include defining a "power cost benchmark" and would require that the DOI develop a plan within 180 days that identifies how the power benefit would be developed and delivered to Klamath Basin irrigators through prioritization of conservation and efficiency and new renewable generation. A related bill in the House of Representatives (H.R. 8-North American Energy Security and Infrastructure Act of 2015) has no provision to supply a power benefit to On-Project or Off-Project irrigators. Both the Senate and House of Representative bills went to the conference committee on September 8, 2016 to work out differences in the two bills. As of December 2016, a compromised bill has yet to be defined that includes a Klamath Basin power provision, and it is uncertain whether the bill will be passed in the 2017 Congressional session. If Congress passes, and the President of the United States signs, an energy bill with similar language to that within SB 2012, Reclamation would continue to develop the CAPP with close guidance and support from the irrigation community. Implementation of the final CAPP would be subject to the availably of a Federal appropriation.

If Congress fails to provide authorizing legislation, Reclamation may rely on the Klamath Basin Water Supply Enhancement Act of 2000 (P.L. 106-498) (Enhancement Act) to complete the CAPP. The Enhancement Act directs the Secretary to engage in feasibility studies of, among other things, innovative water management measures to reduce conflicts over water in the Klamath Basin. While the Enhancement Act allows for 100 percent non-reimbursable funding for the feasibility study (under the Directive and Standards [D&S], feasibility studies normally include some element of cost share), in the absence of Congressional action providing separate funding, project development would be fully reimbursable and would exclude the Off-Project irrigators.

This report presents the potential alternatives that could move forward with and without legislation and provides a general discussion on how the alternatives might perform, potential funding sources, and policy changes needed to make the best alternatives functional.

Figure 1. Klamath Basin Area Subject to New PacifiCorp Tariffs

CAPP Initial Alternatives Information Report

The CAPP IAIR, completed in January 2016, was the first major step in the study process to identify methods to reduce power costs to Klamath Basin irrigators. The CAPP IAIR identified and screened a comprehensive list of options to meet the CAPP objectives. The options and objectives were developed with a tiered stakeholder program composed of the Klamath Basin irrigation community, California and Oregon state agencies, and other interested stakeholders. The screening included technical, economic, and regulatory and policy viability of power cost reduction options. Viable options capable of reducing agricultural power costs were formulated into alternatives for both the On-Project and Off-Projects areas of the Klamath Basin. In the development of the IAIR, Reclamation assumed, consistent with the KBRA, that Federal legislation would appropriate $40 million as an investment in an alternative(s) to lower power costs for the Klamath Basin irrigation community. The alternatives developed in the IAIR are presented in Table 1. The complete IAIR, including the process used to

develop and screen the alternatives, can be found at Reclamation's website, https://www.usbr.gov/mp/kbao/programs/spcl-projects/affrdbl-pwr.html.

Table 1. CAPP IAIR Alternatives[1]

Alternative	Description
Alternative 1: Utility-Scale Solar	Develops 26 megawatts (MW) of solar photovoltaic (PV) at multiple distributed sites. A power purchase agreement (PPA) with PacifiCorp provides a revenue stream for a bill credit.
Alternative 2: Low-Head Hydropower	Develops up to 4 MW of low-head hydropower (hydro). The IAIR identified several locations for low-head hydro; Keno dam provided the best ratio of project cost to annual net revenue. A PPA with PacifiCorp provides a revenue stream for a bill credit.
Alternative 3: Out-of-Basin Investment	Invests $40 million in pure-play (100 percent) renewable energy assets through a yieldco. A yieldco is a dividend-yielding public company that bundles renewable energy projects and generates a predictable cash flow from long-term power contracts on the operating asset. The yieldco dividend provides a revenue stream for a bill credit.
Alternative 4: Utility-Scale Solar and Out-of-Basin Investment	Develops approximately 13 MW of solar PV and invests in a renewable energy yieldco. A PPA with PacifiCorp and a yieldco dividend provides a revenue stream for a bill credit.
Alternative 5: Geothermal	Develop approximately 7 MW of electricity using conventional geothermal technology at an unspecified location in the Klamath Basin. A PPA with PacifiCorp provides a revenue stream for a bill credit.
Alternative 5: Shared Solar	Develops utility-scale solar PV at multiple distributed sites similar to Alternative 1. Shared solar allows for meter aggregation or virtual metering. Each participating meter is credited for the resource value of solar power. At the time of the CAPP IAIR's development PacifiCorp was not required to provide this service but Oregon has since developed a community solar program.
Alternative 7: Utility-Scale and Net Metered Solar	Combines utility-scale solar PV with net-metered solar, leveraging Oregon and California net metering incentives. Develops 13 MW of utility-scale solar PV and would install approximately 1,100 small-scale solar PV systems. A PPA with PacifiCorp provides a revenue stream and net metering offsets full tariff rate.
Alternative 8: Net Metering	Installs approximately 1,700 small-scale solar PV systems and 500 natural gas-powered fuel cells, leveraging net metering incentives. Solar PV systems would be limited to a capacity of 5 kilowatt (kW) and fuel cells to 8 kW. Net metering offsets full tariff rate. This opportunity is limited by a small natural gas distribution footprint located only in select Oregon urban areas.
Alternative 9: Demand Management	Adjusts irrigation operations to maximize access to PacifiCorp's time-of-use and load control programs. A funding pool would build water management infrastructure at the district and on-farm level to support demand management. PacifiCorp offers a lower power rate for customers that curtail energy use during peak demand hours.

Alternative	Description
Alternative 10: Revenue Stream and Efficiency	A funding pool would be established for pump and motor efficiency improvements. A revenue stream would be established through an out-of-basin investment or new power development. Power cost would be reduced by maximizing pumping efficiency.
Alternative 11: Natural Gas Development	A natural gas alternative would capitalize on cost savings generated by using natural gas motors over electrical motors and net metering natural gas fuel cells. This opportunity is limited by a small natural gas distribution footprint located only in select Oregon urban areas.
Alternative 12: Regional Maximized Opportunity	Maximizes each region's ability to reduce power rates and/or costs by leveraging region-specific opportunities in the Oregon On-Project, Oregon Off-Project, and California On-Project areas.
Alternative 13: Biomass Power Development	Biomass power would be produced in conjunction with the Klamath Tribes at the Tribes' Giiwas site, former location of the Crater Lake Mill. The Tribes are studying a number of potential inexpensive fuel feedstock options. At the time of the IAIR's completion, the specifics of the biofuels program had not been fully developed so a specific economic analysis was not performed on the alternative.

[1] Project sizes may differ from those presented in the CAPP IAIR due to reduced development costs for solar energy, as published by GTM Research and Solar Energy Industries Association's report titled *U.S. Solar Market Insight 2015 Year in Review (PV Magazine 2016)*.

Regulatory Framework

For the development of the IAIR, Reclamation performed an in-depth review of the regulations governing generation, transmission, and distribution of power that serves the approximately 1,000 metered irrigators, or corporate farms, affected by the new PacifiCorp power rates. The most important aspects of power regulation are summarized here to provide context on alternatives formulation and where policy changes may be needed to support some alternatives. This information is contained in detail in the Regulatory Framework Report available on Reclamation's website at https://www.usbr.gov/mp/kbao/programs/spcl-projects/affrdbl-pwr.html.

As an investor-owned utility and owner/operator of the power distribution system, PacifiCorp is regulated by the California Public Utilities Commission (CPUC) and the Oregon Public Utilities Commission (OPUC) for power development, transmission, and distribution to its customers in the Klamath Basin. As such, it is important to emphasize that any alternative that develops power or interconnects with PacifiCorp's transmission system must follow the regulations of the PUCs in the respective states. Consistent with PUC regulations, power generated and interconnected with PacifiCorp is sold to PacifiCorp through a power purchase agreement (PPA) at PacifiCorp's avoided cost rate (their cost to generate power) at either a renewable or non-renewable (standard) rate. The rate at which PacifiCorp charges its customers is set by the PUCs. PacifiCorp's Schedule 37 identifies the kilowatt-hour (kWh) rate that they will pay for third party power generation in each year from 2016 through 2035. Figure 2 shows PacifiCorp's current projected renewable and standard price for tracking

photovoltaic (PV) solar in each year. Fixed solar PV and other power generation technologies would receive a different set of rates.

The PUCs also set the rates that irrigators pay. In Oregon, the primary OPUC-approved rate for Schedule 41 energy use is 9.6 cents per kilowatt-hour (¢/kWh) and in California, the CPUC-approved rate for Schedule PA-20 is 13.4 ¢/kWh. PacifiCorp has no ability to lower these rates arbitrarily, but has agreed to work with the irrigation community to provide a bill credit to participating irrigators if a separate funding stream were developed. One of the best measures to reduce individual power rates is through net metering, which directly offsets the Schedule 41 and Schedule PA-20 rates. Net metering policies exist in both states, although the rules differ. Alternatives developed in the IAIR took these and other regulatory opportunities and constraints into account.

It is important to note that energy pricing in the renewables market is very fluid and subject to change based upon many factors including shifting state and Federal policies and emerging technologies. As an example, since the development of the IAIR alternatives, Oregon passed the Clean Electricity and Coal Transition law (OR-1547) which now allows community solar and has now capped solar generating facilities for a single person/ company at 3 megawatts (MW) or less which is down from 10 MW for a single facility as reported in the IAIR.

Figure 2. PacifiCorp's Updated Avoided Cost Prices for Tracking Solar PV, 2016-2035

IAIR Alternatives and Performance

The IAIR process reviewed the spectrum of power cost reduction options, screened, and grouped these options into 13 alternatives as shown in Table 1.

These alternatives were further screened into three tiers and additional economic analysis was performed on the Tier 1 and 2 alternatives to understand the alternatives' ability to reduce irrigator power costs. The results of this screening are presented in Table 2. Tier 1 presents the best opportunities, while Tier 2 represents opportunities that have promise but may contain implementation obstacles or provide a lower potential for reducing power costs. Tier 3 alternatives represent alternatives that provide a de minimis ability to reduce power costs or in the case of geothermal energy development- a substantial resource uncertainty.

In the development of the alternatives, the most important criteria identified by stakeholders were an alternative's ability to lower power costs or rates, followed by equitable access to and distribution of the economic benefit to all irrigators. Major common assumptions used to develop the IAIR alternatives included:

- Viable alternatives must provide significant revenue to offset a basin-wide power bill totaling approximately $13 million annually. Some alternatives appear viable, particularly given the independent development now occurring in the Klamath Basin, but nevertheless fail to provide sufficient revenue to materially impact the agricultural power bill.

- The Federal government made an initial non-reimbursable investment of $40 million to fund alternative implementation (excluding the funding of natural gas).

- Alternatives resulting in a revenue stream would reduce power costs through a PacifiCorp bill credit to all eligible irrigators.

- Rate reduction percentages for CAPP alternatives were calculated separately for Oregon and California, and were allocated to Oregon and California on an energy use basis (roughly 81 percent Oregon, 19 percent California).

- All utility-scale solar PV would be composed of single axis tracking technology.

For this report, Reclamation updated the resulting rate reductions for the new power generation alternatives as shown in Table 2 with PacifiCorp's updated renewable pricing from Schedule 37 (effective August 24, 2016). Schedule 37 provides the avoided cost pricing that PacifiCorp will pay for new standard (conventional) and renewable power development with a signed power purchase Agreement (PPA) in 2016. The updated Schedule 37 avoided cost rates have been reduced when compared to the 2015 Schedule 37 rates. The projected costs for solar development were updated to 2016 prices, tracking solar PV costs at 1,540 dollars/kilowatt ($/kW) and net-metered solar at $3,500/kW, based on the GM Research and Solar Energy Industries Association report U.S. Solar Market Insight 2015 Year in Review (PV Magazine 2016).

Table 2. Alternatives Ranking with Federal Legislation and $40 Million Non-Reimbursable Investment

Alternative	Average Rate Reduction[1] Oregon	Average Rate Reduction[1] California
Tier 1		
Alternative 7: Utility-Scale and Net Metered Solar	19.8%	14.6%
Alternative 6: Shared Solar	23.4%	16.7%
Alternative 3: Out-of-Basin Investment	10.8%	7.7%
Alternative 4: Utility-Scale Solar and Out-of-Basin Investment	14.6%	10.4%
Alternative 8: Net Metering	23.9%	14.0%
Tier 2		
Alternative 1: Utility-Scale Solar	18.4%	13.1%
Alternative 10: Revenue Stream and Efficiency[2]	up to 15%	up to 15%
Alternative 9: Demand Management (Time of Use) [2]	33%	30%
Alternative 2: Hydropower at Keno Dam	8.8%	6.3%
Alternative 13: Biofuels and Biomass Power Development	NA	NA
Alternative 12: Regional Maximized Opportunity	NA	NA
Tier 3		
Alternative 2: Hydropower at Eastside Powerhouse	5.9%	4.2%
Alternative 2: Hydropower at Eastside Powerhouse with A Canal Water	4.4%	3.1%
Alternative 2: Hydropower at A Canal	1.9%	1.3%
Alternative 2: Hydropower at Westside Powerhouse	1.5%	1.1%
Alternative 2: Hydropower at G Canal	0.5%	0.4%
Alternative 11: Natural Gas Development	NA	NA
Alternative 5: Geothermal	10.6%	7.6%
Alternative 2: Hydropower at all Facilities[3]	15.5%	11.0%

[1] The values shown here represent the average rate reduction percentage from 2015 to 2035, based on the renewable pricing option provided in PacifiCorp's 2016 Schedule 37, where applicable.
[2] These values represent the potential savings for an individual Klamath Basin irrigator.
[3] Alternative would develop hydropower facilities at all locations, and the facility at the Eastside Powerhouse would use A-Canal water. This alternative would require more than $40 million.
[NA] No economic analysis was performed.

The IAIR identified several viable alternatives that could reduce power rates or costs. The best alternatives that fully distributed the benefits to all irrigators relied on utility-scale solar PV and/or net metering as shown in Table 2. To test the viability of utility-scale solar PV sites in the Klamath Basin, Reclamation performed an initial assessment to identify potential sites of 40 acres or more by reviewing land use and proximity to transmission interconnection. This study, conducted in November 2015, identified several candidate sites and demonstrated that land use and interconnection would not limit utility-scale solar PV

development in the Klamath Basin. The results of this assessment are included as Appendix 1 to this report.

Performance of CAPP IAIR Alternatives without Federal Legislation

Reclamation performed an initial analysis on the CAPP alternatives to assess which alternatives might perform well in the absence of Federal legislation, given uncertainty of its passage. Table 3 provides a summary of the alternatives' performances. Major common assumptions used to develop this alternative analysis included:

- Viable alternatives must provide significant revenue to offset a basin-wide power bill totaling approximately $13 million annually. Some alternatives appear viable, particularly given the independent development now occurring in the Klamath Basin, but nevertheless fail to provide sufficient revenue to materially impact the agricultural power bill.

- For new power generation creating a revenue stream through a PPA, Reclamation used PacifiCorp's updated Schedule 37 avoided costs.

- The Federal government would not make a non-reimbursable investment to fund alternative implementation. The cost of money to fund an alternative's development at $40 million was 3 percent with a 30-year payback period.

- The inflation rate applied to PacifiCorp's Schedule 40 and PA-20 power rates was 3 percent.

- For net metering, Energy Trust of Oregon will provide $1.00 per watt in incentive funding (about 25 percent) for the installed costs for a 5-kilowatt (kW) net-metered renewable power system. No incentive is available in California.

- The projected costs for solar development were updated to 2016 prices with tracking solar PV costs at $1,540/kW and net-metered solar at $3,500/kW, based on the GM Research and Solar Energy Industries Association report *U.S. Solar Market Insight 2015 Year in Review* (PV Magazine 2016).

- The assessment is highly sensitive to PacifiCorp's tariff inflation rate (3 percent), cost of money (3 percent), and the PPA rates, which ultimately must be negotiated with PacifiCorp. Appendix 2 provides the rate reduction calculator used for each alternative.

Many alternatives that rely on a PPA with PacifiCorp have little effect on irrigator power costs after a bill credit is applied. In general, the cost of money at 3 percent interest greatly reduces the viability of an alternative that relies on a PPA

to generate a profit. The rate reductions presented in Table 3 were developed for the purpose of comparing alternatives. More detailed engineer costing and/or alternative design may improve an alternative's performance but not likely its tiered placement in Table 3. Alternatives that still have the potential to reduce irrigator power costs without Federal funding were investigated further and are discussed below.

Table 3. Performance of CAPP IAIR Alternatives without Federal Legislation

Alternative	Average Rate Reduction[1] Oregon	Average Rate Reduction[1] California
Tier 1		
Alternative 7: Utility-Scale and Net Metered Solar	5.1%	5.9%
Alternative 6: Shared Solar	9.5%	6.8%
Alternative 3: Out-of-Basin Investment	-3.0%	-2.1%
Alternative 4: Utility-Scale Solar and Out-of-Basin Investment	0.8%	0.6%
Alternative 8: Net Metering	13.6%	5.7%
Tier 2		
Alternative 1: Utility-Scale Solar	4.5%	3.2%
Alternative 10: Revenue Stream and Efficiency[2]	up to 15%	up to 15%
Alternative 9: Demand Management (Time of Use)[2]	33%	30%
Alternative 2: Hydropower at Keno Dam	-3.6%	-2.6%
Alternative 13: Biofuels and Biomass Power Development	NA	NA
Alternative 12: Regional Maximized Opportunity	NA	NA
Tier 3		
Alternative 2: Hydropower at Eastside Powerhouse	-3.7%	-2.7%
Alternative 2: Hydropower at Eastside Powerhouse with A Canal Water	-2.3%	-1.7%
Alternative 2: Hydropower at A Canal	-2.1%	-1.5%
Alternative 2: Hydropower at Westside Powerhouse	-0.8%	-0.6%
Alternative 2: Hydropower at G Canal	-1.1%	-0.8%
Alternative 11: Natural Gas Development	NA	NA
Alternative 5: Geothermal	-3.2%	-2.3%
Alternative 2: Hydropower at all Facilities[3]	-18.4%	-13.1%

[1] The values shown here represent the average rate reduction percentage from 2016 to 2035, based on the renewable pricing option provided in Schedule 37, where applicable.
[2] These values represent the potential savings for an individual Klamath Basin irrigator.
[3] Alternative would develop hydropower facilities at all locations, and the facility at the Eastside Powerhouse would use A-Canal water.
[NA] No economic analysis was performed.

Viable Alternatives without Federal Legislation

Viable alternatives that evenly reduce irrigator power costs are challenged by the rapidly changing energy market that is affecting PacifiCorp's operations in Oregon and California. In 2016, Oregon passed the Clean Electricity and Coal Transition law, which established the goal of removing all coal generated

electricity from Oregon's energy supply by 2040. In response, PacifiCorp purchased the renewable attributes of several solar generation facilities, allowing the company to meet their renewable portfolio standard requirements through 2027, eliminating their need to identify Renewable Energy Certificates (RECs), and substantially reducing the avoided cost they will pay for renewable energy in their updated Schedule 37 (see Figure 2). Concurrently, the installation cost for utility-scale solar has continued to drop at a 10 to 15 percent year-over-year rate since 2010 with a projected installed cost equal to that of natural gas before 2022 (Trabish 2015).

Other programs with the potential to affect future energy prices in the basin include PacifiCorp's Energy Imbalance Market (EIM) with the California Independent System Operator (ISO) that allows for real-time transmission of electricity between the California ISO and PacifiCorp's Balancing Authority Area (BAA). Through the EIM, PacifiCorp will be able to dispatch renewable and demand management resources into California. PacifiCorp reported $10.5 million in benefits in the second quarter of 2016 through its participation in the EIM (California ISO 2016).

The 30 percent Federal Investment Tax Credit (ITC) for solar electric systems was set to expire on December 31, 2016 but was renewed by Congress for an additional three years followed by a 10 percent credit for an unspecified period of time. To qualify for this credit, a taxable entity (third party solar energy developer or the individual irrigator) would need to own the system with a tax base large enough to take advantage of the benefit. Given the uncertainty of CAPP implementation in the next three years and the taxable entities, the ITC was not included in the Table 3 analysis. To the extent that the ITC could be used, it would further improve all of the renewable alternatives.

Because of these and other factors, there is uncertainty in the future energy markets and the market's effect on the CAPP alternatives' performance. The greatest apparent factor is the substantial reduction in the cost of solar PV and its resulting downward pressure on the wholesale market value for renewables as reflected in PacifiCorp's updated Schedule 37.

Alternative 1: Utility-Scale Solar PV

The Klamath Basin is an ideal location for the development of utility-scale solar PV. As shown in Table 3, capitalizing a 26-MW facility and distributing the financial benefit to the irrigators would result in approximately a 4 percent reduction in rates averaged over a 20-year period if capitalized with 3 percent financing. Provided below are current assumptions and constraints with this alternative.

- Using PacifiCorp's updated Schedule 37, this alternative loses money between 2016 and 2024 when the price PacifiCorp will pay for utility-scale

solar is less than 5¢/kWh (see Figure 3). Substantial revenue generation would not occur until 2028, when PacifiCorp would need additional RECs to meet their renewable portfolio standards. The company would sign a contract today to secure the future RECs needed in 2028, however, there is no assurance that these prices will be available in the future as additional renewable projects are brought on-line.

- The updated Schedule 37 has capped the size of new utility-scale solar facilities at 3,000 kW per site in Oregon. Prior to 2016, the cap was 10,000 kW. Multiple sites would be required for the development of the 26,000 kW of capacity proposed under this alternative.

- Figure 3 and Table 3 currently use a 30-year payback period for Alternative 1. However, PacifiCorp will only contract under Schedule 37 for a 15 or 20-year period. If the payback period is required to occur over the contract period, which is standard for a third party investor, this opportunity does not generate sufficient revenue to finance the debt and provide an average rate reduction over the 20-year period; i.e. the revenue made after 2027 does not make up for revenue lost before this period. (see Figure 4).

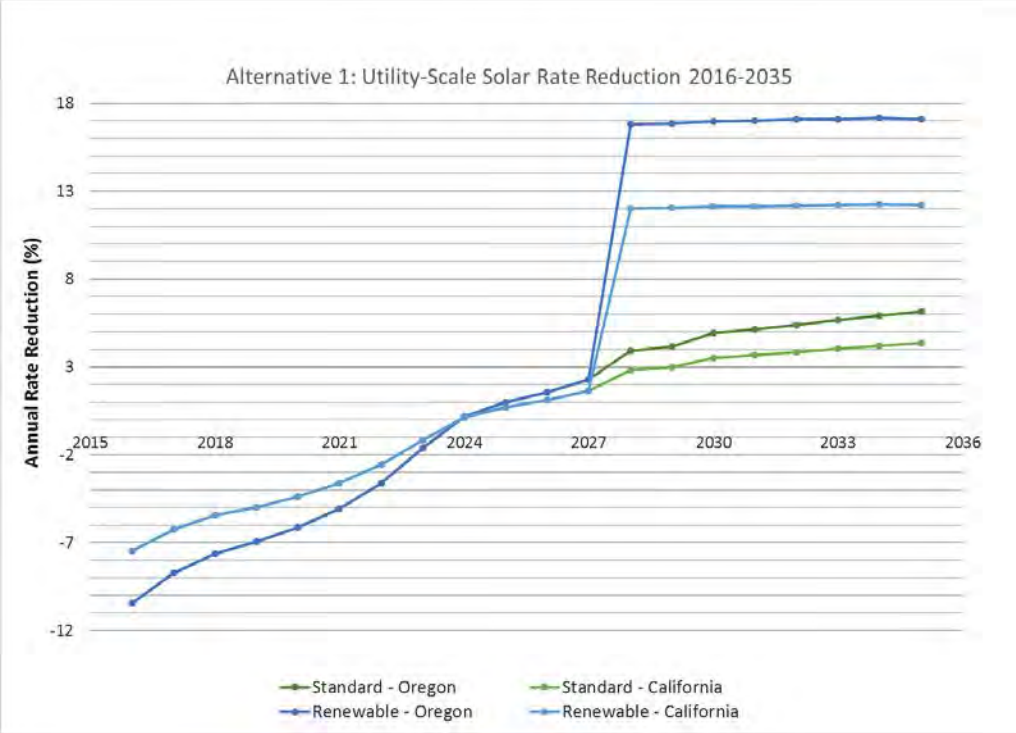


Figure 3. Projected Annual Rate Reduction with a 30-Year Payback Period for Alternative 1

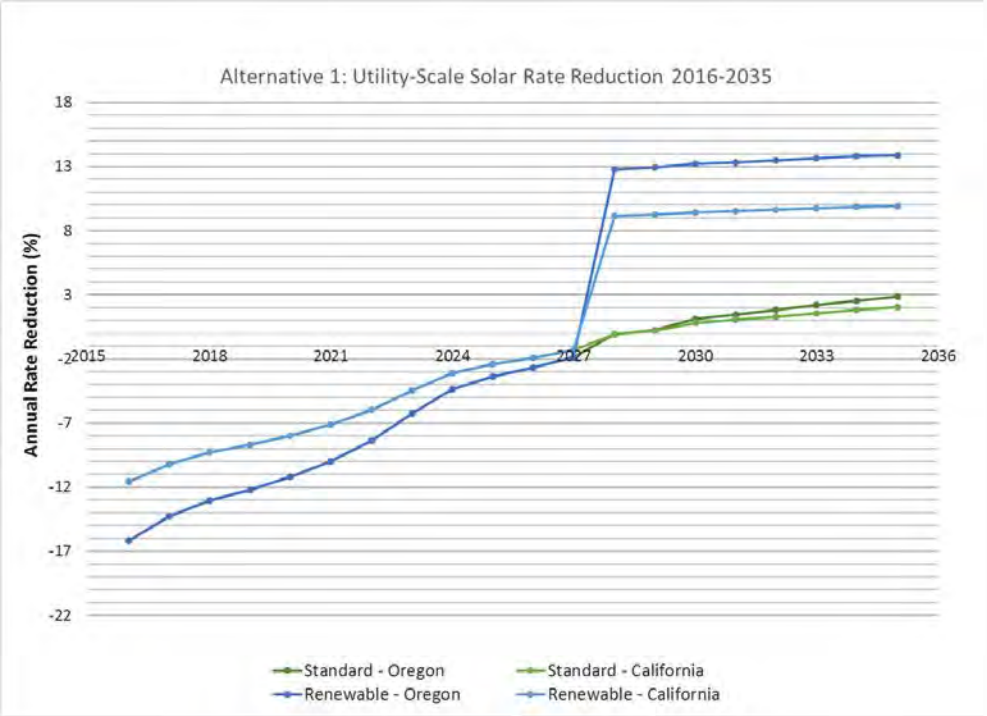


Figure 4. Projected Annual Rate Reductions with a 20-Year Payback Period for Alternative 1

Alternative 2: Low Head Hydropower

Several low head hydropower (hydro) facility developments are possible, as shown in Tables 2 and 3. Since none of these facilities would directly serve an irrigation load, the power would be sold to PacifiCorp through a PPA at the avoided cost price for renewable base load in Schedule 37. As with Alternative 1, these rates are less than 5 ¢/kWh through 2027. Provided below are current assumptions and constraints associated with this alternative.

- All hydro options appear to lose money with PacifiCorp's updated Schedule 37 rates. The Keno Dam location is the best hydro alternative and has the ability to generate revenue starting in 2028 (See Figure 5).

- The East and Westside facilities are unlikely to be viable hydro candidates. PacifiCorp must sell these assets at auction and there is no guarantee of ownership. Costs presented in Table 3 do not include a facilities purchase price.

- Alternative 2 uses a 30-year payback period; however, PacifiCorp will only contract for renewables under Schedule 37 for a 15 or 20-year period. If a shorter payback period is required, hydro would perform worse than what is presented in Table 3.

- Hydro within the Klamath Project (A and G canals) produce too little revenue to substantially effect rates through a revenue stream and are therefore not good candidates as standalone options to reduce rates through a revenue stream.

- More detailed engineering design may improve a specific hydro alternative's economic viability, but likely not its tiered placement in Table 3.

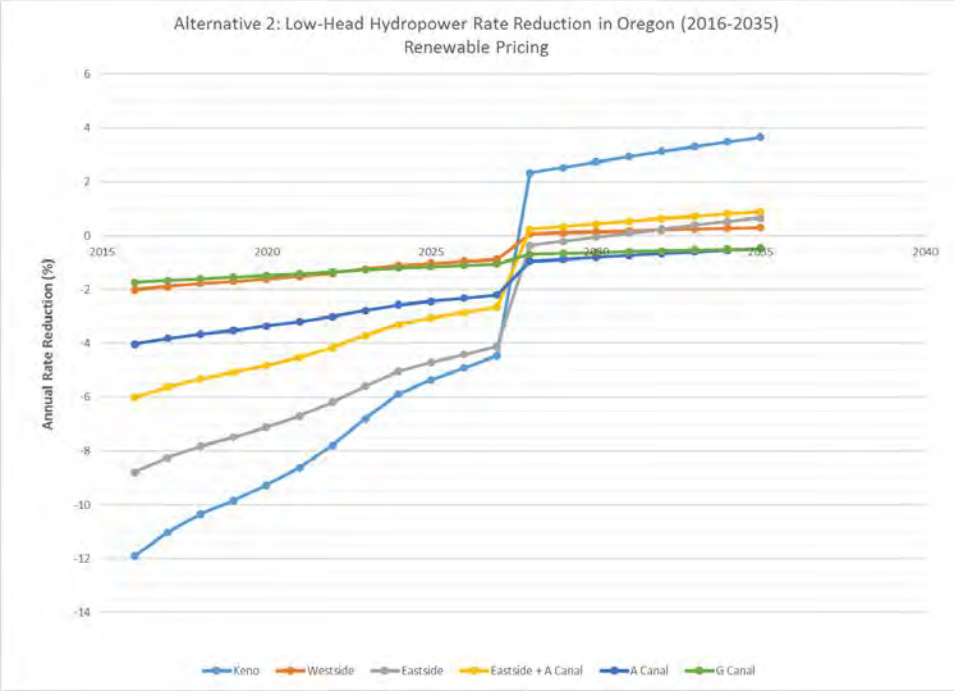


Figure 5. Projected Annual Rate Reductions with a 30-Year Payback Period for Alternative 2

Alternative 6: Community Solar

Community solar programs provide an ability to leverage the lower cost of utility-scale solar PV and distribute the benefit to multiple participants directly through a bill credit. Oregon adopted a community solar program in 2016 with the passage of the Clean Electricity and Coal Transition law and California operates several community solar programs including the Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT) Program.

The Oregon community solar program requires operation by an established organization such as a water district, local government, or non-profit entity. The facility size is limited to 3,000 kW and the participants are credited on their PacifiCorp bill for the "resource value of solar energy," which is set by the OPUC.

The California RES-BCT program authorizes local governments to generate renewable energy on-site under one account and transfer excess bill credits to up to 50 other accounts in the same geographical boundary owned or operated by the same local government. A generating account is limited to a capacity of 5,000 kW and allows third party financing through a PPA. Both the Oregon and California programs have the ability to reduce the irrigator power rates. Provided below are current assumptions and constraints associated with this alternative:

- The community solar rate reductions shown in Table 3 assume a full net-metered rate is applied. As of December 2016, the OPUC had not defined the resource value of solar energy. If the OPUC defines the resource value of solar equivalent to the Schedule 37 renewable rates, then this alternative directly mirrors Alternative 1: Utility-Scale Solar PV.

- It is possible to use the community solar program in Oregon to serve agricultural loads. It would require multiple utility-scale solar PV facilities to distribute the benefits to participating irrigators.

- PacifiCorp is not required by the CPUC to participate in the California RES-BCT program and state legislation would be required to compel PacifiCorp to provide this service. As with Oregon, the resource value of solar energy would be subject to CPUC review and approval.

- Alternative 6 uses a 30-year payback period which may be acceptable as a PPA with PacifiCorp would not be required.

Alternative 8: Net Metering

Net metering provides one of the best opportunities to reduce energy rates for irrigation loads; however, distributing the benefits equitably between irrigators and between Oregon and California is challenging given the different pump load sizes that would be served. Provided below are current assumptions and constraints associated with this alternative:

- Energy Trust of Oregon (Energy Trust) will provide an approximately 25 percent incentive ($1.00/watt) for the installation cost of a 5 kW net-metered system (size required for a 50-horsepower (Hp) pump). This upfront cash incentive is included in the rate reductions presented in Tables 2 and 3. The California Solar Incentive Program (CSIP), which was similar to the Energy Trust rebate program, concluded in March 2016 and was not renewed by the CPUC. Rate reductions shown in Tables 2 and 3 that include net metering are accordingly less in California than those for Oregon.

- The recipient of each solar PV system in Oregon would be responsible for applying for the Energy Trust incentive.

- Without a Federal funding pool for net metering, an overall funding mechanism is uncertain. A third party investor would aim to own each individual asset and charge the pump owner a set rate thereby reducing the benefit of net metering to the irrigator.

- In Oregon, if the owner takes advantage of the Energy Trust's incentive program, the RECs for net-metered systems are owned by the system owner for first five years, by Energy Trust for years six through 20, and by the system owner for the remaining system life. According to the Energy Trust website (https://energytrust.org/), there is currently no market for the purchase or sale of RECs from small, net-metered systems in Oregon.

Alternative 9: Demand Management

PacifiCorp is systematically developing agricultural time-of-use (TOU) and load control programs in both Oregon and California that would functionally operate the same in both states. Both programs are in various stages of pilot development and as Table 3 shows, the cost savings for TOU for an individual irrigator can provide a 33 percent rate reduction in Oregon and a 30 percent rate reduction in California if the irrigator is able to curtail pumping operations during peak periods.

PacifiCorp started its Oregon irrigation load control program in spring 2016 and has a pilot program pending before the CPUC for 2017. The irrigation load control programs provide participants with annual compensation for unused power during designated shutdown periods. Notification is sent to participants prior to shutdown periods, allowing participants the option to opt out of a given shutdown period. The current payment is $23 to $25 per kW. Provided below are current assumptions and constraints with the demand management alternative.

- PacifiCorp's Oregon pilot load control program is capped at 3,000 kW; PacifiCorp has not publicly reported on the success of the 2016 pilot. If approved by the CPUC, PacifiCorp would institute the same load control pilot program in California in 2017. The pilots would run over a five-year period to evaluate their success and pricing. If these programs are found to be successful, the full program would potentially expand to 8,000 kW in 2022 with the approval of the respective PUCs.

  Collectively the full 8,000 kW load control program is equivalent to approximately 200 50-Hp pumps, and would curtail up to 50 acre-feet of irrigation water from surface supplies or groundwater during the shutdown period. The load control program does not appear to be substantial enough to affect the irrigation system by itself and would only benefit eight percent of basin irrigation pumps.

- In April 2016, the OPUC approved PacifiCorp's request to add 25 new Klamath Basin irrigation meters to the TOU program for a total of 120 meters, and the CPUC approved PacifiCorp's request for 25 Klamath Basin irrigation meters in California. The total Klamath TOU pilot program stands at 145 meters. In the future, PacifiCorp plans to establish TOU schedules that would be available to any irrigator, following the conclusion of the pilots and acceptance from the OPUC and CPUC.

- PacifiCorp has not publicly released information on the TOU pilot program, so there is not an understanding of how or where water deliveries are being affected in the Klamath Basin or within the Klamath Project. As discussed in the CAPP IAIR, a large-scale TOU program is capable of disrupting Klamath Project water deliveries. From all appearances, PacifiCorp plans to expand this voluntary program.

Alternative 10: Efficiency

Efficiency improvements provide an excellent opportunity to reduce energy costs if current equipment is not energy efficient. Strategic equipment replacements could be undertaken to assist in maximizing energy savings at private pumps and select Reserve and Transferred (R&T) Works facilities. Field testing found that annual energy consumption could be reduced by 9 to 30 percent at R&T Works facilities and 12 to 30 percent at private pumping facilities through pump upgrades and reoperation (e.g., operating a more efficient pump more frequently than a less efficient pump). Provided below are current assumptions and constraints associated with the efficiency alternative.

- No changes have been made to this alternative since completion of the CAPP IAIR. Incentives by Energy Trust and PacifiCorp to reduce energy and water use remain unchanged. Detailed information on the efficiency and energy consumption for private pumps and R&T Works facilities and incentives is available on Reclamation's website at: http://www.usbr.gov/mp/kbao/special_projects/power.html.

- This alternative had included a funding stream for efficiency improvements by investing in renewables either through power development or outside the Klamath Basin. Third party funding through a financial institution may be possible at the irrigation district level, but more difficult at the individual irrigator level as there are no obvious mechanisms to secure and repay the loan. In the past, California has provided grants to the irrigation community to improve pumping efficiency and reduce the peak loads of irrigation pumps, as was reported in the CAPP Initial Scoping Report available at: http://www.usbr.gov/mp/kbao/special_projects/power.html. Further investigation on the availability of grants and loans in both California and Oregon should be made to support Basin pump efficiency upgrades.

Summary of Future Actions to Advance CAPP Alternatives

This section provides a summary of future actions that Reclamation can take and recommended actions that the irrigation community might take to advance the CAPP Alternatives. Important for both Reclamation and the irrigation community is the need to continually track the policy and technical developments in the power industry. The past three years of the CAPP's development have seen changes in renewable power development regulations and technology that directly affect project economics and the coming years promise to provide additional anticipated and unanticipated changes that will further affect renewable power development economics and viable CAPP alternatives.

Reclamation Actions

In the absence of Federal legislation to advance the CAPP, Reclamation could rely on the Enhancement Act (Public Law 106-498). By using the Enhancement Act, Reclamation would undertake a Federal feasibility study in conjunction with a local non-Federal Project Sponsor(s) to advance and ultimately implement the CAPP preferred alternative. The next steps to advance the CAPP Feasibility Study are defined in D&S CMP 09-02, and are presented below.

- **Identify the Project Sponsor(s).** Reclamation would work with the Klamath Basin irrigation community to identify non-Federal organizations or agencies to act as the Project Sponsor(s) in the On-Project area. The Project Sponsor(s) would help Reclamation define the CAPP's next steps, including the alternatives to be investigated in the feasibility study. Without Federal legislation the Off-Project could not be a party to or benefit from the study.

- **Prepare a Plan of Study**. The Plan of Study defines the study elements of the feasibility study and clearly defines its objectives and scope. The Plan of Study also defines the role of the Project Sponsor and cost sharing, including any in-kind services. The alternatives defined in the IAIR would provide the foundation for the Plan of Study. The Project Sponsor would take a lead role in the development and advancement of new Federal legislation to serve the Off-Project area. Without this, Reclamation's authority is limited to the On-Project area.

- **Prepare the CAPP Feasibility Study.** Reclamation would conduct the CAPP feasibility study in coordination with the Project Sponsor to define the best alternatives for achieving the CAPP objectives, including economic justification for the preferred alternative. To receive Federal funding and environmental clearance for project development, the feasibility study would be performed in conjunction with environmental compliance processes such as those falling under the National Environmental Policy Act, Endangered Species Act, and other laws and regulations. While the

Enhancement Act allows for 100 percent non-reimbursable funding for the feasibility study (under the D&S, feasibility studies normally include some element of cost share with the Local Sponsor), in the absence of Congressional action providing separate funding, project development would be fully reimbursable under the Enhancement Act.

Irrigation Community Actions

In addition to the advancing Federal legislation, Reclamation recommends that the irrigation community undertake the following actions whether or not a decision is made to use the Enhancement Act to advance a Federal feasibility study.

- Engage the OPUC and CPUC on regulations and policies effecting community solar programs in both states. In California, promote legislation that requires PacifiCorp to offer existing community solar programs in its California service territory. Investigate with the OPUC the rule-making process to define the resource value of solar energy (the price per kWh that PacifiCorp would credit to the benefiting accounts) for Oregon's community solar program.

- PacifiCorp is on course to develop a demand management program in the Klamath Basin to satisfy their portfolio goals for this service; the company may also recognize benefits from demand management through the EIM where they now can dispatch energy resources to the California ISO. PacifiCorp has reported that they intend to eventually provide optional TOU metering to all Klamath Basin irrigators with approval from the CPUC and OPUC. Subject to the irrigation community's interest, the TOU and load control programs have the potential to disrupt irrigation water deliveries particularly in the Klamath Project. While the demand management program is in its early stages the irrigation community should investigate the needed policies and programs that would both support PacifiCorp's TOU program and ensure agricultural water deliveries.

- Many of the initial CAPP IAIR alternatives were evaluated with a funding stream provided through a non-reimbursable investment made by DOI with the passage KBRA legislation. Promising renewable alternatives that rely on a PPA with PacifiCorp lose money until Schedule 37 avoided cost rates increase in 2028 (see Figures 4 and 5). Capital financing for renewables may be available to the irrigation community but the estimated rates of return used in this analysis (three percent) may not be sufficient to attract investment. Typical rates of return for pure-play renewable (hydro, wind, and solar) yieldcos with a long-term PPA, as reported in the IAIR, were approximately five percent. Additionally, because of the uncertainty of future energy prices, PacifiCorp's maximum PPA is 20 years; a payback period that makes financing hydro and utility-scale solar very challenging with low Schedule 37 rates over the next 10 years.

- PacifiCorp does not disclose its future business opportunities but their reported economic benefits from the EIM with the California ISO may be enhanced with a large demand management program in the Klamath Basin where electricity can be dispatched into California in real-time. In 2022, they plan to secure 8,000 kW in the load control program at an approximate cost of $200,000 annually. Strategically identifying district-level pumps for load control meters could provide a revenue stream equivalent to or better than most of the CAPP IAIR alternatives with no up-front investment.

- PacifiCorp met its total kW net metering goal in California in 2016 and no longer offers a financial incentive for new net metering. The irrigation community should engage the CPUC to renew net metering incentives similar to those offered by Energy Trust of Oregon.

- Energy Trust (Oregon) and PacifiCorp (California) currently provide cash incentives for energy efficiency. The irrigation community should explore with the OPUC and CPUC an expansion of these programs to include incentives for demand management measures given the resulting environmental benefits realized by peak load reduction.

- The irrigation community should investigate low interest loans and grants for efficiency and demand management through the states of California and Oregon. California has provided funding for these programs to the irrigation community in the past, and California's Bond 1 has earmarked money for water and power use efficiency.

References

California ISO. 2016. EIM Continues to Save Millions While Reducing Carbon Emissions. Market Wired. July 28, 2016. Available at: http://www.marketwired.com/press-release/eim-continues-to-save-millions-while-reducing-carbon-emissions-2146350.htm.

PV Magazine. 2016. US Solar System Prices Fell 17% in 2015, Find GTM. March 16, 2016. Available at: https://www.pv-magazine.com/2016/03/16/us-solar-system-prices-fell-17-in-2015-finds-gtm_100023743/#axzz4T25nG8ny.

Trabish, Herman K. 2015. Utility-Scale Solar Booms as Costs Drop, Challenging Gas On Price. Utility Drive. October 8, 2015. Available at: http://www.utilitydive.com/news/utility-scale-solar-booms-as-costs-drop-challenging-gas-on-price/406692/.

Appendix 1

Identification and Screening of Potential Utility-Scale Solar Photovoltaic Sites in the Klamath Basin

This page left blank intentionally.

Klamath Comprehensive Agricultural Power Plan

Identification and Screening of Potential Utility-Scale Solar Photovoltaic Sites in the Klamath Basin

Prepared by

United States Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
Klamath Basin Area Office

This page left blank intentionally.

Identification and Screening of Potential Utility-Scale Solar Photovoltaic Sites in the Klamath Basin

1. Introduction

Following completion of the Klamath Comprehensive Agricultural Power Plan (CAPP) Initial Alternatives Information Report (IAIR) the Bureau of Reclamation (Reclamation) conducted a preliminary investigation of the upper Klamath Basin area to identify sites with the potential to accommodate utility-scale solar photovoltaic (PV) power generation. Utility-scale solar PV was identified as one of the most promising technologies in the CAPP process to reduce effective power costs for Klamath Basin irrigators. The IAIR identified that up to 15 megawatts (MW) of utility-scale solar PV generation could be developed with an initial investment of $40 million. Solar PV is land intensive, requiring approximately eight acres for every MW of solar capacity. This evaluation considered sites capable of accommodating 5 to 15 MW (40 to over 120 acres). This investigation included an initial desktop investigation of viable sites, followed by a field investigation and initial review of biological resources at the sites exhibiting the greatest promise.

The sites identified in this assessment should not be considered an exhaustive review of potential utility-scale solar PV sites in the Klamath Basin. Rather, they are a sampling of the types of sites which can be identified through the use of screening criteria; the most important of which are proximity to electrical interconnection and land use. Sites too distant from electrical interconnection are more costly to develop and compatible land use, including the willing sale or lease of land, is equally critical to site development. A feasibility-level investigation of utility-scale solar PV sites in the Basin that refines these criteria will identify additional viable sites, and will likely remove some of the sites identified in this analysis.

Additionally, care should be taken in future studies to 1) utilize the very latest geographic information system (GIS) data available; a case in point is the addition of a new Pacific Power substation on Highway 97 south of Joe Wright Road, which may provide additional solar PV site development opportunities and 2) utilize local expertise and site knowledge.

2. Desktop Review of Potential Solar PV Sites

To identify potential solar PV sites in the Klamath Basin, an initial desktop evaluation was completed to identify promising sites. The desktop evaluation used various GIS tools coupled with Google Earth to identify sites in the Klamath Basin for their suitability to accommodate a large solar PV array. As shown in Figure 1, the area around Klamath Falls and the large flat areas to the south of the city were evaluated. The darker areas in the figure are typically hilly

areas covered with vegetation. The light areas and green areas are typically dry grasslands or irrigated farm lands of various quality. A request to PacifiCorp for transmission and substation infrastructure was denied due to security concerns. Available web data on transmission lines and substations was used, but this data may not be the most recent or accurately reflect PacifiCorp's infrastructure. The set of evaluation criteria used in the initial desktop survey to evaluate potential sites included:

- Site access – Is the site easily accessible from public or private roads.
- Topography – Is the site flat or sloped, and if sloped what direction.
- Existing land use – Is the existing land productive farmland, fallowed or undeveloped. Is the land clear of debris and not contaminated, which may preclude PV installation.
- Land use restriction – Is the land protected by local, state, or federal land use restrictions.
- Proximity to transmission lines – Is the site close to existing power lines of appropriate voltage level to convey power.
- Proximity to a substation – Is the site close to an electrical substation for transmission interconnection.
- Parcel Ownership – Who owns the land and is it compatible with solar PV power development.

Figure 1. Desktop Survey General Area

Using the above criteria, an initial screening was conducted to identify general areas or regions for more detailed review. In general, the process to identify the most favorable solar PV sites entailed overlaying one or more criteria on the map and systematically eliminating areas that failed to meet one or more of the criteria. For each of the criteria the following actions were taken:

- Site Access – Roads were identified in Google Earth, and access routes from public and private roads were reviewed. Remote areas with no roads were excluded from further analysis.

- Topography – Contours were added to the maps and a slope evaluation was conducted. Areas with slopes exceeding five percent that were not south facing were generally removed from further consideration.

- Existing Land Use– Productive farmland and land that showed development or disposal of waste and construction debris were removed from consideration. Areas showing surface water were also removed from consideration.

- Land Use Restrictions –Local, state and federal, parks, preservers, wildlife refuges and lands were removed from further consideration.

- Proximity to Transmission Lines– Databases of transmission lines were overlaid on the Google Earth map. Using graphic options within the databases, the transmission line voltages and locations were identified. Transmission lines were identified through S&P Global Platts available at http://www.platts.com/maps-geospatial/electric-power and California Energy Commission maps available at http://www.energy.ca.gov/maps/.

- Proximity to Substations– Similar to the transmission line database, substations in Oregon and California were identified. Areas close to a substation were given higher ratings. Substation locations were identified through S&P Global Platts available at http://www.platts.com/maps-geospatial/electric-power and California Energy Commission maps available at http://www.energy.ca.gov/maps/.

- Parcel Ownership – Parcel ownership was evaluated in conjunction with the Land Use Restrictions. Superior PV solar sites with private parcel ownership were noted.

Several areas were identified that met most of the criteria. Within these areas seven sites showed high promise and were identified for further evaluation through field inspection as discussed in the next section. Two additional sites, Over the Horizon Backscatter Site and the Klamath Tribes Giiwas Mill, were evaluated in the field inspections per stakeholder request.

3. Field Visits of Potential Solar PV Sites

From the initial desktop survey, seven sites were identified for further evaluation through field inspection. In addition to these seven, two other sites were included (Over the Horizon Backscatter, and Klamath Tribes Giiwas Mill) at the suggestion of CAPP stakeholders familiar with the potential at each site. Each of these sites was visited in November 2015. Provided below is a description of each site and its suitability to accommodate solar PV.

3.1 Site PV-1

Site PV-1 is an approximately 40-acre site located adjacent to the Cobb Energy Facility on the west side of the Klamath River. Although the location is excellent with respect to electric lines, based on the site inspection, it is not recommended due to the severity of the uneven terrain, which slopes to the north and east, which is opposite of the preferred slope directions for PV. Figures 2 and 3 provide an aerial and ground-level view, respectively, of the site. Table 1 summarizes the observations made by the inspection group during the site visit.

Figure 2. Site PV-1 - Aerial View

Table 1. Site PV-1 Field Observations

Category	Findings
Coordinates	N 42°11.571', W 121°47.192'. Taken at south end of site.
Access Roads	The site is accessed from Memorial Drive. An abandoned, partially paved road extends into the lot from Memorial Drive.
Neighbors	The Cobb Energy Facility is adjacent to this site. The Klamath Memorial Park, which is a cemetery, is across Memorial Drive. Some residences exist between the cemetery and Green Springs Drive.
Conflicts/ Concerns	▪ Sloped to northeast, with undulating terrain ▪ Potentially native scrub and grass ▪ ▪ Near river – may have flooding concerns ▪ Possibly only 20 usable acres due to drainage issues ▪ Gas pipeline marker
Proximity to Transmission Lines	Very good, transmission lines are adjacent to the site
Proximity to Substations	Very good, a substation is adjacent to the site.
Parcel Ownership	Not evaluated

Figure 3. Site PV-1 - Field Photograph

3.2 Site PV-2

Site PV-2 is an approximately 40-acre site located north of Highway (Hwy) 140, east of the Klamath River. The site has excellent access to transmission lines and a nearby substation. The site inspection identified uneven terrain that if used to support solar PV would require extensive earth work and grading. The site was therefore not recommended for further evaluation. Figures 4 and 5 provide an aerial and ground-level view, respectively, of the site. Table 2 summarizes the observations made by the inspection group during the site visit.

Table 2. Site PV-2 Field Observations

Category	Findings
Coordinates	N 42°11.367', W 121°46.183'. Taken at the corner of Hwy 140 and Tingley Lane
Access Roads	Good access via Hwy 140, Tingley Lane, and Klad Road. After crossing the railroad tracks, a dirt access road is available.
Neighbors	Neighbors surrounding the site include the livestock auction, a waste oil recycler, and a few residences.
Terrain	Sloped/ uneven land – slopes to north and west.
Conflicts/ Concerns	The terrain is rolling and sloped to the north and west. Use of the site would require extensive grading.
Proximity to Transmission lines	230-kV and 69-kV lines pass over the site.
Proximity to Substations	A substation is about 2,000 feet away.
Parcel Ownership	Not evaluated

Figure 4. Site PV-2 - Aerial View

Figure 5. Site PV-2 - Field Photograph

3.3 Site PV-3

Site PV-3 is an approximately 40-acre site bounded by railroad lines to the west and south, the Walmart to the east, the Texum Substation (2175 Laverne Ave) to the south, and the wastewater treatment plant to the north. The site has excellent access to transmission lines and a nearby substation. The majority of the site is recommended for further investigation; however, about one-third of the site contains piles of soil debris and would require earthwork and grading. Figures 6 and 7 provide an aerial and ground-level view, respectively, of the site. Table 3 summarizes the observations made by the inspection group during the site visit.

Figure 6. Site PV-3 - Aerial View

Table 3. Site PV-3 Field Observations

Category	Findings
Coordinates	Substation: N 42°11.34', W 121°45.48' Backside of Walmart: N 42°11.670', W 121°45.690'
Access Roads	The Texum Substation is accessed via Laverne Avenue and that access could be extended. Or the site could be accessed from behind the Walmart parking lot. In either instance, a drainage ditch would need to be crossed.
Neighbors	Major neighbors include a railyard, the Walmart shopping area, and the wastewater treatment plant.
Terrain	Undulating grassland, grasses, low brush
Conflicts/ Concerns	▪ Various debris piles on approximately one-third of the site, near the railway line ▪ Berm protecting site from flooding. Berm evidently developed for

Category	Findings
	wastewater treatment plant protection ▪ Drainage / irrigation culvert around property
Security	No apparent problem areas. Site would be surrounded by fencing.
Proximity to Transmission lines	Very good, adjacent to substation. Substation has 69-kV and 12-kV lines.
Proximity to Substations	Very good, adjacent to Texum Substation. Texum Substation has a large area inside the fence; space appears to be available for additional 69-kV and 12-kV circuit bays.
Parcel Ownership	South Suburban Sanitation District

Figure 7. Site PV-3 - Field Photograph

3.4 Site PV-4

Site PV-4 is an approximately 110-acre site located between the wastewater treatment plant and Reach, Inc., along Maywood Drive. The site has excellent access to transmission lines and a nearby substation and the site is relatively flat, with minimal obstructions. Based on several favorable criteria, this site was retained for further analysis. Figures 8 and 9 provide an aerial and ground-level view, respectively, of the site. Table 4 summarizes the observations made by the inspection group during the site visit.

Figure 8. Site PV-4 - Aerial View

Table 4. Site PV-4 Field Observations

Category	Findings
Coordinates	Reach Inc. entrance gate: N 42°12.378', W 121°45.557' Near the meteorological tower: N 42°12.253', W 121°45.606'
Access Roads	The property has no direct access. However, an old dirt road from Maywood Dr. at Crosby Ave could potentially provide site access.
Neighbors	Reach Inc. is located to the northeast of the site. A chain of small businesses are located on the east side of Maywood Drive. The wastewater treatment plant is to the south of the site. Railroad tracks and the Klamath River are to the west. The site currently has what appears to be an abandoned meteorological tower and shed in the northeastern corner.
Terrain	The terrain is relatively flat and covered with scrub and grass. The far west side appears to get more uneven.
Conflicts/ Concerns	▪ Potential seasonal flooding ▪ Drainage ditch along property line ▪ High potential for Applegate's milkvetch
Proximity to Transmission lines	Very good, Texum Substation is about 1,000 feet to south.
Proximity to Substations	Very good, Texum Substation is about 1,000 feet to the south. As noted above, Texum Substation has a lot of spare area for new circuits.
Parcel Ownership	South Suburban Sanitation District

Figure 9. Site PV-4 - Field Photograph

3.5 Site PV-5

Site PV-5 is an approximately 160-acre site of that appears to be fallowed farmland in Midland, Oregon; five miles south of Klamath Falls. The site does not have access to appropriately sized transmission lines or a substation and was not retained for additional analysis. Figure 10 provides an aerial view of the site. Adjacent land owners asked the inspection group about our intentions while looking at the site from a public road, no photos of this land are available. Table 5 summarizes the observations made by the inspection group during the site visit.

Figure 10. Site PV-5 - Aerial View

Table 5. Site PV-5 Field Observations

Category	Findings
Coordinates	N 42°07.566', W 121°48.079'
Access Roads	The site is adjacent to Old Midland Road.
Neighbors	farmland
Terrain	Very flat and soil appears salt stained. Good exposure to sunlight. .
Conflicts/ Concerns	Land ownership
Proximity to Transmission lines	Proximity is poor. A small distribution line of either 4 or 12-kV runs along the road.
Proximity to Substations	The nearest substation was not located. No substation within 2 miles of the site.
Parcel Ownership	Luther and Candace Horsley

3.6 Site PV-6

Site PV-6 is an approximately 200-acre site of farmland adjacent to Hwy 97 in the Klamath Drainage District. Investigation of this site was unplanned and identified during the site visit. If developed, the site would require either a new connection to the existing 69-kV line that runs adjacent to the site, with a new PV substation tied into the line, or the existing 69-kV line would need to run into and out of a new "loop" substation. Although this site has good interconnection potential, its value as farmland makes this a poor site and not recommended for further analysis. Figures 11 and 12 provide an aerial and ground-level view, respectively,

of the site. Table 6 summarizes the observations made by the inspection group during the site visit.

Figure 11. Site PV-6 - Aerial View

Table 6. Site PV-6 Field Observations

Category	Findings
Coordinates	N 42°04.929, W 121°50.633'
Access Roads	Dirt/gravel access road directly off Hwy 97 going into the property and along the canal
Neighbors	Farmland.
Terrain	Fla fallowed field
Conflicts/ Concerns	▪ Good farmland ▪ ▪ Possibility of flooding
Proximity to Transmission lines	69-kV sub-transmission runs along west side of property. Capacity of 69-kV line would need to be verified.
Proximity to Substations	According to Platts maps, the nearest substation is in Dorris, which is 9 miles to the south. Dorris Substation appears to have transformers of sufficient size to handle the new power generation.
Parcel Ownership	Henzel Properties, LLC.

Figure 12. Site PV-6 - Field Photograph

3.7 Site PV-7

Site PV-7 is an approximately 180-acre site of unfarmed land next to an abandoned PacifiCorp substation on the south side of Picard Road at Loghouse Road, approximately 5 miles west of Dorris. If developed, the site would require either a 69-kV line tap and radial substation or a new loop substation. This site is recommended for further analysis based on the flat terrain and location next to existing power lines. Figures 13 and 14 provide an aerial and ground-level view, respectively, of the site. Table 7 summarizes the observations made by the inspection group during the site visit.

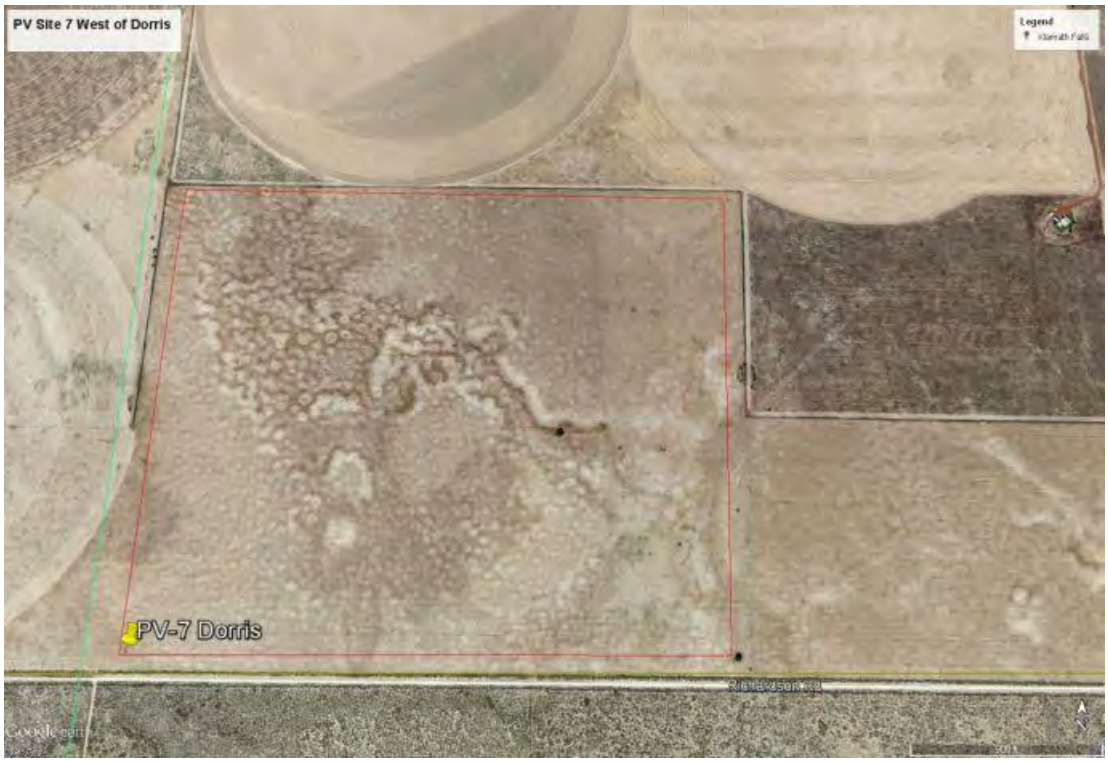


Figure 13. Site PV-7 - Aerial View

Table 7. Site PV-7 Field Observations

Category	Findings
Coordinates	N 41° 57.992', W 121° 59.741'
Access Roads	A dirt road at the intersection of Picard and Loghouse Road (entrance to PBM Farms and Sky Mountain Game-Bird Club) runs along the property.
Neighbors	The two main neighbors are PBM Farms and Sky Mountain Game Bird Club
Terrain	Flat, unfarmed land
Conflicts/ Concerns	▪ Sign on entrance of access road says "Wildlife management area" ▪ Abandoned substation at Picard Road, under existing 69-kV sub-transmission lines ▪ PBM Farms appears to be a wildlife management area ▪ Access to a private hunt club. The site may be used for hunting.
Security	No apparent problem areas. Site would be surrounded by fencing.
Proximity to Transmission lines	Good, 69-kV subtransmission line runs along west side of property. This line connects to a similar 69-kV line along Picard Road.
Proximity to Substations	Former "Picard Substation" is now abandoned, no switchgear or devices present. According to Platts maps, nearest substation is Dorris, 5 miles to east.
Parcel Ownership	George and Alice Silveira.

Figure 14. Site PV-7 - Field Photograph

3.8 Site PV-8 Over The Horizon Backscatter Site

Site PV-8 is approximately 100-acre site located in the Over the Horizon Backscatter (OTHB) site, which is approximately 50 miles south of Klamath Falls. The OTHB site was once used by the military for intelligence gathering and resides on National Forest lands. The site was not accessible and required a high clearance vehicle and 4-wheel drive in November of 2015. While aerial photos (see Figure 15) of the area indicate potentially flat terrain, the remote location could create security and maintenance concerns. Further study of this site is recommended. Table 8 summarizes the observations made by the inspection group during the site visit.

Figure 15.Site PV-8 - Aerial View

Table 8. Site PV-8 Field Observations

Category	Findings
Coordinates	N 41°47'49", W 121° 09'41" (from Google Earth)
Access Roads	Deeply rutted dirt roads.
Neighbors	None
Terrain	Unknown
Conflicts/ Concerns	▪ Remote site will make operation and maintenance more difficult. ▪ Remote transmission line may not need or accept power from new generation.
Proximity to Transmission lines	Not confirmed. 69-kV subtransmission line runs North-South west of the property. Power entering the site not confirmed.
Proximity to Substations	Nearest substation not located. According to Platts maps, the nearest 69-kV to 12-kV substation is Perez Substation, west of site. Near the north access road, there is the Clear Lake Substation. Both of these substations are small, with Clear Lake the larger of the two.
Parcel Ownership	Federal government.

3.9 Site PV-9 Giiwas Mill Site- Klamath Tribes

Site PV-9 Giiwas Mill site is an approximately 128-acre site located at the former Crater Lake Mill, north of Klamath Falls and is owned by the Klamath Tribes. While the site has adequate flat land and the possibility to support a small biomass facility in addition to solar PV, it is not recommended due to the lack of appropriately sized transmission lines or a nearby substation.

Table 9 summarizes the observations made by the inspection group during the site visit. Figure 16 provides a ground-level view of the site, taken by the inspection group.

Table 9. Site PV-9 (Giiwas) Field Observations

Category	Findings
Coordinates	N 42° 55.47', W 121° 49.182' taken at driveway to warehouse,
Access Roads	Access to the site is via a dirt road off of Hwy 97 near mile marker 224. Another small dirt road runs along the train tracks north of the warehouse.
Neighbors	Remote site. No noticeable neighbors.
Terrain	Relatively flat vacant industrial site surrounded by evergreen forest.
Conflicts/ Concerns	▪ Large solar PV array would reduce the available space for planned biomass activities by Klamath Tribes. ▪ Railway line on east side of site is currently in use.
Proximity to Transmission lines	Only a small distribution line runs along the railroad, at either 4 or 12 kV. The previous electrical tap to site is abandoned.
Proximity to Substations	A substation is not located within 2 miles of the site. There is a small abandoned stepdown substation on the site, with no usable features (for previous stepdown of 4 or 12 kV to site power distribution).
Parcel Ownership	Klamath Tribes

Figure 16. Site PV-9 (Giiwas) - Field Photograph

3.10 Summary of Solar PV Site Field Survey

Table 10 provides a summary of each of the visited sites. Sites were either recommended for further evaluation or were rejected due to one or more issues associated with land use or proximity to transmission or interconnection. Although Site PV-8 OTHB site was not visited, it has been retained for further consideration given what is currently know about the site.

Table 10. Klamath Solar PV Site Screening with Assigned Ratings

Site	Acres	Access	Site Conditions and land use	Proximity to 12–69-kV Transmission Lines	Proximity to Substation	Parcel Ownership	Recommended for Further Evaluation?
PV-1	40	Good	Poor	Good	Good	Not Verified	No
PV-2	40	OK	Poor	OK	OK	Not Verified	No
PV-3	40	Limited	Good	Good	Good	Municipal	Yes
PV-4	110	Limited	Good	Good	Good	Municipal	Yes
PV-5	160	Good	Good	Poor	Poor	Private	No
PV-6	200	Good	Poor	OK	Poor	Private	No
PV-7	180	OK	Good	OK	Poor	Private	Yes
PV-8	100	Poor	Good	unknown	unknown	Federal	Yes
PV-9	128	Good	Fair	Poor	Poor	Tribes	No

4. Initial Biological Review

A desktop biological review was conducted for the three sites (Site PV-8 OTHB was not reviewed pending a field visit) that were recommended for further consideration following the site visits. The desktop biological review entailed a search of natural resources databases and biological inventory documents for the site vicinities. Aerial and street-level imagery of the sites was reviewed using Google Earth Pro. The findings of the initial site visits were also considered. The determination of the potential for special status species to occur at each site was based on vegetation communities and habitat present at the site and in the vicinity. The findings for each site are presented below.

4.1 Site PV-3

Site PV-3 is located in Klamath County, Oregon. The site is a parcel of vacant land located near roads and developed areas consisting of light industrial land use. The site is adjacent to several wastewater treatment ponds and surrounded by a drainage ditch that supports cattails and other wetland vegetation. The site is located just east of and across a railway from the Klamath River/Lake Ewauna. It is unclear if fish from the Klamath River can enter the drainage ditch surrounding the site, but the ditch likely does support common amphibians and reptiles. There is evidence of flooding on aerial imagery.

Habitat at Site PV-3 is primarily upland with bunchgrasses and a few scattered shrubs, likely sagebrush, but the site appears to be managed such that vegetation on a large portion of the site is somewhat sparse. Common species of birds, reptiles, and small mammals likely occur at the site.

Special status species identified for the PV-3 site vicinity are presented in Appendix A, Table A-1. Each species' habitat requirements are shown, along with the likelihood of occurrence at the site based on the habitat present.

Most of the special status species listed in Appendix A, Table A-1 are very unlikely to occur at PV-3 given the lack of suitable habitat. Species with some, albeit low, potential to occur include two fish (which could occur in the perimeter drainage waterway around the site if there is access), one amphibian, one reptile, eight birds (many of which would only occur transiently and/or seasonally), nine mammals (seven of which are bats, which may only forage over the site), and four plants. None of these species are federal or state-listed as threatened or endangered.

4.2 Site PV-4

Site PV-4 is also located in Klamath County, Oregon, just north of the wastewater treatment ponds that are north of Site PV-3. The site is a parcel of vacant land located near roads and developed areas consisting of light industrial land use. Habitat conditions are similar to PV-3: sparse grasses and shrubs with evidence of flooding and a perimeter drainage ditch that may support some wetland vegetation. Special status species that have some potential to occur are the same as those identified for Site PV-3 above and in Appendix A, Table A-1.

4.4 Site PV-7

Site PV-7 is located in Siskiyou County, California. The site consists of farmland in a rural setting. The site is located approximately one mile from the southern edge of a large area of open space land supporting juniper and sagebrush-shrub habitat that transitions to forested areas along the Klamath River further west, and the large wetland complexes of the Klamath Basin further north. Area surrounding the site shows center pivot irrigation, and the site itself may have been irrigated in the past but is not today. Consequently, this would allow for more natural, unmanaged habitat of grasses and scattered shrubs to occur at the site.

Special status species identified for the Site PV-7 site vicinity are presented in Appendix A, Table A-3. Species with some potential to occur include three birds. Two of these species are state-listed as threatened.

5. Findings

This study generally concludes that there are viable solar PV sites in the basin that are large enough to accommodate utility-scale solar in close proximity to interconnection with compatible land use. This study identified four potential sites ranging in size from 40 to over 200 acres. The potential for special status species occurrence exists at all sites although most are federal or state species of concern and are not specifically protected under federal or state laws. A feasibility-level investigation of utility-scale solar PV sites that refines the assessment criteria will identify additional viable sites, and will likely remove some of the sites identified in this analysis. The feasibility level analysis should include refined transmission and interconnection and outreach to land owners on land sale or leasing. Once a site(s) have been defined an application for an interconnection study would be made with PacifiCorp which will ultimately identify the cost for this important piece of site development.

Appendix A

Tables of Special Status Species at Recommended PV Sites

This page left blank intentionally.

Appendix A.
Table of Special Status Species at Recommended PV Sites

Table A-11. Special Status Species – Potential to Occur at Sites PV-3 and PV-7, Klamath Falls, Oregon

Species	Status	Habitat Requirements	Likelihood of Occurrence
Invertebrates			
Beller's ground beetle *Agonum belleri*	FSC	Low-lying sphagnum bogs.	Unlikely to occur.
Cascades apatanian caddisfly *Apatania tavala*	FSC	High elevation streams.	Unlikely to occur.
Schuh's homoplectran caddisfly *Homoplectra schuhi*	FSC	Springs and seeps in montane, forested areas.	Unlikely to occur.
Fish			
Klamath largescale sucker *Catostomus snyderi*	**FSC**	**Large streams with good water quality. Occurs in the Klamath River below Klamath Falls but exists mostly above the falls.**	**Potential to occur in suitable habitat adjacent to the site.**
Shortnose sucker *Chasmistes brevirostris*	FE, SE	Deeper water of lakes and spawns in springs or tributary streams upstream from its home lake. Currently occupies only a fraction of its former range and is restricted to a few areas in the Upper Klamath Basin, such as the Upper Klamath Lake, Tule Lake, and Clear Lake drainages.	Unlikely to occur.
Slender sculpin *Cottus tenuis*	FSC	Mud, sand, and gravel near lake shores, and in riffles, runs, and pools of creeks and small to medium rivers. Occurs only in upper Klamath River drainage (upper Klamath Lake and upstream).	Unlikely to occur.
Lost River sucker *Deltistes luxatus*	FE, SE	Deeper water of lakes and spawns in springs or tributary streams upstream of the home lake. Currently restricted to a few areas in the Upper Klamath Basin, such as the drainages of Upper Klamath Lake, Tule Lake, and Clear Lake.	Unlikely to occur.
Pacific lamprey *Entosphenus tridentatus*	FSC, SV	Freshwater habitat similar to salmon: gravel bottomed streams at the upstream end of riffle habitat.	Unlikely to occur.
Klamath Basin redband trout *Oncorhynchus mykiss*	**SV**	**Rivers with riparian cover, higher gradient channels, often in riffles or with substrates dominated by boulders, cobbles, and pocket water.**	**Potential to occur in suitable habitat adjacent to the site.**

Species	Status	Habitat Requirements	Likelihood of Occurrence
Bull trout (Klamath River population) *Salvelinus confluentus*	FT, SC	Clean, cold rivers, inhabiting the entire river system from the mainstem to the highest elevation tributaries. Currently, most bull trout populations are confined to headwater areas of tributaries to the Columbia, Snake, and Klamath Rivers.	Unlikely to occur.
Amphibians			
Oregon slender salamander *Batrachoseps wrighti*	FSC, SV	Can be found in moist Douglas fir and mixed maple, hemlock and red cedar woodlands; dependent on mature and old-growth stands, commonly in large downed logs.	Unlikely to occur.
Western toad ***Anaxyrus boreas***	**SV**	**A variety of terrestrial habitats including prairies, forests, canyon grasslands and ponderosa pine-Oregon Oak habitat. Most common around marshes and small lakes.**	**Potential to occur.**
Coastal tailed frog *Ascaphus truei*	FSC, SV	Can be found in clear, cold swift-moving mountain streams with coarse substrates. Primarily in older forest sites. Lives primarily in the Cascade Mountains.	Unlikely to occur.
Northern leopard frog *Lithobates pipiens*	SC	Permanent ponds, swamps, marshes, and slow-moving streams throughout forest, open, and urban areas. They normally inhabit water bodies with abundant aquatic vegetation.	Unlikely to occur.
Cascades frog *Rana cascadae*	FSC, SV	Habitat includes open wetlands in higher elevations located primarily in the Cascade Mountains.	Unlikely to occur.
Oregon spotted frog *Rana pretiosa*	FT, SC	Almost always found in or near a perennial body of water that includes zones of shallow water and abundant emergent or floating aquatic plants, which the frogs use for basking and escape cover. Prefers fairly large, warm marshes.	Unlikely to occur.
Reptiles			
Northern sagebrush lizard ***Sceloporus graciosus graciosus***	**FSC**	**Sagebrush, woodlands, and other shrublands.**	**Potential to occur.**
Western pond turtle *Actinemys marmorata*	FSC, SC	Ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches, with abundant vegetation, and either rocky or muddy bottoms, in woodland, forest, and grassland.	Unlikely to occur.
Common kingsnake *Lampropeltis getula*	FSC, SV	Most common in thick vegetation along watercourses, but ranges into farmland, chaparral, and deciduous and mixed coniferous woodlands in the Rogue and Umpqua river valleys of southwestern Oregon.	Unlikely to occur.
California mountain kingsnake *Lampropeltis zonata*	FSC, SV	Pine forests, oak woodland, and in chaparral of southwestern Oregon valleys. It is usually found in, under, or near rotting logs in open wooded areas near streams.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Birds*			
Northern goshawk *Accipiter gentilis*	FSC, SV	Mature coniferous forests with dense stands of trees.	Unlikely to occur.
Tricolored blackbird *Agelaius tricolor*	FSC	Found by marshes and in upland or agricultural areas, especially fields farmed for grain and silage.	Unlikely to occur.
Western burrowing owl ***Athene cunicularia hypugaea***	**FSC, SC**	**Open, well-drained grasslands, steppes, deserts, prairies, and agricultural lands, often associated with burrowing mammals.**	**Potential to occur.**
Upland sandpiper ***Bartramia longicauda***	**FSC, SC**	**Grasslands**	**Potential to occur.**
Swainson's hawk ***Buteo swainsoni***	**SV**	**Open country, including bunchgrass prairies east of the Cascades.**	**Potential to occur.**
Greater sage-grouse *Centrocercus urophasianus*	SV	Shrub-steppe and meadow-steppe habitats in areas with low, rolling hills adjacent to valleys in southeastern Oregon.	Unlikely to occur.
Western snowy plover *Charadrius nivosus nivosus*	ST	Summer resident east of the Cascades, breeding on alkaline flats and salt pans.	Unlikely to occur.
Black tern *Chlidonias niger*	FSC	Breeds in marsh wetland complexes of southeast, south central and central Oregon.	Unlikely to occur.
Yellow-billed cuckoo *Coccyzus americanus*	FT, SC	Dense willow and cottonwood stands in river floodplains.	Unlikely to occur.
Olive-sided flycatcher *Contopus cooperi*	FSC, SV	Mixed conifer, montane hardwood conifer, Douglas fir, and redwood forests.	Unlikely to occur.
Yellow rail *Coturnicops noveboracensis*	FSC, SC	Shallow marshes and wet meadows; in winter, drier fresh-water and brackish marshes, as well as dense, deep grass, and rice fields.	Unlikely to occur.
Pileated woodpecker *Dryocopus pileatus*	SV	Mature forests and younger forests with large snags and logs, requiring large diameter snags for nesting and foraging.	Unlikely to occur.
Snowy egret *Egretta thula*	SV	Nest in colonies, typically near marshes, and winter in marshes, grassy ponds, and temporary pools. Forage on beaches, shallow reefs, and wet fields.	Unlikely to occur.
Willow flycatcher *Empidonax traillii adastrus*	FSC, SV	Thicket, shrubby areas often near water.	Unlikely to occur.
Peregrine falcon ***Falco peregrinus***	**SV**	**Breed in open landscapes with cliffs (or skyscrapers) for nest sites. Winter in nearly any open habitat, but with a greater likelihood along barrier islands, mudflats, coastlines, lake edges, and mountain chains.**	**Potential to occur.**

Species	Status	Habitat Requirements	Likelihood of Occurrence
Greater sandhill crane *Grus canadensis tabida*	SV	Breed throughout southeast, south central, northeast and central Oregon in large emergent marsh-meadow wetlands. Winter in wet prairies and grain fields.	Unlikely to occur.
Bald eagle ***Haliaeetus leucocephalus***	**BGEPA, SV**	**Large trees or cliffs near water (reservoirs, rivers, and streams) with abundant prey.**	**Potential to occur.**
Harlequin duck *Histrionicus histrionicus*	FSC	Wetland and open water habitats such as cold, fast moving streams.	Unlikely to occur.
Yellow-breasted chat *Icteria virens*	FSC	Riparian thickets of willow and other brushy tangles near watercourses.	Unlikely to occur.
Loggerhead shrike ***Lanius ludovicianus***	**SV**	**Breed in open habitats east of the Cascades where rare but regular in the winter, especially at low-elevation sites.**	**Potential to occur.**
Acorn woodpecker *Melanerpes formicivorus*	FSC	Forested areas with oak trees.	Unlikely to occur.
Lewis' woodpecker *Melanerpes lewis*	FSC, SC	Pine forest and riparian woodland, preferably old growth.	Unlikely to occur.
Long-billed curlew ***Numenius americanus***	**SV**	**Breeds in open grassland areas east of the Cascades.**	**Potential to occur.**
Mountain quail *Oreortyx pictus*	FSC	Pine-oak woodland, conifer forest, and chaparral.	Unlikely to occur.
Flammulated owl *Otus flammeolus*	SV	Breed on the eastern slope of the Cascades, in the Blue and Wallowa mountains, and in small numbers in the mountains of southwest Oregon.	Unlikely to occur.
American white pelican *Pelecanus erythrorhynchos*	SV	Breed at a few interior sites in Oregon, including Lower Klamath and Upper Klamath National Wildlife Refuges. They forage in shallow water on inland marshes, along lake or river edges, and in wetlands.	Unlikely to occur.
White-headed woodpecker *Picoides albolarvatus*	FSC, SC	Open ponderosa pine or mixed-conifer forests dominated by ponderosa pine.	Unlikely to occur.
Black-backed woodpecker *Picoides arcticus*	SV	Boreal and montane forests.	Unlikely to occur.
American three-toed woodpecker *Picoides dorsalis*	SV	Old growth and mature conifer forests.	Unlikely to occur.
White-faced ibis ***Plegadis chihi***	**FSC**	**Breed in mixed colonies in areas isolated from disturbance and predators with other colonial-nesting waterbirds. Forages in seasonal wetlands along shallow lake shores and in irrigated agricultural fields.**	**Potential to occur.**

Species	Status	Habitat Requirements	Likelihood of Occurrence
Red-necked grebe *Podiceps grisegena*	SC	Shallow bodies of fresh water such as lakes, marshes or fish-ponds.	Unlikely to occur.
Great gray owl *Strix nebulosa*	SV	Forests adjacent to openings above 3,000 feet in the Cascade, Blue, and Wallowa mountains.	Unlikely to occur.
Northern spotted owl *Strix occidentalis caurina*	FT, ST	Forested regions of western Oregon, from the coastal mountains to the eastern foothills of the Cascade Range.	Unlikely to occur.
Columbian sharp-tailed grouse *Tympanuchus phasianellus columbianus*	FSC, SC	Sagebrush-bunchgrass, meadow-steppe, and mountain shrub interspersed with stream bottoms containing deciduous shrubs and trees.	Unlikely to occur.
Mammals			
Pallid bat ***Antrozous pallidus pacificus***	**FSC, SV**	**Deserts, grasslands, shrublands, woodlands, and forests. Most common in open dry habitats with rocky areas, buildings, or trees for roosting.**	**Potential to occur.**
Townsend's big-eared bat *Corynorhinus townsendii*	**FSC, SC**	**Primarily found in rural settings in a wide variety of habitats including oak woodlands and mixed coniferous-deciduous forest. Day roosts highly associated with caves and mines and occasionally buildings.**	**Potential to occur.**
Silver-haired bat *Lasionycteris moctivagans*	FSC, SV	Coniferous or mixed coniferous and deciduous forest types.	Unlikely to occur.
Hoary bat ***Lasiurus cinereus***	**SV**	**A variety of forest types, but also occur in open cover types (e.g., grasslands, deserts, clearcuts, meadows), particularly when foraging and migrating.**	**Potential to occur.**
California myotis ***Myotis californicus***	**SV**	**Occur in various habitats, foraging over meadows/grassland, shrubland, and wooded areas; over water; and around street lights.**	**Potential to occur.**
Western small-footed myotis ***Myotis ciliolabrum***	**FSC**	**Found under rocks on hillsides and open ridges, in cracks and crevices in rocky outcrops and talus slopes, beneath the bark of dead and dying trees, in buildings, and in bridge expansion joints.**	**Potential to occur.**
Western long-eared myotis ***Myotis evotis***	**FSC**	**Coniferous forests but may occur far from trees in shrub-steppe regions of the state. Forages in openings in dense forest, between the trees beneath the canopy in ponderosa pine, and over willow-bordered creeks.**	**Potential to occur.**
Fringed myotis *Myotis thysanodes*	FSC, SV	Roosts in trees, snags, buildings, caves, rocks, cliffs and bridges. Found in the Coast Range from Jackson County to Clatsop County and in the northeastern corner of the state.	Unlikely to occur.
Long-legged myotis *Myotis volans*	FSC, SV	Coniferous forests, roost in tree cavities and beneath exfoliating bark in both living trees and dead snags.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Yuma myotis *Myotis yumanensis*	**FSC**	**Rock crevices, trees, and human structures.**	**Potential to occur.**
Preble's shrew *Sorex preblei*	**FSC**	**Marshes, along streams, dry bunchgrass, and wet, alkaline habitat.**	**Potential to occur.**
Ringtail *Bassariscus astutus*	SV	Semi-arid oak forests, pinyon pine or juniper woodlands, conifer forests, deserts and other dry, rocky habitats.	Unlikely to occur.
Pacific marten (Interior Population) *Martes caurina*	SV	A variety of forest habitats.	Unlikely to occur.
Fisher *Pekania pennanti*	FPT, SC	Continuous-canopy forests at relatively low elevations.	Unlikely to occur.
Pygmy rabbit *Brachylagus idahoensis*	FSC, SV	Tall, dense stands of sagebrush.	Unlikely to occur.
White-tailed jackrabbit *Lepus townsendii*	**SV**	**Mountainous terrain, sagebrush, and native short grass prairie. Barren, grazed, or cultivated lands; grasslands.**	**Potential to occur.**
Canada lynx *Lynx canadensis*	FT	Forests large woody debris, such as downed logs and windfalls, to provide denning sites with security and thermal cover for kittens; snowshoe hare habitat.	Unlikely to occur.
Kit fox *Vulpes macrotis*	ST	Desert scrub, chaparral, and grasslands.	Unlikely to occur.
Gray wolf *Canis lupus*	FE	Habitat generalists; can use temperate forests, mountains, tundra, taiga, and grasslands.	Unlikely to occur.
Wolverine *Gulo gulo*	ST	Suitable wolverine habitat in Oregon is considered to be the high-elevation forests of the Cascade Range, and of the Blue Mountains, Wallowa Mountains, and Ochoco Mountains.	Unlikely to occur.
Grizzly bear *Ursus arctos horribilis*	FT	Wide variety of habitats; mainly restricted to old forests at higher elevations in open habitats.	Unlikely to occur.
Plants			
Estes' artemisia *Artemisia ludoviciana* ssp. *estesii*	FSC	Found only on the Deschutes River of Central Oregon's high desert steppes.	Unlikely to occur.
Green-flowered wild-ginger *Asarum wagneri*	C	Understory of *Abies* forests and open boulder fields in *Tsuga* forests near timberline.	Unlikely to occur.
Applegate's milk-vetch *Astragalus applegatei*	FE, SE	Flat seasonally moist remnants of alkaline floodplain grasslands of the Klamath Basin.	Unlikely to occur. Does occur nearby at the Ewauna Flat Preserve.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Peck's mild-vetch *Astragalus peckii* Piper	ST	Natural openings of sagebrush-juniper woodlands, lodgepole pine forests, and ponderosa pine forests. Occurs east of the Cascades from Cline Buttes south to a few miles south of Chiloquin.	Unlikely to occur.
Mountain grape-fern *Botrychium montanum*	FSC	Dark coniferous forests, usually near swamps and streams.	Unlikely to occur.
Pumice grape-fern *Botrychium pumicola*	ST	Loose volcanic soils in alpine and montane habitats.	Unlikely to occur.
Greene's mariposa-lily *Calochorus greenei*	**FSC, C**	**Grasslands, shrublands and oak woodlands around the Oregon/California border.**	**Potential to occur.**
Oregon daisy *Erigeron oreganus*	FSC, C	Moist, shady basalt cliffs and ledges.	Unlikely to occur.
Prostrate buckwheat *Eriogonum prociduum*	FSC, C	Volcanic soils of the Modoc Plateau.	Unlikely to occur.
Green buckwheat *Eriogonum umbellatum* var. *glaberrimum*	FSC	Known from the Warner Mountains of Lake County, Oregon, and Modoc County, California	Unlikely to occur.
Warner Mountain bedstraw *Galium serpenticum* ssp. *warnerense*	FSC	Known from the Warner Mountains of Lake County, Oregon.	Unlikely to occur.
Boggs Lake hedge-hyssop *Gratiola heterosepala*	FSC, ST	In shallow water or in wet mud at the margins of lakes and vernal pools. Known from extreme southern Lake County, Oregon.	Unlikely to occur.
Bellinger's meadow-foam *Limnanthes floccosa* ssp. *bellingeriana*	FSC, C	Low elevation, vernal ponds or rocky, open meadows and grassy openings in oak-pine/buckbrush chaparral woodlands.	Unlikely to occur.
Suksdorf's lomatium *Lomatium suksdorfii*	FSC, C	Dry open, grassy slopes or in open oak woods. Known to occur in Hood River and Wasco Counties.	Unlikely to occur.
White meconella *Meconella oregana*	FSC, C	Occurs primarily in open grassland, sometimes within a mosaic of forest/grassland. Not known to occur in Klamath County.	Unlikely to occur.
Disappearing monkeyflower *Mimulus evanescens*	FSC, C	Sagebrush-juniper plant associations, among rocky rubble and boulders in vernally moist, heavy gravel; generally restricted to a narrow ecotone on fluctuating banks of intermittent streams or pools, between sagebrush on the upper bank and emergent, wetland species on the lower bank.	Unlikely to occur.
Barrett's penstemon *Penstemon barrettiae*	FSC, C	Basalt cliffs and other rocky ground.	Unlikely to occur.
Blue-leaved penstemon *Penstemon glaucinus*	FSC	Open understory of pine forests, usually lodgepole or white-bark, occasionally ponderosa. Also in open areas dominated by shrub-grasses on exposed slopes, rims and ridges at higher elevations.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Peck's penstemon *Penstemon peckii*	FSC	Dry, sandy loams, usually at lower elevations with ponderosa pine.	Unlikely to occur.
Red-root yampah ***Perideridia erythrorhiza***	**FSC, C**	**Lower elevations in poorly drained, heavy clay soils. Found in moist prairies, pastureland and wood edges.**	**Potential to occur.**
Playa phacelia ***Phacelia inundata***	**FSC**	**Alkali playas and seasonally inundated areas with clay soils.**	**Potential to occur.**
Whitebark pine *Pinus albicaulis*	FC	Within montane forests and on thin, rocky, cold soils at or near timberline.	Unlikely to occur.
Desert allocarya *Plagiobothrys salsus*	FSC	Wet to moist alkaline meadows.	Unlikely to occur.
Oregon semaphore grass *Pleuropogon oregonus*	FSC, ST	Moist to wet meadows, marshlands, and streambanks.	Unlikely to occur.
Profuse-flowered pogogyne ***Pogogyne floribunda***	**FSC**	**Vernal pools and edges of seasonal ponds and intermittent flooded drainages.**	**Potential to occur.**
Dalles Mt. buttercup *Ranunculus triternatus*	FSC	Open ridges, in sagebrush or open oak woodlands at or just east of the transition between the coniferous woodlands and the steppe of eastern Washington and Oregon. Endemic to the Columbian Gorge.	Unlikely to occur.
Short-podded thelypody *Thelypodium brachycarpum*	FSC	Damp meadows and open flats, usually alkaline in nature.	Unlikely to occur.
Howell's thelypody *Thelypodium howellii*	FSC	Moist alkaline meadows.	Unlikely to occur.

Sources: Oregon Biodiversity Information Center, Rare, Threatened and Endangered Species of Oregon, July 2013; U.S. Fish and Wildlife Service Information for Planning and Conservation (IPaC), accessed 12/3/2015.

Key:

FE – Federal Endangered
FT – Federal Threatened
FPT – Federal Proposed Threatened
FC – Federal Candidate
FSC – Federal Species of Concern
C – State Candidate
SC – State Critical
SE – State Endangered
ST – State Threatened
SV – State Vulnerable
* Additional Federal Protections for Birds
MBTA - Migratory Bird Treaty Act (excludes House Sparrows, Rock Pigeons, European Starlings)
BGEPA - Bald and Golden Eagle Protection Act

Table A-12. Special Status Species – Potential to Occur at Site PV-10, Klamath County, Oregon

Species	Status	Habitat Requirements	Likelihood of Occurrence
Invertebrates			
Beller's ground beetle *Agonum belleri*	FSC	Low-lying sphagnum bogs.	Unlikely to occur.
Cascades apatanian caddisfly *Apatania tavala*	FSC	High elevation streams.	Unlikely to occur.
Schuh's homoplectran caddisfly *Homoplectra schuhi*	FSC	Springs and seeps in montane, forested areas.	Unlikely to occur.
Fish			
Klamath largescale sucker *Catostomus snyderi*	**FSC**	**Large streams with good water quality. Occurs in the Klamath River below Klamath Falls but exists mostly above the falls.**	**Potential to occur in suitable habitat adjacent to the site.**
Shortnose sucker *Chasmistes brevirostris*	FE, SE	Deeper water of lakes and spawns in springs or tributary streams upstream from its home lake. Currently occupies only a fraction of its former range and is restricted to a few areas in the Upper Klamath Basin, such as the Upper Klamath Lake, Tule Lake, and Clear Lake drainages.	Unlikely to occur.
Slender sculpin *Cottus tenuis*	FSC	Mud, sand, and gravel near lake shores, and in riffles, runs, and pools of creeks and small to medium rivers. Occurs only in upper Klamath River drainage (upper Klamath Lake and upstream).	Unlikely to occur.
Lost River sucker *Deltistes luxatus*	FE, SE	Deeper water of lakes and spawns in springs or tributary streams upstream of the home lake. Currently restricted to a few areas in the Upper Klamath Basin, such as the drainages of Upper Klamath Lake, Tule Lake, and Clear Lake.	Unlikely to occur.
Pacific lamprey *Entosphenus tridentatus*	FSC, SV	Freshwater habitat similar to salmon: gravel bottomed streams at the upstream end of riffle habitat.	Unlikely to occur.
Klamath Basin redband trout *Oncorhynchus mykiss*	**SV**	**Rivers with riparian cover, higher gradient channels, often in riffles or with substrates dominated by boulders, cobbles, and pocket water.**	**Potential to occur in suitable habitat adjacent to the site.**
Bull trout (Klamath River population) *Salvelinus confluentus*	FT, SC	Clean, cold rivers, inhabiting the entire river system from the mainstem to the highest elevation tributaries. Currently, most bull trout populations are confined to headwater areas of tributaries to the Columbia, Snake, and Klamath Rivers.	Unlikely to occur.
Amphibians			
Oregon slender salamander *Batrachoseps wrighti*	FSC, SV	Can be found in moist Douglas fir and mixed maple, hemlock and red cedar woodlands; dependent on mature and old-growth stands, commonly in large downed logs.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Western toad ***Anaxyrus boreas***	**SV**	**A variety of terrestrial habitats including prairies, forests, canyon grasslands and ponderosa pine-Oregon Oak habitat. Most common around marshes and small lakes.**	**Potential to occur.**
Coastal tailed frog *Ascaphus truei*	FSC, SV	Can be found in clear, cold swift-moving mountain streams with coarse substrates. Primarily in older forest sites. Lives primarily in the Cascade Mountains.	Unlikely to occur.
Northern leopard frog ***Lithobates pipiens***	**SC**	**Permanent ponds, swamps, marshes, and slow-moving streams throughout forest, open, and urban areas. They normally inhabit water bodies with abundant aquatic vegetation.**	**Potential to occur in suitable habitat adjacent to the site.**
Cascades frog *Rana cascadae*	FSC, SV	Habitat includes open wetlands in higher elevations located primarily in the Cascade Mountains.	Unlikely to occur.
Oregon spotted frog *Rana pretiosa*	FT, SC	Almost always found in or near a perennial body of water that includes zones of shallow water and abundant emergent or floating aquatic plants, which the frogs use for basking and escape cover. Prefers fairly large, warm marshes.	Unlikely to occur.
Reptiles			
Northern sagebrush lizard ***Sceloporus graciosus graciosus***	**FSC**	**Sagebrush, woodlands, and other shrublands.**	**Potential to occur.**
Western pond turtle ***Actinemys marmorata***	**FSC, SC**	**Ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches, with abundant vegetation, and either rocky or muddy bottoms, in woodland, forest, and grassland.**	**Potential to occur in suitable habitat adjacent to the site.**
Common kingsnake *Lampropeltis getula*	FSC, SV	Most common in thick vegetation along watercourses, but ranges into farmland, chaparral, and deciduous and mixed coniferous woodlands in the Rogue and Umpqua river valleys of southwestern Oregon.	Unlikely to occur.
California mountain kingsnake *Lampropeltis zonata*	FSC, SV	Pine forests, oak woodland, and in chaparral of southwestern Oregon valleys. It is usually found in, under, or near rotting logs in open wooded areas near streams.	Unlikely to occur.
Birds*			
Northern goshawk *Accipiter gentilis*	FSC, SV	Mature coniferous forests with dense stands of trees.	Unlikely to occur.
Tricolored blackbird ***Agelaius tricolor***	**FSC**	**Found by marshes and in upland or agricultural areas, especially fields farmed for grain and silage.**	**Potential to occur.**
Western burrowing owl ***Athene cunicularia hypugaea***	**FSC, SC**	**Open, well-drained grasslands, steppes, deserts, prairies, and agricultural lands, often associated with burrowing mammals.**	**Potential to occur.**

Species	Status	Habitat Requirements	Likelihood of Occurrence
Upland sandpiper *Bartramia longicauda*	**FSC, SC**	**Grasslands**	**Potential to occur.**
Swainson's hawk *Buteo swainsoni*	**SV**	**Open country, including bunchgrass prairies east of the Cascades.**	**Potential to occur.**
Greater sage-grouse *Centrocercus urophasianus*	SV	Shrub-steppe and meadow-steppe habitats in areas with low, rolling hills adjacent to valleys in southeastern Oregon.	Unlikely to occur.
Western snowy plover *Charadrius nivosus nivosus*	ST	Summer resident east of the Cascades, breeding on alkaline flats and salt pans.	Unlikely to occur.
Black tern *Chlidonias niger*	**FSC**	**Breeds in marsh wetland complexes of southeast, south central and central Oregon.**	**Potential to occur.**
Yellow-billed cuckoo *Coccyzus americanus*	FT, SC	Dense willow and cottonwood stands in river floodplains.	Unlikely to occur.
Olive-sided flycatcher *Contopus cooperi*	FSC, SV	Mixed conifer, montane hardwood conifer, Douglas fir, and redwood forests.	Unlikely to occur.
Yellow rail *Coturnicops noveboracensis*	**FSC, SC**	**Shallow marshes and wet meadows; in winter, drier fresh-water and brackish marshes, as well as dense, deep grass, and rice fields.**	**Potential to occur.**
Pileated woodpecker *Dryocopus pileatus*	SV	Mature forests and younger forests with large snags and logs, requiring large diameter snags for nesting and foraging.	Unlikely to occur.
Snowy egret *Egretta thula*	**SV**	**Nest in colonies, typically near marshes, and winter in marshes, grassy ponds, and temporary pools. Forage on beaches, shallow reefs, and wet fields.**	**Potential to occur.**
Willow flycatcher *Empidonax traillii adastrus*	FSC, SV	Thicket, shrubby areas often near water.	Unlikely to occur.
Peregrine falcon *Falco peregrinus*	**SV**	**Breed in open landscapes with cliffs (or skyscrapers) for nest sites. Winter in nearly any open habitat, but with a greater likelihood along barrier islands, mudflats, coastlines, lake edges, and mountain chains.**	**Potential to occur.**
Greater sandhill crane *Grus canadensis tabida*	**SV**	**Breed throughout southeast, south central, northeast and central Oregon in large emergent marsh-meadow wetlands. Winter in wet prairies and grain fields.**	**Potential to occur.**
Bald eagle *Haliaeetus leucocephalus*	**BGEPA, SV**	**Large trees or cliffs near water (reservoirs, rivers, and streams) with abundant prey.**	**Potential to occur.**
Harlequin duck *Histrionicus histrionicus*	FSC	Wetland and open water habitats such as cold, fast moving streams.	Unlikely to occur.
Yellow-breasted chat *Icteria virens*	FSC	Riparian thickets of willow and other brushy tangles near watercourses.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Loggerhead shrike *Lanius ludovicianus*	**SV**	**Breed in open habitats east of the Cascades where rare but regular in the winter, especially at low-elevation sites.**	**Potential to occur.**
Acorn woodpecker *Melanerpes formicivorus*	FSC	Forested areas with oak trees.	Unlikely to occur.
Lewis' woodpecker *Melanerpes lewis*	FSC, SC	Pine forest and riparian woodland, preferably old growth.	Unlikely to occur.
Long-billed curlew *Numenius americanus*	**SV**	**Breeds in open grassland areas east of the Cascades.**	**Potential to occur.**
Mountain quail *Oreortyx pictus*	FSC	Pine-oak woodland, conifer forest, and chaparral.	Unlikely to occur.
Flammulated owl *Otus flammeolus*	SV	Breed on the eastern slope of the Cascades, in the Blue and Wallowa mountains, and in small numbers in the mountains of southwest Oregon.	Unlikely to occur.
American white pelican *Pelecanus erythrorhynchos*	**SV**	**Breed at a few interior sites in Oregon, including Lower Klamath and Upper Klamath National Wildlife Refuges. They forage in shallow water on inland marshes, along lake or river edges, and in wetlands.**	**Potential to occur.**
White-headed woodpecker *Picoides albolarvatus*	FSC, SC	Open ponderosa pine or mixed-conifer forests dominated by ponderosa pine.	Unlikely to occur.
Black-backed woodpecker *Picoides arcticus*	SV	Boreal and montane forests.	Unlikely to occur.
American three-toed woodpecker *Picoides dorsalis*	SV	Old growth and mature conifer forests.	Unlikely to occur.
White-faced ibis *Plegadis chihi*	**FSC**	**Breed in mixed colonies in areas isolated from disturbance and predators with other colonial-nesting waterbirds. Forages in seasonal wetlands along shallow lake shores and in irrigated agricultural fields.**	**Potential to occur.**
Red-necked grebe *Podiceps grisegena*	**SC**	**Shallow bodies of fresh water such as lakes, marshes or fish-ponds.**	**Potential to occur.**
Great gray owl *Strix nebulosa*	SV	Forests adjacent to openings above 3,000 feet in the Cascade, Blue, and Wallowa mountains.	Unlikely to occur.
Northern spotted owl *Strix occidentalis caurina*	FT, ST	Forested regions of western Oregon, from the coastal mountains to the eastern foothills of the Cascade Range.	Unlikely to occur.
Columbian sharp-tailed grouse *Tympanuchus phasianellus columbianus*	FSC, SC	Sagebrush-bunchgrass, meadow-steppe, and mountain shrub interspersed with stream bottoms containing deciduous shrubs and trees.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Mammals			
Pallid bat ***Antrozous pallidus pacificus***	**FSC, SV**	**Deserts, grasslands, shrublands, woodlands, and forests. Most common in open dry habitats with rocky areas, buildings, or trees for roosting.**	**Potential to occur.**
Townsend's big-eared bat *Corynorhinus townsendii*	**FSC, SC**	**Primarily found in rural settings in a wide variety of habitats including oak woodlands and mixed coniferous-deciduous forest. Day roosts highly associated with caves and mines and occasionally buildings.**	**Potential to occur.**
Silver-haired bat *Lasionycteris moctivagans*	FSC, SV	Coniferous or mixed coniferous and deciduous forest types.	Unlikely to occur.
Hoary bat ***Lasiurus cinereus***	**SV**	**A variety of forest types, but also occur in open cover types (e.g., grasslands, deserts, clearcuts, meadows), particularly when foraging and migrating.**	**Potential to occur.**
California myotis ***Myotis californicus***	**SV**	**Occur in various habitats, foraging over meadows/grassland, shrubland, and wooded areas; over water; and around street lights.**	**Potential to occur.**
Western small-footed myotis ***Myotis ciliolabrum***	**FSC**	**Found under rocks on hillsides and open ridges, in cracks and crevices in rocky outcrops and talus slopes, beneath the bark of dead and dying trees, in buildings, and in bridge expansion joints.**	**Potential to occur.**
Western long-eared myotis ***Myotis evotis***	**FSC**	**Coniferous forests but may occur far from trees in shrub-steppe regions of the state. Forages in openings in dense forest, between the trees beneath the canopy in ponderosa pine, and over willow-bordered creeks.**	**Potential to occur.**
Fringed myotis *Myotis thysanodes*	FSC, SV	Roosts in trees, snags, buildings, caves, rocks, cliffs and bridges. Found in the Coast Range from Jackson County to Clatsop County and in the northeastern corner of the state.	Unlikely to occur.
Long-legged myotis *Myotis volans*	FSC, SV	Coniferous forests, roost in tree cavities and beneath exfoliating bark in both living trees and dead snags.	Unlikely to occur.
Yuma myotis ***Myotis yumanensis***	**FSC**	**Rock crevices, trees, and human structures.**	**Potential to occur.**
Preble's shrew ***Sorex preblei***	**FSC**	**Marshes, along streams, dry bunchgrass, and wet, alkaline habitat.**	**Potential to occur.**
Ringtail *Bassariscus astutus*	SV	Semi-arid oak forests, pinyon pine or juniper woodlands, conifer forests, deserts and other dry, rocky habitats.	Unlikely to occur.
Pacific marten (Interior Population) *Martes caurina*	SV	A variety of forest habitats.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Fisher *Pekania pennanti*	FPT, SC	Continuous-canopy forests at relatively low elevations.	Unlikely to occur.
Pygmy rabbit *Brachylagus idahoensis*	FSC, SV	Tall, dense stands of sagebrush.	Unlikely to occur.
White-tailed jackrabbit ***Lepus townsendii***	**SV**	**Mountainous terrain, sagebrush, and native short grass prairie. Barren, grazed, or cultivated lands; grasslands.**	**Potential to occur.**
Canada lynx *Lynx canadensis*	FT	Forests large woody debris, such as downed logs and windfalls, to provide denning sites with security and thermal cover for kittens; snowshoe hare habitat.	Unlikely to occur.
Kit fox *Vulpes macrotis*	ST	Desert scrub, chaparral, and grasslands.	Unlikely to occur.
Gray wolf *Canis lupus*	FE	Habitat generalists; can use temperate forests, mountains, tundra, taiga, and grasslands.	Unlikely to occur.
Wolverine *Gulo gulo*	ST	Suitable wolverine habitat in Oregon is considered to be the high-elevation forests of the Cascade Range, and of the Blue Mountains, Wallowa Mountains, and Ochoco Mountains.	Unlikely to occur.
Grizzly bear *Ursus arctos horribilis*	FT	Wide variety of habitats; mainly restricted to old forests at higher elevations in open habitats.	Unlikely to occur.
Plants			
Estes' artemisia *Artemisia ludoviciana* ssp. *estesii*	FSC	Found only on the Deschutes River of Central Oregon's high desert steppes.	Unlikely to occur.
Green-flowered wild-ginger *Asarum wagneri*	C	Understory of *Abies* forests and open boulder fields in *Tsuga* forests near timberline.	Unlikely to occur.
Applegate's milk-vetch *Astragalus applegatei*	FE, SE	Flat seasonally moist remnants of alkaline floodplain grasslands of the Klamath Basin.	Unlikely to occur. Does occur at the Ewauna Flat Preserve.
Peck's mild-vetch *Astragalus peckii* Piper	ST	Natural openings of sagebrush-juniper woodlands, lodgepole pine forests, and ponderosa pine forests. Occurs east of the Cascades from Cline Buttes south to a few miles south of Chiloquin.	Unlikely to occur.
Mountain grape-fern *Botrychium montanum*	FSC	Dark coniferous forests, usually near swamps and streams.	Unlikely to occur.
Pumice grape-fern *Botrychium pumicola*	ST	Loose volcanic soils in alpine and montane habitats.	Unlikely to occur.
Greene's mariposa-lily *Calochorus greenei*	FSC, C	Grasslands, shrublands and oak woodlands around the Oregon/California border.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Oregon daisy *Erigeron oreganus*	FSC, C	Moist, shady basalt cliffs and ledges.	Unlikely to occur.
Prostrate buckwheat *Eriogonum prociduum*	FSC, C	Volcanic soils of the Modoc Plateau.	Unlikely to occur.
Green buckwheat *Eriogonum umbellatum* var. *glaberrimum*	FSC	Known from the Warner Mountains of Lake County, Oregon, and Modoc County, California	Unlikely to occur.
Warner Mountain bedstraw *Galium serpenticum* ssp. *warnerense*	FSC	Known from the Warner Mountains of Lake County, Oregon.	Unlikely to occur.
Boggs Lake hedge-hyssop *Gratiola heterosepala*	FSC, ST	In shallow water or in wet mud at the margins of lakes and vernal pools. Known from extreme southern Lake County, Oregon.	Unlikely to occur.
Bellinger's meadow-foam *Limnanthes floccosa* ssp. *bellingeriana*	FSC, C	Low elevation, vernal ponds or rocky, open meadows and grassy openings in oak-pine/buckbrush chaparral woodlands.	Unlikely to occur.
Suksdorf's lomatium *Lomatium suksdorfii*	FSC, C	Dry open, grassy slopes or in open oak woods. Known to occur in Hood River and Wasco Counties.	Unlikely to occur.
White meconella *Meconella oregana*	FSC, C	Occurs primarily in open grassland, sometimes within a mosaic of forest/grassland. Not known to occur in Klamath County.	Unlikely to occur.
Disappearing monkeyflower ***Mimulus evanescens***	**FSC, C**	**Sagebrush-juniper plant associations, among rocky rubble and boulders in vernally moist, heavy gravel; generally restricted to a narrow ecotone on fluctuating banks of intermittent streams or pools, between sagebrush on the upper bank and emergent, wetland species on the lower bank.**	**Potential to occur.**
Barrett's penstemon *Penstemon barrettiae*	FSC, C	Basalt cliffs and other rocky ground.	Unlikely to occur.
Blue-leaved penstemon *Penstemon glaucinus*	FSC	Open understory of pine forests, usually lodgepole or white-bark, occasionally ponderosa. Also in open areas dominated by shrub-grasses on exposed slopes, rims and ridges at higher elevations.	Unlikely to occur.
Peck's penstemon *Penstemon peckii*	FSC	Dry, sandy loams, usually at lower elevations with ponderosa pine.	Unlikely to occur.
Red-root yampah *Perideridia erythrorhiza*	FSC, C	Lower elevations in poorly drained, heavy clay soils. Found in moist prairies, pastureland and wood edges.	Unlikely to occur.
Playa phacelia ***Phacelia inundata***	**FSC**	**Alkali playas and seasonally inundated areas with clay soils.**	**Potential to occur.**
Whitebark pine *Pinus albicaulis*	FC	Within montane forests and on thin, rocky, cold soils at or near timberline.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Desert allocarya ***Plagiobothrys salsus***	**FSC**	**Wet to moist alkaline meadows.**	**Potential to occur.**
Oregon semaphore grass ***Pleuropogon oregonus***	**FSC, ST**	**Moist to wet meadows, marshlands, and streambanks.**	**Potential to occur.**
Profuse-flowered pogogyne ***Pogogyne floribunda***	**FSC**	**Vernal pools and edges of seasonal ponds and intermittent flooded drainages.**	**Potential to occur.**
Dalles Mt. buttercup *Ranunculus triternatus*	FSC	Open ridges, in sagebrush or open oak woodlands at or just east of the transition between the coniferous woodlands and the steppe of eastern Washington and Oregon. Endemic to the Columbian Gorge.	Unlikely to occur.
Short-podded thelypody ***Thelypodium brachycarpum***	**FSC**	**Damp meadows and open flats, usually alkaline in nature.**	**Potential to occur.**
Howell's thelypody ***Thelypodium howellii***	**FSC**	**Moist alkaline meadows.**	**Potential to occur.**

Sources: Oregon Biodiversity Information Center, Rare, Threatened and Endangered Species of Oregon, July 2013; U.S. Fish and Wildlife Service Information for Planning and Conservation (IPaC), accessed 12/3/2015.

Key:

FE – Federal Endangered
FT – Federal Threatened
FPT – Federal Proposed Threatened
FC – Federal Candidate
FSC – Federal Species of Concern
C – State Candidate
SC – State Critical
SE – State Endangered
ST – State Threatened
SV – State Vulnerable
* Additional Federal Protections for Birds
MBTA - Migratory Bird Treaty Act (excludes House Sparrows, Rock Pigeons, European Starlings)
BGEPA - Bald and Golden Eagle Protection Act

Table A-13. Special Status Species – Potential to Occur at Site PV-6, Siskiyou County, California

Species	Status	Habitat Requirements	Likelihood of Occurrence
Invertebrates			
Conservancy fairy shrimp *Branchinecta conservatio*	FE	Vernal pools.	Unlikely to occur.
Vernal pool fairy shrimp *Branchinecta lynchi*	FT	Vernal pools.	Unlikely to occur.
Vernal pool tadpole shrimp *Lepidurus packardi*	FE	Vernal pools.	Unlikely to occur.
Amphibians			
Oregon spotted frog *Rana pretiosa*	FT, SSC	Almost always found in or near a perennial body of water that includes zones of shallow water and abundant emergent or floating aquatic plants, which the frogs use for basking and escape cover. Prefers fairly large, warm marshes.	Unlikely to occur.
Birds*			
Western burrowing owl ***Athene cunicularia hypugaea***	**FSC, SSC**	**Open, well-drained grasslands, steppes, deserts, prairies, and agricultural lands, often associated with burrowing mammals.**	**Potential to occur.**
Swainson's hawk ***Buteo swainsoni***	**ST**	**Open country, including grasslands and agricultural fields. Often nest in riparian habitat, but will also use lone trees in agricultural fields or pastures and roadside trees when available and adjacent to suitable foraging habitat.**	**Potential to occur.**
Yellow-billed cuckoo *Coccyzus americanus*	FT, SE	Dense willow and cottonwood stands in river floodplains.	Unlikely to occur.
Olive-sided flycatcher *Contopus cooperi*	FSC	Mixed conifer, montane hardwood conifer, Douglas fir, and redwood forests.	Unlikely to occur.
Greater sandhill crane ***Grus canadensis tabida***	**ST**	**Winter in wet prairies and grain fields. Prefers grain fields within 4 miles of a shallow body of water used as a communal roost site; irrigated pasture used as loafing sites.**	**Potential to occur.**
Bald eagle *Haliaeetus leucocephalus*	BGEPA, SE	Large trees or cliffs near water (reservoirs, rivers, and streams) with abundant prey.	Unlikely to occur.
Lewis' woodpecker *Melanerpes lewis*	FSC	Pine forest and riparian woodland, preferably old growth.	Unlikely to occur.
White-headed woodpecker *Picoides albolarvatus*	FSC	Open ponderosa pine or mixed-conifer forests dominated by ponderosa pine.	Unlikely to occur.

Species	Status	Habitat Requirements	Likelihood of Occurrence
Bank swallow *Riparia riparia*	ST	Riparian habitat. Requires vertical banks/cliffs with fine-textured/sandy soils near streams, rivers, and lakes to dig nesting hole.	Unlikely to occur.
Northern spotted owl *Strix occidentalis caurina*	FT, SC	Relatively large areas of complex mature and old growth forests. Ranges south from Siskiyou to Marin County in Northwestern California.	Unlikely to occur.
Mammals			
Fisher *Pekania pennanti*	FPT, SC	Continuous-canopy forests at relatively low elevations.	Unlikely to occur.
Gray wolf *Canis lupus*	FE, SE	Habitat generalists; can use temperate forests, mountains, tundra, taiga, and grasslands.	Unlikely to occur.
Plants			
Hoover's spurge *Chamaesyce hooveri*	FT, CNPS List 1B.2	Vernal pools.	Unlikely to occur.
Gentner's fritillary *Fritillaria gentneri*	FE, CNPS List 1B.1	Chaparral, cismontane woodland.	Unlikely to occur.
Slender Orcutt grass *Orcuttia tenuis*	FT, SE, CNPS List 1B.1	Vernal pools.	Unlikely to occur.
Newberry's cinquefoil *Potentilla newberryi*	CNPS List 2B.3	Marshes and swamps, vernal pools.	Unlikely to occur.

Sources: California Natural Diversity Database (CNDDB) search of the Dorris and Sams Neck USGS 7.5-Minute Quadrangles, 12/8/15; U.S. Fish and Wildlife Service Information for Planning and Conservation (IPaC), accessed 12/8/2015; California Native Plant Society (CNPS) Rare and Endangered Plant Inventory, accessed 12/8/15.

Key:

FE – Federal Endangered
FT – Federal Threatened
FPT – Federal Proposed Threatened
FBCC – Federal Bird of Conservation Concern
SC – State Candidate
SE – State Endangered
ST – State Threatened
SSC – State Species of Concern
California Native Plant Society (CNPS):
List 1B.1 – seriously endangered in California
List 1B.2 – fairly endangered in California
List 2B.3 – not very endangered in California
* Additional Federal Protections for Birds
MBTA - Migratory Bird Treaty Act (excludes House Sparrows, Rock Pigeons, European Starlings)
BGEPA - Bald and Golden Eagle Protection Act

Appendix 2

Klamath CAPP Alternatives Economic Analysis

This page left blank intentionally.

Schedule Available Online: Standard Avoided Cost Rates, Avoided Cost Purchases from Eligible Qualifying Facilities

Baseload

	Schedule 37 Avoided Cost Prices (¢/kWh)				Change in Avoided Cost (¢/kWh/year)			
Year	On-Peak Standard	Off-Peak Standard	On-Peak Renewable	Off-Peak Renewable	On-Peak Standard	Off-Peak Standard	On-Peak Renewable	Off-Peak Renewable
2016	2.34	1.99	2.34	1.99	-	-	-	-
2017	2.63	2.17	2.63	2.17	0.29	0.18	0.29	0.18
2018	2.82	2.30	2.82	2.30	0.19	0.13	0.19	0.13
2019	2.94	2.38	2.94	2.38	0.12	0.08	0.12	0.08
2020	3.10	2.51	3.10	2.51	0.16	0.13	0.16	0.13
2021	3.30	2.71	3.30	2.71	0.20	0.20	0.20	0.20
2022	3.60	3.00	3.60	3.00	0.30	0.29	0.30	0.29
2023	4.03	3.37	4.03	3.37	0.43	0.37	0.43	0.37
2024	4.44	3.73	4.44	3.73	0.41	0.36	0.41	0.36
2025	4.66	3.93	4.66	3.93	0.22	0.20	0.22	0.20
2026	4.84	4.09	4.84	4.09	0.18	0.16	0.18	0.16
2027	5.06	4.27	5.06	4.27	0.22	0.18	0.22	0.18
2028	6.28	3.25	10.26	6.60	1.22	-1.02	5.20	2.33
2029	6.44	3.34	10.47	6.74	0.16	0.09	0.21	0.14
2030	6.71	3.55	10.72	6.87	0.27	0.21	0.25	0.13
2031	6.88	3.64	10.94	7.03	0.17	0.09	0.22	0.16
2032	7.04	3.74	11.18	7.20	0.16	0.10	0.24	0.17
2033	7.24	3.86	11.41	7.37	0.20	0.12	0.23	0.17
2034	7.43	3.98	11.65	7.55	0.19	0.12	0.24	0.18
2035	7.62	4.09	11.87	7.76	0.19	0.11	0.22	0.21
				2016-2027:	7.26%	7.19%	7.26%	7.19%
				2028-2035:	2.80%	3.34%	2.10%	2.34%
				average:	5.03%	5.26%	4.68%	4.76%

Inflation Estimates for Baseload:	
Avg. Standard Rate:	5.07%
Avg. Renewable Rate:	4.70%

Average Inflation Estimate:
4.89%


Avoided Cost Prices - Baseload
Avoided Cost Price (¢/kWh)
14
12
10
8
6
4
2
0
2013
2016
2019
2022
2025
2028
2031
2034
2037
Standard On-Peak
Standard Off-Peak
Renewable On-Peak
Renewable Off-Peak

Tracking Solar

	Schedule 37 Avoided Cost Prices (¢/kWh)				Change in Avoided Cost (¢/kWh/year)			
Year	On-Peak Standard	Off-Peak Standard	On-Peak Renewable	Off-Peak Renewable	On-Peak Standard	Off-Peak Standard	On-Peak Renewable	Off-Peak Renewable
2016	2.34	1.99	2.34	1.99	-	-	-	-
2017	2.63	2.17	2.63	2.17	0.29	0.18	0.29	0.18
2018	2.82	2.30	2.82	2.30	0.19	0.13	0.19	0.13
2019	2.94	2.38	2.94	2.38	0.12	0.08	0.12	0.08
2020	3.10	2.51	3.10	2.51	0.16	0.13	0.16	0.13
2021	3.30	2.71	3.30	2.71	0.20	0.20	0.20	0.20
2022	3.60	3.00	3.60	3.00	0.30	0.29	0.30	0.29
2023	4.03	3.37	4.03	3.37	0.43	0.37	0.43	0.37
2024	4.44	3.73	4.44	3.73	0.41	0.36	0.41	0.36
2025	4.66	3.93	4.66	3.93	0.22	0.20	0.22	0.20
2026	4.84	4.09	4.84	4.09	0.18	0.16	0.18	0.16
2027	5.06	4.27	5.06	4.27	0.22	0.18	0.22	0.18
2028	5.79	3.25	8.78	6.6	0.73	-1.02	3.72	2.33
2029	5.93	3.34	8.96	6.74	0.14	0.09	0.18	0.14
2030	6.20	3.55	9.17	6.87	0.27	0.21	0.21	0.13
2031	6.35	3.64	9.36	7.03	0.15	0.09	0.19	0.16
2032	6.51	3.74	9.56	7.2	0.16	0.10	0.20	0.17
2033	6.69	3.86	9.76	7.37	0.18	0.12	0.20	0.17
2034	6.87	3.98	9.97	7.55	0.18	0.12	0.21	0.18
2035	7.05	4.09	10.15	7.76	0.18	0.11	0.18	0.21
				2016-2027:	7.26%	7.19%	7.26%	7.19%
				2028-2035:	2.85%	3.34%	2.09%	2.34%
				average:	5.06%	5.26%	4.68%	4.76%

Inflation Estimates for Solar:	
Avg. Standard Rate:	5.09%
Avg. Renewable Rate:	4.69%


Avoided Cost Prices -Tracking Solar
Avoided Cost Price (¢/kWh)
12
10
8
6
4
2
0
2013
2016
2019
2022
2025
2028
2031
2034
2037
Standard On-Peak
Standard Off-Peak
Renewable On-Peak
Renewable Off-Peak

Analysis with Reimbursable Investment

Alternative 1: Utility-Scale Solar

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 The full loan amount is used for project development.

4 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

5 On-peak hours are from 6AM to 10PM

6 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 1: Utility-Scale Solar

Loan details

Principal - Amount Borrowed ($):	40,000,000.00
Interest Rate:	3.0%
Payback Period (years):	30
Annual Loan Payments ($):	2,040,770.37

Alternative 1: Utility-Scale Solar

Based on Standard Solar Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	25,974
Capacity Factor:	0.3
Project Annual Generation (kWh):	68,259,740
Estimated O&M Costs ($/kW):	27
Project Annual O&M ($):	701,298.70
Annual Loan Payment:	2,040,770.37

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

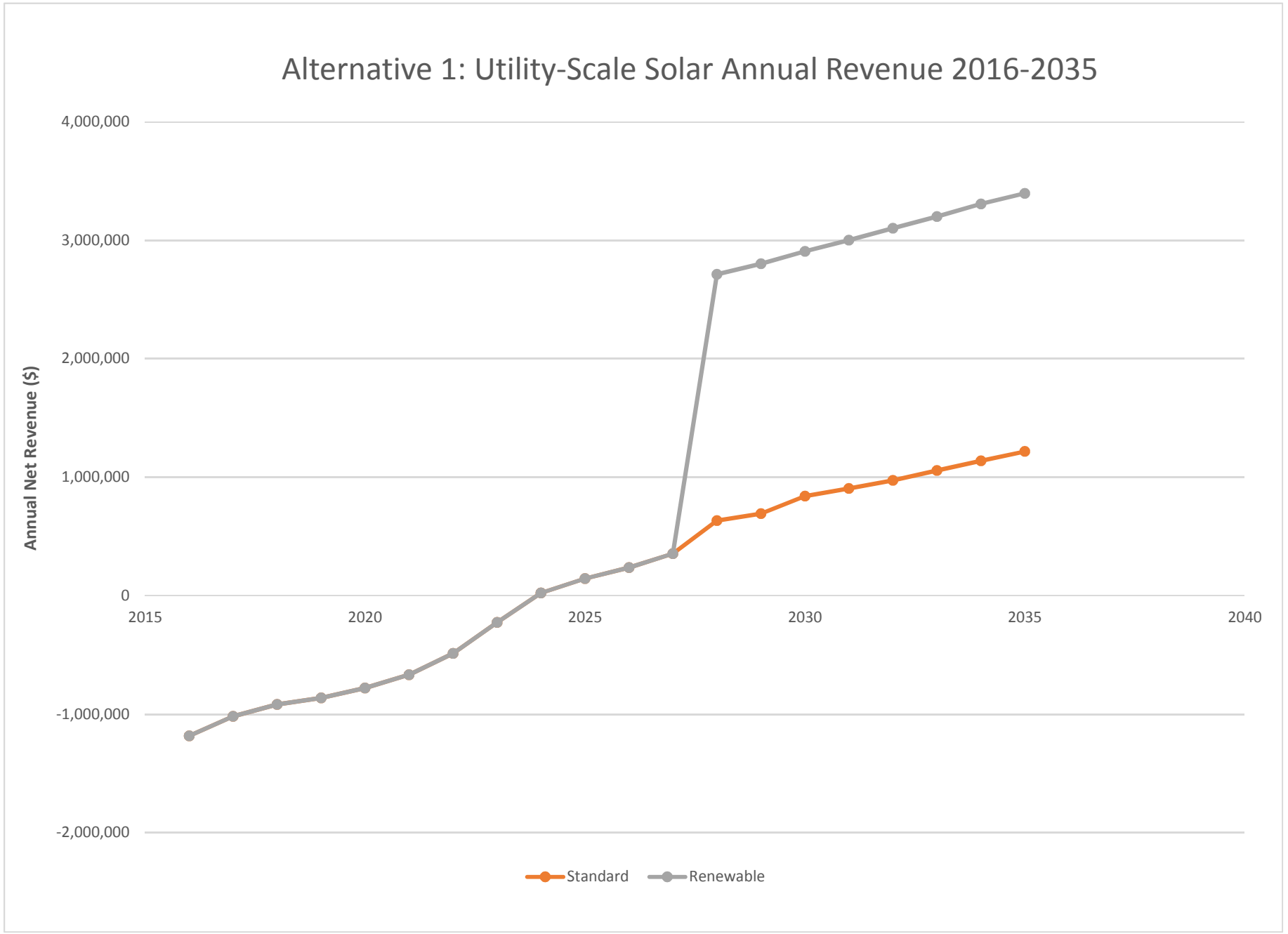
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,559,052	(1,183,017)	10.599	14.403	-10.5	-7.5
2017	2.63	2.17	1,744,992	(1,018,116)	10.747	14.666	-8.7	-6.2
2018	2.82	2.30	1,868,133	(916,646)	10.958	14.994	-7.6	-5.5
2019	2.94	2.38	1,945,676	(861,423)	11.216	15.374	-7.0	-5.0
2020	3.10	2.51	2,051,615	(778,473)	11.460	15.743	-6.1	-4.4
2021	3.30	2.71	2,188,134	(665,634)	11.689	16.101	-5.1	-3.6
2022	3.60	3.00	2,391,821	(486,336)	11.870	16.415	-3.6	-2.6
2023	4.03	3.37	2,678,785	(224,494)	11.992	16.674	-1.6	-1.2
2024	4.44	3.73	2,953,189	24,035	12.136	16.958	0.2	0.1
2025	4.66	3.93	3,101,177	145,370	12.397	17.365	1.0	0.7
2026	4.84	4.09	3,221,860	238,603	12.694	17.811	1.6	1.1
2027	5.06	4.27	3,367,663	356,131	12.981	18.252	2.3	1.6
2028	5.79	3.25	3,674,831	634,177	13.144	18.573	3.9	2.8
2029	5.93	3.34	3,764,934	694,283	13.503	19.096	4.2	3.0
2030	6.20	3.55	3,942,683	841,135	13.802	19.562	4.9	3.5
2031	6.35	3.64	4,038,519	905,148	14.183	20.116	5.1	3.7
2032	6.51	3.74	4,141,182	975,033	14.572	20.684	5.4	3.8
2033	6.69	3.86	4,257,497	1,057,586	14.964	21.259	5.7	4.0
2034	6.87	3.98	4,373,811	1,139,127	15.371	21.855	5.9	4.2
2035	7.05	4.09	4,489,034	1,218,532	15.793	22.472	6.1	4.4
						average	**-0.2**	**-0.1**

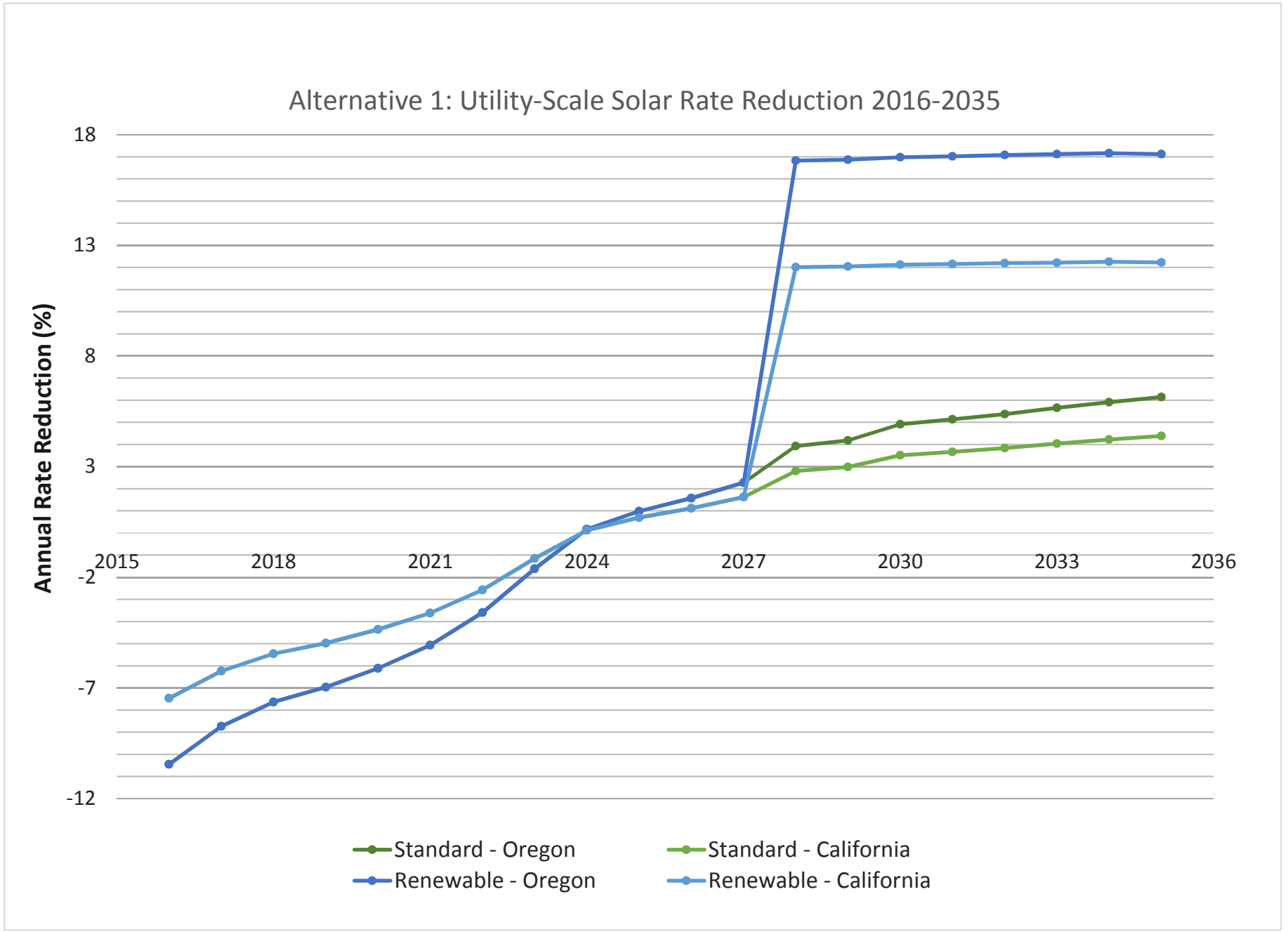
Alternative 1: Utility-Scale Solar

Based on Renewable Solar Fixed Avoided Cost Prices from Schedule 37

		Current Cost Information		Inflation Assumptions:	
Project Size (kW):	25,974	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	68,259,740	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	27	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	701,299	PAC PA-20 rate ($/kWh):	0.13403		
Annual Loan Payment ($):	2,040,770.37				

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,559,052	(1,183,017)	10.599	14.403	-10.5	-7.5
2017	2.63	2.17	1,744,992	(1,018,116)	10.747	14.666	-8.7	-6.2
2018	2.82	2.30	1,868,133	(916,646)	10.958	14.994	-7.6	-5.5
2019	2.94	2.38	1,945,676	(861,423)	11.216	15.374	-7.0	-5.0
2020	3.10	2.51	2,051,615	(778,473)	11.460	15.743	-6.1	-4.4
2021	3.30	2.71	2,188,134	(665,634)	11.689	16.101	-5.1	-3.6
2022	3.60	3.00	2,391,821	(486,336)	11.870	16.415	-3.6	-2.6
2023	4.03	3.37	2,678,785	(224,494)	11.992	16.674	-1.6	-1.2
2024	4.44	3.73	2,953,189	24,035	12.136	16.958	0.2	0.1
2025	4.66	3.93	3,101,177	145,370	12.397	17.365	1.0	0.7
2026	4.84	4.09	3,221,860	238,603	12.694	17.811	1.6	1.1
2027	5.06	4.27	3,367,663	356,131	12.981	18.252	2.3	1.6
2028	8.78	6.60	5,755,115	2,714,461	11.380	16.815	16.8	12.0
2029	8.96	6.74	5,873,614	2,802,963	11.715	17.313	16.9	12.0
2030	9.17	6.87	6,008,222	2,906,675	12.050	17.816	17.0	12.1
2031	9.36	7.03	6,134,639	3,001,268	12.405	18.344	17.0	12.2
2032	9.56	7.20	6,267,882	3,101,733	12.769	18.886	17.1	12.2
2033	9.76	7.37	6,401,125	3,201,215	13.146	19.447	17.1	12.2
2034	9.97	7.55	6,541,194	3,306,510	13.533	20.022	17.2	12.3
2035	10.15	7.76	6,667,338	3,396,836	13.946	20.630	17.1	12.2
						average	**4.5**	**3.2**


Alternative 1: Utility-Scale Solar Annual Revenue 2016-2035
Annual Net Revenue ($)
4,000,000
3,000,000
2,000,000
1,000,000
0
-1,000,000
-2,000,000
2015
2020
2025
2030
2035
2040
Standard
Renewable


Alternative 1: Utility-Scale Solar Rate Reduction 2016-2035
Annual Rate Reduction (%)
18
13
8
3
-2
-7
-12
2015
2018
2021
2024
2027
2030
2033
2036
Standard - Oregon
Standard - California
Renewable - Oregon
Renewable - California

Alternative 2: Low-head Hydropower

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 The full loan amount is used for project development.

3 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

4 On-peak hours are from 6AM to 10PM

5 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 2: Low-head Hydropower

Loan details for hydropower projects

	Keno Dam	West Side	East Side	East Side With A-Canal Water	A- Canal	G-Canal	All Projects
Principal - Amount Borrowed ($):	35,900,000	5,800,000	24,600,000	17,000,000	10,500,000	4,300,000	98,100,000
Interest Rate:	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Payback Period (years):	30	30	30	30	30	30	30
Annual Loan Payments ($):	1,831,591.41	295,911.70	1,255,073.78	867,327.41	535,702.22	219,382.82	5,004,989.34

Alternative 2: Low-Head Hydro at Keno Dam

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	3,790.46
Capacity Factor:	0.825
Project Annual Generation (kWh):	27,393,680.80
Estimated O&M Costs ($/kW):	30
Project Annual O&M ($):	113,713.91
Annual Loan Payment:	1,831,591.41

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	598,826	(1,346,479)	10.738	14.541	-11.9	-8.5	2.34	1.99	598,826	(1,346,479)	10.738	14.541	-11.9	-8.5
2017	2.63	2.17	665,009	(1,283,708)	10.972	14.890	-11.0	-7.9	2.63	2.17	665,009	(1,283,708)	10.972	14.890	-11.0	-7.9
2018	2.82	2.30	709,825	(1,242,405)	11.234	15.270	-10.3	-7.4	2.82	2.30	709,825	(1,242,405)	11.234	15.270	-10.3	-7.4
2019	2.94	2.38	737,876	(1,217,973)	11.519	15.676	-9.8	-7.0	2.94	2.38	737,876	(1,217,973)	11.519	15.676	-9.8	-7.0
2020	3.10	2.51	778,090	(1,181,487)	11.802	16.084	-9.3	-6.6	3.10	2.51	778,090	(1,181,487)	11.802	16.084	-9.3	-6.6
2021	3.30	2.71	832,877	(1,130,540)	12.083	16.494	-8.6	-6.2	3.30	2.71	832,877	(1,130,540)	12.083	16.494	-8.6	-6.2
2022	3.60	3.00	913,853	(1,053,519)	12.351	16.895	-7.8	-5.6	3.60	3.00	913,853	(1,053,519)	12.351	16.895	-7.8	-5.6
2023	4.03	3.37	1,024,414	(947,031)	12.605	17.285	-6.8	-4.9	4.03	3.37	1,024,414	(947,031)	12.605	17.285	-6.8	-4.9
2024	4.44	3.73	1,130,702	(844,939)	12.872	17.693	-5.9	-4.2	4.44	3.73	1,130,702	(844,939)	12.872	17.693	-5.9	-4.2
2025	4.66	3.93	1,188,557	(791,405)	13.192	18.157	-5.4	-3.8	4.66	3.93	1,188,557	(791,405)	13.192	18.157	-5.4	-3.8
2026	4.84	4.09	1,235,455	(748,958)	13.531	18.646	-4.9	-3.5	4.84	4.09	1,235,455	(748,958)	13.531	18.646	-4.9	-3.5
2027	5.06	4.27	1,290,900	(698,098)	13.875	19.143	-4.5	-3.2	5.06	4.27	1,290,900	(698,098)	13.875	19.143	-4.5	-3.2
2028	6.28	3.25	1,355,111	(638,610)	14.223	19.649	-4.0	-2.8	10.26	6.60	2,369,444	375,724	13.363	18.792	2.3	1.7
2029	6.44	3.34	1,390,503	(608,081)	14.608	20.197	-3.7	-2.6	10.47	6.74	2,418,533	419,949	13.736	19.328	2.5	1.8
2030	6.71	3.55	1,457,234	(546,360)	14.978	20.735	-3.2	-2.3	10.72	6.87	2,472,554	468,960	14.117	19.877	2.7	2.0
2031	6.88	3.64	1,494,161	(514,593)	15.387	21.317	-2.9	-2.1	10.94	7.03	2,525,588	516,834	14.512	20.444	2.9	2.1
2032	7.04	3.74	1,530,759	(483,310)	15.809	21.916	-2.7	-1.9	11.18	7.20	2,582,895	568,827	14.916	21.027	3.1	2.2
2033	7.24	3.86	1,575,904	(443,640)	16.237	22.528	-2.4	-1.7	11.41	7.37	2,638,669	619,126	15.336	21.630	3.3	2.4
2034	7.43	3.98	1,619,514	(405,667)	16.681	23.161	-2.1	-1.5	11.65	7.55	2,697,182	672,000	15.767	22.250	3.5	2.5
2035	7.62	4.09	1,661,920	(369,070)	17.140	23.814	-1.9	-1.3	11.87	7.76	2,756,243	725,253	16.212	22.889	3.7	2.6
						average:	**-5.9**	**-4.2**						**average:**	**-3.6**	**-2.6**

Alternative 2: Low-Head Hydro at Westside Powerhouse

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	526.45
Capacity Factor:	0.825
Project Annual Generation (kWh):	3,804,677.93
Estimated O&M Costs ($/kW):	30
Project Annual O&M ($):	15,793.60
Annual Loan Payment:	295,911.70

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	83,170	(228,535)	9.790	13.596	-2.0	-1.4	2.34	1.99	83,170	(228,535)	9.790	13.596	-2.0	-1.4
2017	2.63	2.17	92,362	(219,817)	10.070	13.991	-1.9	-1.3	2.63	2.17	92,362	(219,817)	10.070	13.991	-1.9	-1.3
2018	2.82	2.30	98,587	(214,080)	10.362	14.400	-1.8	-1.3	2.82	2.30	98,587	(214,080)	10.362	14.400	-1.8	-1.3
2019	2.94	2.38	102,483	(210,687)	10.664	14.824	-1.7	-1.2	2.94	2.38	102,483	(210,687)	10.664	14.824	-1.7	-1.2
2020	3.10	2.51	108,068	(205,619)	10.975	15.259	-1.6	-1.2	3.10	2.51	108,068	(205,619)	10.975	15.259	-1.6	-1.2
2021	3.30	2.71	115,677	(198,543)	11.293	15.706	-1.5	-1.1	3.30	2.71	115,677	(198,543)	11.293	15.706	-1.5	-1.1
2022	3.60	3.00	126,924	(187,846)	11.617	16.163	-1.4	-1.0	3.60	3.00	126,924	(187,846)	11.617	16.163	-1.4	-1.0
2023	4.03	3.37	142,280	(173,056)	11.949	16.630	-1.2	-0.9	4.03	3.37	142,280	(173,056)	11.949	16.630	-1.2	-0.9
2024	4.44	3.73	157,042	(158,877)	12.291	17.113	-1.1	-0.8	4.44	3.73	157,042	(158,877)	12.291	17.113	-1.1	-0.8
2025	4.66	3.93	165,077	(151,441)	12.649	17.616	-1.0	-0.7	4.66	3.93	165,077	(151,441)	12.649	17.616	-1.0	-0.7
2026	4.84	4.09	171,591	(145,546)	13.020	18.136	-1.0	-0.7	4.84	4.09	171,591	(145,546)	13.020	18.136	-1.0	-0.7
2027	5.06	4.27	179,292	(138,482)	13.401	18.670	-0.9	-0.6	5.06	4.27	179,292	(138,482)	13.401	18.670	-0.9	-0.6
2028	6.28	3.25	188,210	(130,220)	13.792	19.220	-0.8	-0.6	10.26	6.60	329,089	10,660	13.673	19.100	0.1	0.0
2029	6.44	3.34	193,125	(125,980)	14.199	19.789	-0.8	-0.5	10.47	6.74	335,907	16,802	14.078	19.669	0.1	0.1
2030	6.71	3.55	202,394	(117,407)	14.614	20.373	-0.7	-0.5	10.72	6.87	343,410	23,609	14.495	20.253	0.1	0.1
2031	6.88	3.64	207,522	(112,995)	15.046	20.977	-0.6	-0.5	10.94	7.03	350,776	30,258	14.925	20.856	0.2	0.1
2032	7.04	3.74	212,605	(108,650)	15.491	21.600	-0.6	-0.4	11.18	7.20	358,735	37,480	15.367	21.476	0.2	0.1
2033	7.24	3.86	218,876	(103,141)	15.948	22.240	-0.6	-0.4	11.41	7.37	366,482	44,466	15.823	22.116	0.2	0.2
2034	7.43	3.98	224,933	(97,867)	16.420	22.900	-0.5	-0.4	11.65	7.55	374,609	51,809	16.293	22.774	0.3	0.2
2035	7.62	4.09	230,822	(92,784)	16.905	23.581	-0.5	-0.3	11.87	7.76	382,811	59,206	16.776	23.452	0.3	0.2
						average:	**-1.11**	**-0.79**						**average:**	**-0.78**	**-0.56**

Alternative 2: Low-Head Hydro at Eastside Powerhouse

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	2,227.48
Capacity Factor:	0.765
Project Annual Generation (kWh):	14,927,250.15
Estimated O&M Costs ($/kW):	30
Project Annual O&M ($):	66,824.47
Annual Loan Payment:	1,255,073.78

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	326,310	(995,589)	10.440	14.245	-8.8	-6.3	2.34	1.99	326,310	(995,589)	10.440	14.245	-8.8	-6.3
2017	2.63	2.17	362,374	(961,529)	10.699	14.618	-8.2	-5.9	2.63	2.17	362,374	(961,529)	10.699	14.618	-8.2	-5.9
2018	2.82	2.30	386,795	(939,173)	10.977	15.013	-7.8	-5.6	2.82	2.30	386,795	(939,173)	10.977	15.013	-7.8	-5.6
2019	2.94	2.38	402,080	(926,014)	11.271	15.429	-7.5	-5.3	2.94	2.38	402,080	(926,014)	11.271	15.429	-7.5	-5.3
2020	3.10	2.51	423,994	(906,292)	11.569	15.851	-7.1	-5.1	3.10	2.51	423,994	(906,292)	11.569	15.851	-7.1	-5.1
2021	3.30	2.71	453,848	(878,694)	11.869	16.281	-6.7	-4.8	3.30	2.71	453,848	(878,694)	11.869	16.281	-6.7	-4.8
2022	3.60	3.00	497,973	(836,893)	12.168	16.711	-6.2	-4.4	3.60	3.00	497,973	(836,893)	12.168	16.711	-6.2	-4.4
2023	4.03	3.37	558,219	(779,040)	12.462	17.143	-5.6	-4.0	4.03	3.37	558,219	(779,040)	12.462	17.143	-5.6	-4.0
2024	4.44	3.73	616,137	(723,588)	12.769	17.590	-5.0	-3.6	4.44	3.73	616,137	(723,588)	12.769	17.590	-5.0	-3.6
2025	4.66	3.93	647,664	(694,601)	13.110	18.075	-4.7	-3.4	4.66	3.93	647,664	(694,601)	13.110	18.075	-4.7	-3.4
2026	4.84	4.09	673,219	(671,661)	13.466	18.580	-4.4	-3.2	4.84	4.09	673,219	(671,661)	13.466	18.580	-4.4	-3.2
2027	5.06	4.27	703,432	(644,143)	13.829	19.097	-4.1	-2.9	5.06	4.27	703,432	(644,143)	13.829	19.097	-4.1	-2.9
2028	6.28	3.25	738,421	(611,928)	14.200	19.627	-3.8	-2.7	10.26	6.60	1,291,147	(59,202)	13.732	19.160	-0.4	-0.3
2029	6.44	3.34	757,707	(595,501)	14.597	20.186	-3.6	-2.6	10.47	6.74	1,317,897	(35,311)	14.122	19.713	-0.2	-0.2
2030	6.71	3.55	794,070	(562,082)	14.991	20.748	-3.3	-2.3	10.72	6.87	1,347,334	(8,818)	14.522	20.281	-0.1	0.0
2031	6.88	3.64	814,192	(544,992)	15.412	21.342	-3.1	-2.2	10.94	7.03	1,376,233	17,049	14.936	20.867	0.1	0.1
2032	7.04	3.74	834,135	(528,173)	15.847	21.954	-2.9	-2.1	11.18	7.20	1,407,461	45,153	15.360	21.470	0.2	0.2
2033	7.24	3.86	858,735	(506,790)	16.290	22.582	-2.7	-1.9	11.41	7.37	1,437,852	72,328	15.799	22.092	0.4	0.3
2034	7.43	3.98	882,499	(486,339)	16.749	23.229	-2.5	-1.8	11.65	7.55	1,469,737	100,899	16.251	22.732	0.5	0.4
2035	7.62	4.09	905,606	(466,644)	17.222	23.897	-2.4	-1.7	11.87	7.76	1,501,920	129,669	16.717	23.393	0.7	0.5
						average:	**-5.02**	**-3.59**						**average:**	**-3.75**	**-2.68**

Alternative 2: Low-Head Hydro at Eastside Powerhouse with A Canal Water

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	2,194.48
Capacity Factor:	0.6
Project Annual Generation (kWh):	11,534,181.41
Estimated O&M Costs ($/kW):	30
Project Annual O&M ($):	65,834.37
Annual Loan Payment:	867,327.41

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	252,137	(681,025)	10.173	13.979	-6.0	-4.3	2.34	1.99	252,137	(681,025)	10.173	13.979	-6.0	-4.3
2017	2.63	2.17	280,004	(655,133)	10.439	14.359	-5.6	-4.0	2.63	2.17	280,004	(655,133)	10.439	14.359	-5.6	-4.0
2018	2.82	2.30	298,874	(638,297)	10.722	14.759	-5.3	-3.8	2.82	2.30	298,874	(638,297)	10.722	14.759	-5.3	-3.8
2019	2.94	2.38	310,685	(628,582)	11.019	15.177	-5.1	-3.6	2.94	2.38	310,685	(628,582)	11.019	15.177	-5.1	-3.6
2020	3.10	2.51	327,617	(613,808)	11.321	15.604	-4.8	-3.4	3.10	2.51	327,617	(613,808)	11.321	15.604	-4.8	-3.4
2021	3.30	2.71	350,685	(592,962)	11.627	16.039	-4.5	-3.2	3.30	2.71	350,685	(592,962)	11.627	16.039	-4.5	-3.2
2022	3.60	3.00	384,780	(561,157)	11.934	16.478	-4.2	-3.0	3.60	3.00	384,780	(561,157)	11.934	16.478	-4.2	-3.0
2023	4.03	3.37	431,332	(516,963)	12.240	16.921	-3.7	-2.7	4.03	3.37	431,332	(516,963)	12.240	16.921	-3.7	-2.7
2024	4.44	3.73	476,085	(474,640)	12.558	17.380	-3.3	-2.4	4.44	3.73	476,085	(474,640)	12.558	17.380	-3.3	-2.4
2025	4.66	3.93	500,445	(452,781)	12.905	17.871	-3.1	-2.2	4.66	3.93	500,445	(452,781)	12.905	17.871	-3.1	-2.2
2026	4.84	4.09	520,192	(435,612)	13.266	18.381	-2.9	-2.0	4.84	4.09	520,192	(435,612)	13.266	18.381	-2.9	-2.0
2027	5.06	4.27	543,537	(414,921)	13.635	18.904	-2.6	-1.9	5.06	4.27	543,537	(414,921)	13.635	18.904	-2.6	-1.9
2028	6.28	3.25	570,573	(390,619)	14.013	19.440	-2.4	-1.7	10.26	6.60	997,661	36,469	13.651	19.079	0.2	0.2
2029	6.44	3.34	585,475	(378,532)	14.413	20.003	-2.3	-1.6	10.47	6.74	1,018,330	54,322	14.046	19.637	0.3	0.2
2030	6.71	3.55	613,572	(353,335)	14.814	20.572	-2.1	-1.5	10.72	6.87	1,041,075	74,167	14.452	20.211	0.4	0.3
2031	6.88	3.64	629,120	(340,775)	15.239	21.170	-1.9	-1.4	10.94	7.03	1,063,405	93,510	14.871	20.802	0.5	0.4
2032	7.04	3.74	644,530	(328,442)	15.677	21.786	-1.8	-1.3	11.18	7.20	1,087,535	114,563	15.302	21.411	0.6	0.5
2033	7.24	3.86	663,538	(312,603)	16.126	22.417	-1.7	-1.2	11.41	7.37	1,111,018	134,877	15.746	22.039	0.7	0.5
2034	7.43	3.98	681,901	(297,505)	16.589	23.069	-1.5	-1.1	11.65	7.55	1,135,656	156,249	16.204	22.686	0.8	0.6
2035	7.62	4.09	699,756	(283,013)	17.067	23.742	-1.4	-1.0	11.87	7.76	1,160,523	177,755	16.676	23.352	0.9	0.6
						average:	**-3.31**	**-2.37**						**average:**	**-2.33**	**-1.66**

Alternative 2: Low-Head Hydro at A Canal

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	926.56
Capacity Factor:	0.6
Project Annual Generation (kWh):	4,869,987.69
Estimated O&M Costs ($/kW):	30
Project Annual O&M ($):	27,796.73
Annual Loan Payment:	535,702.22

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	106,458	(457,041)	9.984	13.789	-4.0	-2.9	2.34	1.99	106,458	(457,041)	9.984	13.789	-4.0	-2.9
2017	2.63	2.17	118,224	(446,109)	10.262	14.182	-3.8	-2.7	2.63	2.17	118,224	(446,109)	10.262	14.182	-3.8	-2.7
2018	2.82	2.30	126,191	(439,001)	10.553	14.590	-3.7	-2.6	2.82	2.30	126,191	(439,001)	10.553	14.590	-3.7	-2.6
2019	2.94	2.38	131,178	(434,898)	10.855	15.014	-3.5	-2.5	2.94	2.38	131,178	(434,898)	10.855	15.014	-3.5	-2.5
2020	3.10	2.51	138,327	(428,661)	11.164	15.448	-3.4	-2.4	3.10	2.51	138,327	(428,661)	11.164	15.448	-3.4	-2.4
2021	3.30	2.71	148,067	(419,859)	11.480	15.893	-3.2	-2.3	3.30	2.71	148,067	(419,859)	11.480	15.893	-3.2	-2.3
2022	3.60	3.00	162,463	(406,430)	11.803	16.348	-3.0	-2.1	3.60	3.00	162,463	(406,430)	11.803	16.348	-3.0	-2.1
2023	4.03	3.37	182,118	(387,771)	12.131	16.812	-2.8	-2.0	4.03	3.37	182,118	(387,771)	12.131	16.812	-2.8	-2.0
2024	4.44	3.73	201,014	(369,901)	12.470	17.291	-2.6	-1.8	4.44	3.73	201,014	(369,901)	12.470	17.291	-2.6	-1.8
2025	4.66	3.93	211,299	(360,672)	12.826	17.793	-2.4	-1.7	4.66	3.93	211,299	(360,672)	12.826	17.793	-2.4	-1.7
2026	4.84	4.09	219,636	(353,422)	13.196	18.311	-2.3	-1.7	4.84	4.09	219,636	(353,422)	13.196	18.311	-2.3	-1.7
2027	5.06	4.27	229,493	(344,686)	13.575	18.844	-2.2	-1.6	5.06	4.27	229,493	(344,686)	13.575	18.844	-2.2	-1.6
2028	6.28	3.25	240,909	(334,425)	13.965	19.392	-2.1	-1.5	10.26	6.60	421,234	(154,099)	13.812	19.240	-1.0	-0.7
2029	6.44	3.34	247,201	(329,322)	14.371	19.961	-2.0	-1.4	10.47	6.74	429,961	(146,561)	14.216	19.807	-0.9	-0.6
2030	6.71	3.55	259,064	(318,683)	14.785	20.543	-1.9	-1.3	10.72	6.87	439,565	(138,182)	14.632	20.390	-0.8	-0.6
2031	6.88	3.64	265,629	(313,380)	15.216	21.146	-1.8	-1.3	10.94	7.03	448,993	(130,015)	15.060	20.991	-0.7	-0.5
2032	7.04	3.74	272,135	(308,173)	15.660	21.768	-1.7	-1.2	11.18	7.20	459,181	(121,126)	15.501	21.610	-0.7	-0.5
2033	7.24	3.86	280,161	(301,485)	16.116	22.408	-1.6	-1.2	11.41	7.37	469,097	(112,549)	15.956	22.248	-0.6	-0.4
2034	7.43	3.98	287,914	(295,111)	16.587	23.067	-1.5	-1.1	11.65	7.55	479,499	(103,525)	16.424	22.905	-0.5	-0.4
2035	7.62	4.09	295,452	(288,992)	17.072	23.747	-1.5	-1.0	11.87	7.76	489,999	(94,445)	16.907	23.582	-0.5	-0.3
						average:	**-2.55**	**-1.82**						**average:**	**-2.13**	**-1.52**

Alternative 2: Low-Head Hydro at G Canal

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	261.12	**Current Cost Information**		**Inflation Assumptions:**	
Capacity Factor:	0.6	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	1372451.082	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	30	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	7,833.62	PAC PA-20 rate ($/kWh):	0.13403		
Annual Loan Payment:	219,382.82				

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	30,002	(197,215)	9.763	13.570	-1.7	-1.2	2.34	1.99	30,002	(197,215)	9.763	13.570	-1.7	-1.2
2017	2.63	2.17	33,318	(194,134)	10.048	13.969	-1.7	-1.2	2.63	2.17	33,318	(194,134)	10.048	13.969	-1.7	-1.2
2018	2.82	2.30	35,563	(192,131)	10.343	14.382	-1.6	-1.1	2.82	2.30	35,563	(192,131)	10.343	14.382	-1.6	-1.1
2019	2.94	2.38	36,968	(190,974)	10.648	14.807	-1.5	-1.1	2.94	2.38	36,968	(190,974)	10.648	14.807	-1.5	-1.1
2020	3.10	2.51	38,983	(189,217)	10.961	15.245	-1.5	-1.1	3.10	2.51	38,983	(189,217)	10.961	15.245	-1.5	-1.1
2021	3.30	2.71	41,728	(186,736)	11.283	15.696	-1.4	-1.0	3.30	2.71	41,728	(186,736)	11.283	15.696	-1.4	-1.0
2022	3.60	3.00	45,785	(182,952)	11.613	16.159	-1.4	-1.0	3.60	3.00	45,785	(182,952)	11.613	16.159	-1.4	-1.0
2023	4.03	3.37	51,324	(177,693)	11.953	16.634	-1.3	-0.9	4.03	3.37	51,324	(177,693)	11.953	16.634	-1.3	-0.9
2024	4.44	3.73	56,649	(172,657)	12.302	17.124	-1.2	-0.9	4.44	3.73	56,649	(172,657)	12.302	17.124	-1.2	-0.9
2025	4.66	3.93	59,548	(170,056)	12.665	17.632	-1.2	-0.8	4.66	3.93	59,548	(170,056)	12.665	17.632	-1.2	-0.8
2026	4.84	4.09	61,898	(168,013)	13.039	18.155	-1.1	-0.8	4.84	4.09	61,898	(168,013)	13.039	18.155	-1.1	-0.8
2027	5.06	4.27	64,675	(165,551)	13.423	18.693	-1.1	-0.8	5.06	4.27	64,675	(165,551)	13.423	18.693	-1.1	-0.8
2028	6.28	3.25	67,892	(162,659)	13.820	19.247	-1.0	-0.7	10.26	6.60	118,712	(111,840)	13.776	19.204	-0.7	-0.5
2029	6.44	3.34	69,666	(161,221)	14.229	19.819	-1.0	-0.7	10.47	6.74	121,171	(109,716)	14.185	19.776	-0.7	-0.5
2030	6.71	3.55	73,009	(158,223)	14.649	20.407	-0.9	-0.7	10.72	6.87	123,877	(107,354)	14.606	20.364	-0.6	-0.4
2031	6.88	3.64	74,859	(156,728)	15.083	21.014	-0.9	-0.6	10.94	7.03	126,535	(105,053)	15.039	20.970	-0.6	-0.4
2032	7.04	3.74	76,693	(155,261)	15.530	21.639	-0.9	-0.6	11.18	7.20	129,406	(102,548)	15.486	21.595	-0.6	-0.4
2033	7.24	3.86	78,954	(153,376)	15.991	22.283	-0.8	-0.6	11.41	7.37	132,200	(100,131)	15.946	22.238	-0.5	-0.4
2034	7.43	3.98	81,139	(151,580)	16.465	22.946	-0.8	-0.6	11.65	7.55	135,132	(97,588)	16.419	22.900	-0.5	-0.4
2035	7.62	4.09	83,264	(149,855)	16.954	23.629	-0.8	-0.5	11.87	7.76	138,091	(95,029)	16.907	23.583	-0.5	-0.3
						average:	**-1.18**	**-0.84**						**average:**	**-1.06**	**-0.76**

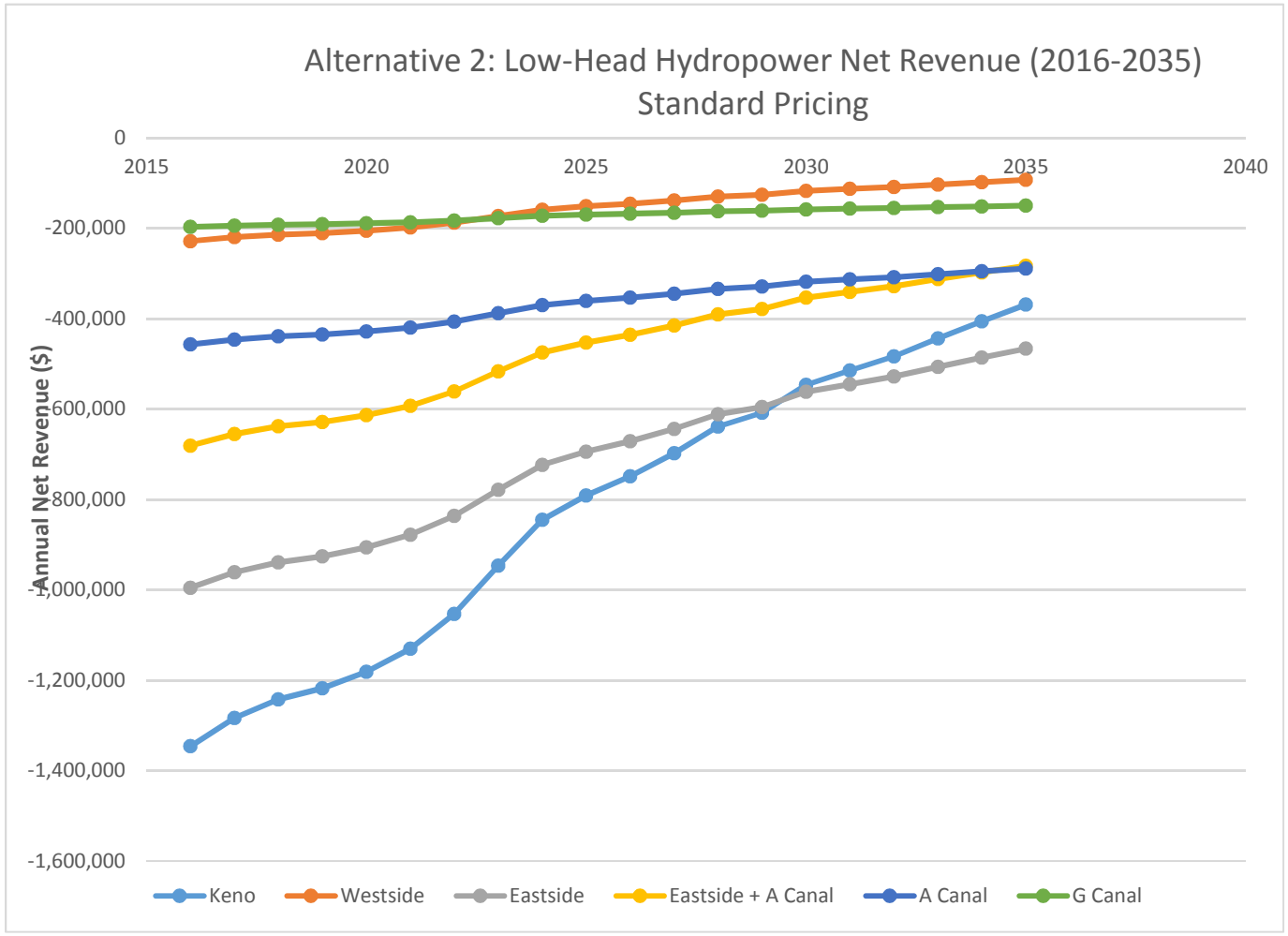
Alternative 2: Low-Head Hydro Developed at All Proposed Locations

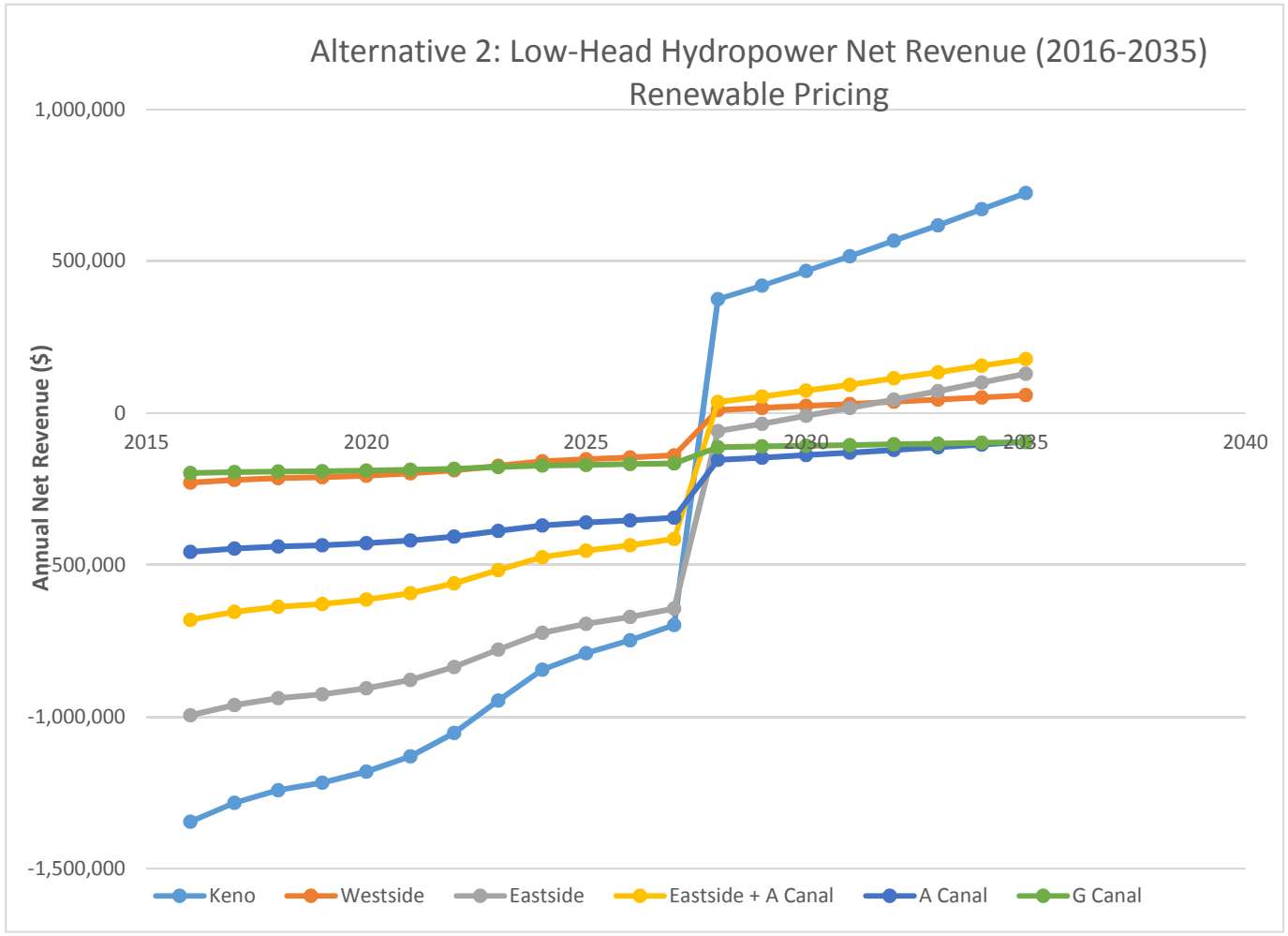
Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

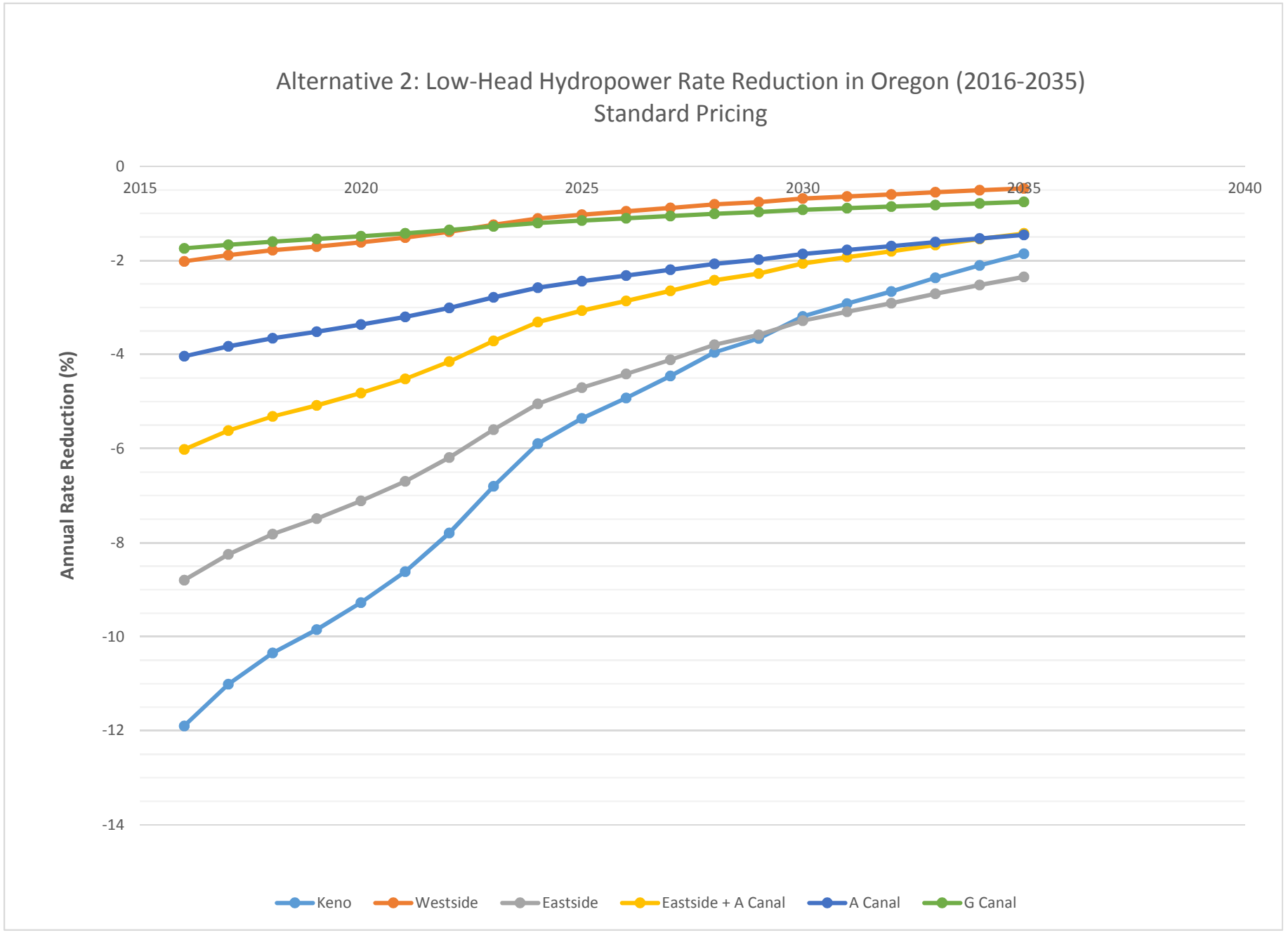
Includes Eastside Powerhouse with A-Canal Water.

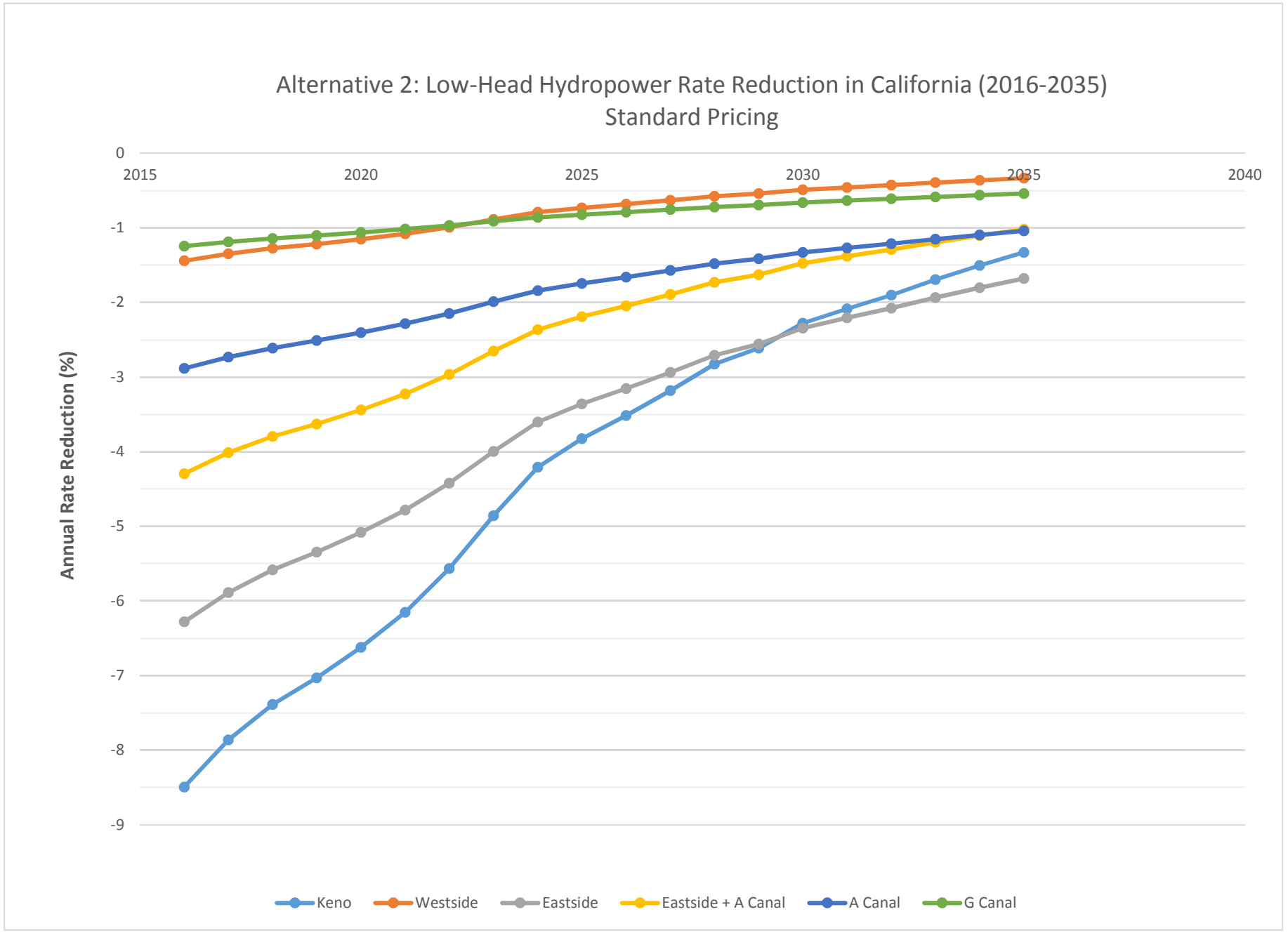
Total Project Size (kW):	7,699.07	**Current Cost Information**		**Inflation Assumptions:**	
Capacity Factor:	varies	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Total Annual Generation (kWh):	48974978.91	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	30	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	230,972.24	PAC PA-20 rate ($/kWh):	0.13403		
Annual Loan Payment:	5,004,989.34				

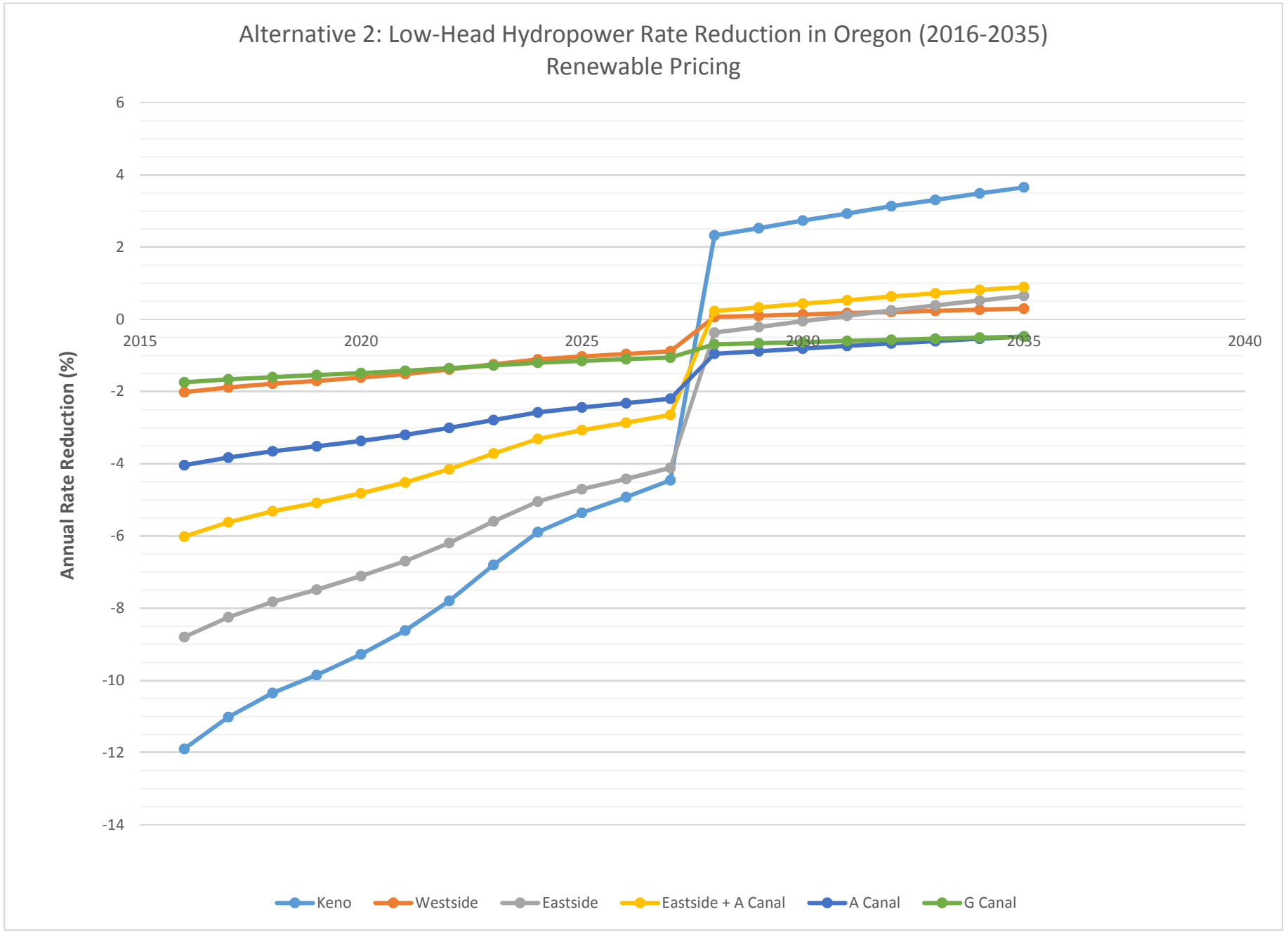
	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,070,593	(4,165,369)	13.128	16.925	-36.8	-26.3	2.34	1.99	1,070,593	(4,165,369)	13.128	16.925	-36.8	-26.3
2017	2.63	2.17	1,188,917	(4,053,974)	13.321	17.233	-34.8	-24.8	2.63	2.17	1,188,917	(4,053,974)	13.321	17.233	-34.8	-24.8
2018	2.82	2.30	1,269,040	(3,980,988)	13.556	17.585	-33.2	-23.7	2.82	2.30	1,269,040	(3,980,988)	13.556	17.585	-33.2	-23.7
2019	2.94	2.38	1,319,190	(3,938,189)	13.825	17.975	-31.8	-22.7	2.94	2.38	1,319,190	(3,938,189)	13.825	17.975	-31.8	-22.7
2020	3.10	2.51	1,391,085	(3,873,865)	14.085	18.360	-30.4	-21.7	3.10	2.51	1,391,085	(3,873,865)	14.085	18.360	-30.4	-21.7
2021	3.30	2.71	1,489,035	(3,783,714)	14.333	18.737	-28.8	-20.6	3.30	2.71	1,489,035	(3,783,714)	14.333	18.737	-28.8	-20.6
2022	3.60	3.00	1,633,805	(3,646,977)	14.550	19.087	-27.0	-19.3	3.60	3.00	1,633,805	(3,646,977)	14.550	19.087	-27.0	-19.3
2023	4.03	3.37	1,831,468	(3,457,588)	14.734	19.407	-24.8	-17.7	4.03	3.37	1,831,468	(3,457,588)	14.734	19.407	-24.8	-17.7
2024	4.44	3.73	2,021,491	(3,276,087)	14.934	19.748	-22.9	-16.3	4.44	3.73	2,021,491	(3,276,087)	14.934	19.748	-22.9	-16.3
2025	4.66	3.93	2,124,926	(3,181,429)	15.218	20.178	-21.5	-15.4	4.66	3.93	2,124,926	(3,181,429)	15.218	20.178	-21.5	-15.4
2026	4.84	4.09	2,208,772	(3,106,625)	15.530	20.639	-20.4	-14.6	4.84	4.09	2,208,772	(3,106,625)	15.530	20.639	-20.4	-14.6
2027	5.06	4.27	2,307,897	(3,016,812)	15.841	21.103	-19.3	-13.7	5.06	4.27	2,307,897	(3,016,812)	15.841	21.103	-19.3	-13.7
2028	6.28	3.25	2,422,694	(2,911,606)	16.150	21.571	-18.0	-12.9	10.26	6.60	4,236,140	(1,098,161)	14.613	20.038	-6.8	-4.9
2029	6.44	3.34	2,485,970	(2,858,210)	16.516	22.099	-17.2	-12.3	10.47	6.74	4,323,903	(1,020,277)	14.957	20.545	-6.1	-4.4
2030	6.71	3.55	2,605,273	(2,749,083)	16.846	22.597	-16.1	-11.5	10.72	6.87	4,420,482	(933,874)	15.307	21.063	-5.5	-3.9
2031	6.88	3.64	2,671,291	(2,693,545)	17.234	23.159	-15.3	-10.9	10.94	7.03	4,515,297	(849,539)	15.671	21.600	-4.8	-3.4
2032	7.04	3.74	2,736,722	(2,638,910)	17.636	23.739	-14.5	-10.4	11.18	7.20	4,617,753	(757,879)	16.041	22.149	-4.2	-3.0
2033	7.24	3.86	2,817,433	(2,569,319)	18.039	24.325	-13.7	-9.8	11.41	7.37	4,717,466	(669,285)	16.428	22.719	-3.6	-2.6
2034	7.43	3.98	2,895,401	(2,502,803)	18.459	24.934	-13.0	-9.3	11.65	7.55	4,822,076	(576,128)	16.825	23.305	-3.0	-2.1
2035	7.62	4.09	2,971,214	(2,438,787)	18.895	25.564	-12.3	-8.8	11.87	7.76	4,927,666	(482,334)	17.236	23.910	-2.4	-1.7
						average:	**-22.59**	**-16.13**						**average:**	**-18.41**	**-13.14**

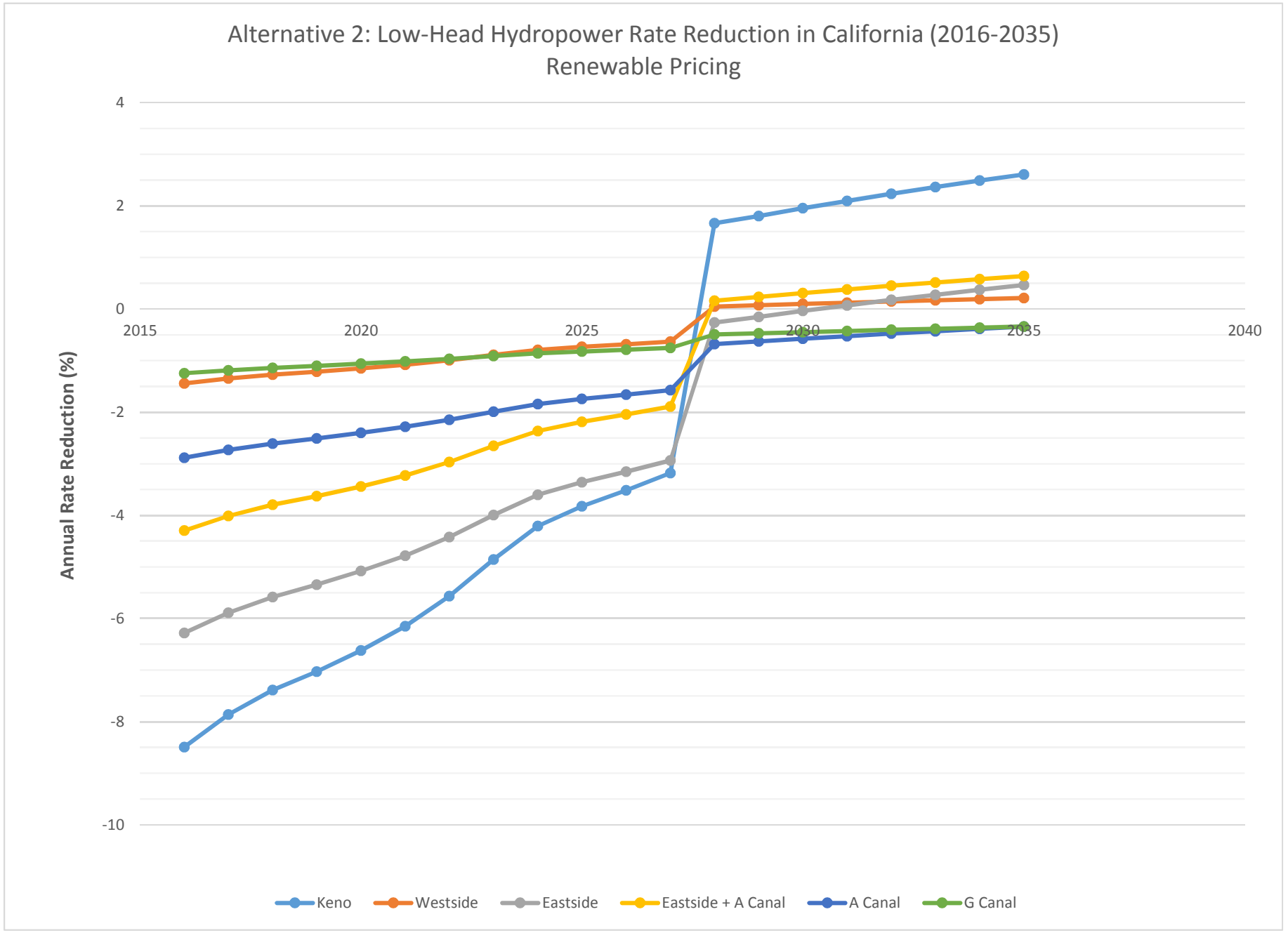

Alternative 2: Low-Head Hydropower Net Revenue (2016-2035)
Standard Pricing
Annual Net Revenue ($)
0
-200,000
-400,000
-600,000
-800,000
-1,000,000
-1,200,000
-1,400,000
-1,600,000
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Net Revenue (2016-2035)
Renewable Pricing
1,000,000
500,000
0
-500,000
-1,000,000
-1,500,000
Annual Net Revenue ($)
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Rate Reduction in Oregon (2016-2035)
Standard Pricing
Annual Rate Reduction (%)
0
-2
-4
-6
-8
-10
-12
-14
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Rate Reduction in California (2016-2035)
Standard Pricing
Annual Rate Reduction (%)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Rate Reduction in Oregon (2016-2035)
Renewable Pricing
Annual Rate Reduction (%)
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Rate Reduction in California (2016-2035)
Renewable Pricing
Annual Rate Reduction (%)
4
2
0
-2
-4
-6
-8
-10
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal

Alternative 3: Out-of-Basin Investment

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 The full loan amount is used for project development.

3 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

Alternative 3: Out-of-Basin Investment

Loan details

Principal - Amount Borrowed ($):	40,000,000.00
Interest Rate:	3.0%
Payback Period (years):	30
Annual Loan Payments ($):	2,040,770.37

Alternative 3: Out-of-Basin Investment

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Yieldco Yield Assumptions:

Average Yield: 4.0%

Inflation Assumptions:

Energy Rate: 3.0%

Initial Investment ($): 40,000,000.00

Annual Loan Payment: 2,040,770.37

Delivery Year	Dividend (Revenue) ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	1,600,000.00	(440,770.37)	9.970	13.776	-3.9	-2.8
2017	1,600,000.00	(440,770.37)	10.258	14.178	-3.8	-2.7
2018	1,600,000.00	(440,770.37)	10.554	14.592	-3.7	-2.6
2019	1,600,000.00	(440,770.37)	10.860	15.018	-3.6	-2.5
2020	1,600,000.00	(440,770.37)	11.174	15.458	-3.5	-2.5
2021	1,600,000.00	(440,770.37)	11.498	15.910	-3.4	-2.4
2022	1,600,000.00	(440,770.37)	11.832	16.377	-3.3	-2.3
2023	1,600,000.00	(440,770.37)	12.176	16.857	-3.2	-2.3
2024	1,600,000.00	(440,770.37)	12.530	17.351	-3.1	-2.2
2025	1,600,000.00	(440,770.37)	12.894	17.861	-3.0	-2.1
2026	1,600,000.00	(440,770.37)	13.270	18.385	-2.9	-2.1
2027	1,600,000.00	(440,770.37)	13.657	18.926	-2.8	-2.0
2028	1,600,000.00	(440,770.37)	14.055	19.482	-2.7	-2.0
2029	1,600,000.00	(440,770.37)	14.466	20.055	-2.7	-1.9
2030	1,600,000.00	(440,770.37)	14.889	20.646	-2.6	-1.8
2031	1,600,000.00	(440,770.37)	15.324	21.254	-2.5	-1.8
2032	1,600,000.00	(440,770.37)	15.772	21.881	-2.4	-1.7
2033	1,600,000.00	(440,770.37)	16.234	22.526	-2.4	-1.7
2034	1,600,000.00	(440,770.37)	16.710	23.190	-2.3	-1.6
2035	1,600,000.00	(440,770.37)	17.200	23.875	-2.2	-1.6
				average:	**-3.0**	**-2.1**


Alternative 3: Out-of-Basin Investments Rate Reduction 2016-2035
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Annual Rate Reduction (%)
Oregon
California

Alternative 4: Utility-Scale Solar and Out-of-Basin Investment

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 The full loan amount is used for project development.

4 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

5 On-peak hours are from 6AM to 10PM

6 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 4: Utility-Scale Solar and Out-of-Basin Investment

Loan details

Principal - Amount Borrowed ($):	40,000,000.00
Interest Rate:	3.0%
Payback Period (years):	30
Annual Loan Payments ($):	2,040,770.37

Alternative 4: Utility-Scale Solar and Out-of-Basin Investment
Based on Standard Solar Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW): 12,987
Capacity Factor: 0.3
Project Annual Generation (kWh): 34129870.13
Estimated O&M Costs ($/kW): 27
Project Annual O&M ($): 350,649.35
Yieldco Initial Investment ($): 20,000,000.00
Annual Loan Payment: 2,040,770.37

Current Cost Information
OR Energy Use (kWh): 96000000
CA Energy Use (kWh): 22000000
PAC 41 rate ($/kWh): 0.09596
PAC PA-20 rate ($/kWh): 0.13403

Inflation Assumptions:
General Rate: 3.0%
Average Energy Rate: 3.0%

Yieldco Yield Assumptions:
Average Yield: 4.0%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Solar Gross Revenue ($)	Yieldco Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	779,526	800,000	(811,893)	10.284	14.089	-7.2	-5.1
2017	2.63	2.17	872,496	800,000	(729,443)	10.502	14.422	-6.3	-4.5
2018	2.82	2.3	934,066	800,000	(678,708)	10.756	14.793	-5.7	-4.0
2019	2.94	2.38	972,838	800,000	(651,097)	11.038	15.196	-5.3	-3.8
2020	3.1	2.51	1,025,807	800,000	(609,622)	11.317	15.601	-4.8	-3.4
2021	3.3	2.71	1,094,067	800,000	(553,202)	11.593	16.005	-4.2	-3.0
2022	3.6	3	1,195,911	800,000	(463,553)	11.851	16.396	-3.4	-2.4
2023	4.03	3.37	1,339,393	800,000	(332,632)	12.084	16.765	-2.4	-1.7
2024	4.44	3.73	1,476,595	800,000	(208,368)	12.333	17.155	-1.5	-1.0
2025	4.66	3.93	1,550,588	800,000	(147,700)	12.646	17.613	1.0	-0.7
2026	4.84	4.09	1,610,930	800,000	(101,084)	12.982	18.098	-0.7	-0.5
2027	5.06	4.27	1,683,831	800,000	(42,320)	13.319	18.589	-0.3	-0.2
2028	5.79	3.25	1,837,416	800,000	96,703	13.600	19.028	0.6	0.4
2029	5.93	3.34	1,882,467	800,000	126,756	13.985	19.576	0.8	0.5
2030	6.2	3.55	1,971,341	800,000	200,182	14.345	20.104	1.2	0.8
2031	6.35	3.64	2,019,260	800,000	232,189	14.753	20.685	1.3	0.9
2032	6.51	3.74	2,070,591	800,000	267,131	15.172	21.282	1.5	1.1
2033	6.69	3.86	2,128,748	800,000	308,408	15.599	21.892	1.6	1.2
2034	6.87	3.98	2,186,906	800,000	349,178	16.040	22.522	1.8	1.3
2035	7.05	4.09	2,244,517	800,000	388,881	16.497	23.173	2.0	1.4
							Average (%)	-1.6	-1.1

Alternative 4: Utility-Scale Solar and Out-of-Basin Investment

Based on Renewable Solar Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	12,987
Project Annual Generation (kWh):	34,129,870
Estimated O&M Costs ($/kW):	27
Project Annual O&M ($):	350,649
Yieldco Initial Investment ($):	20,000,000
Annual Loan Payment:	2,040,770.37

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

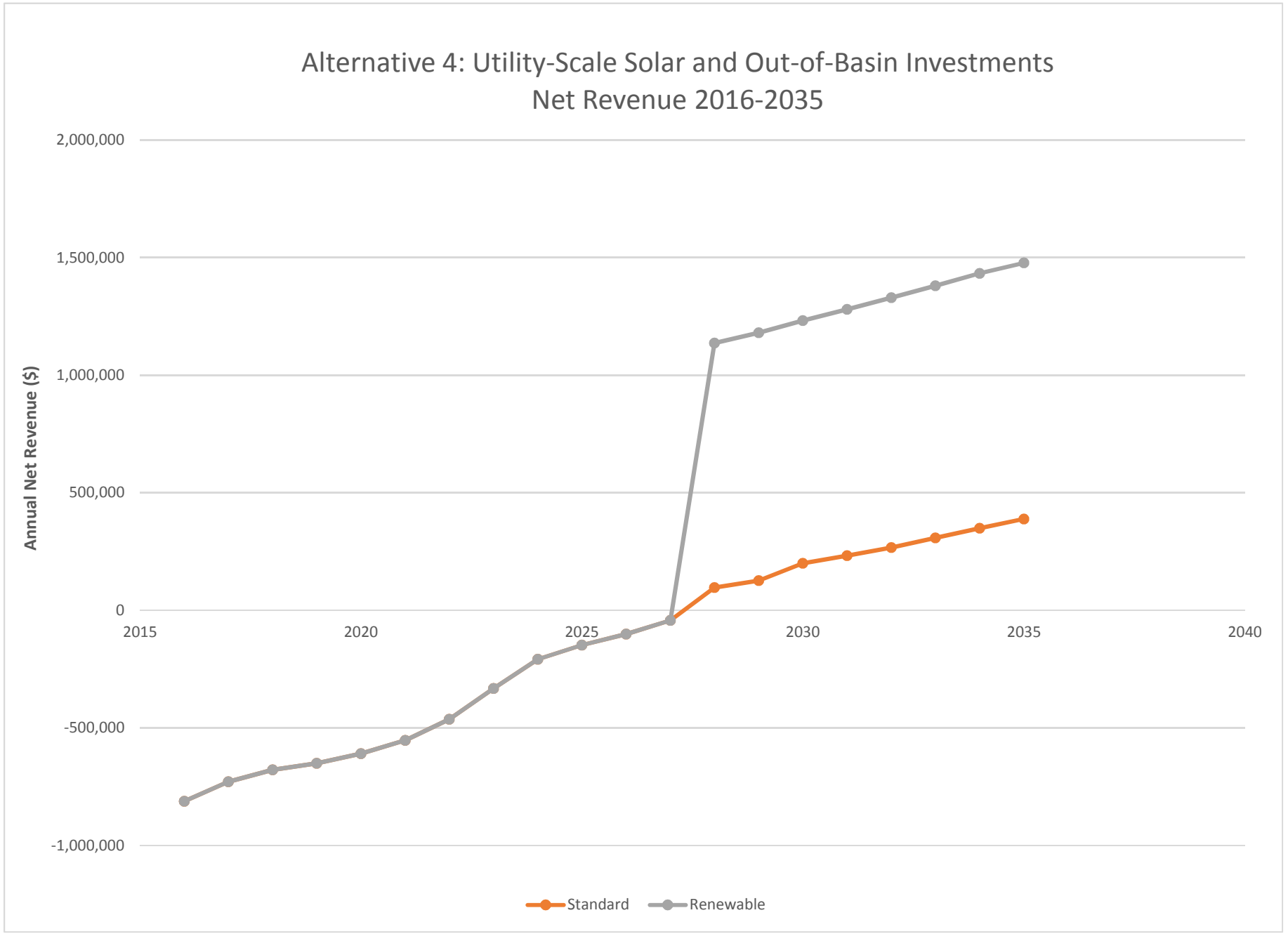
Inflation Assumptions:

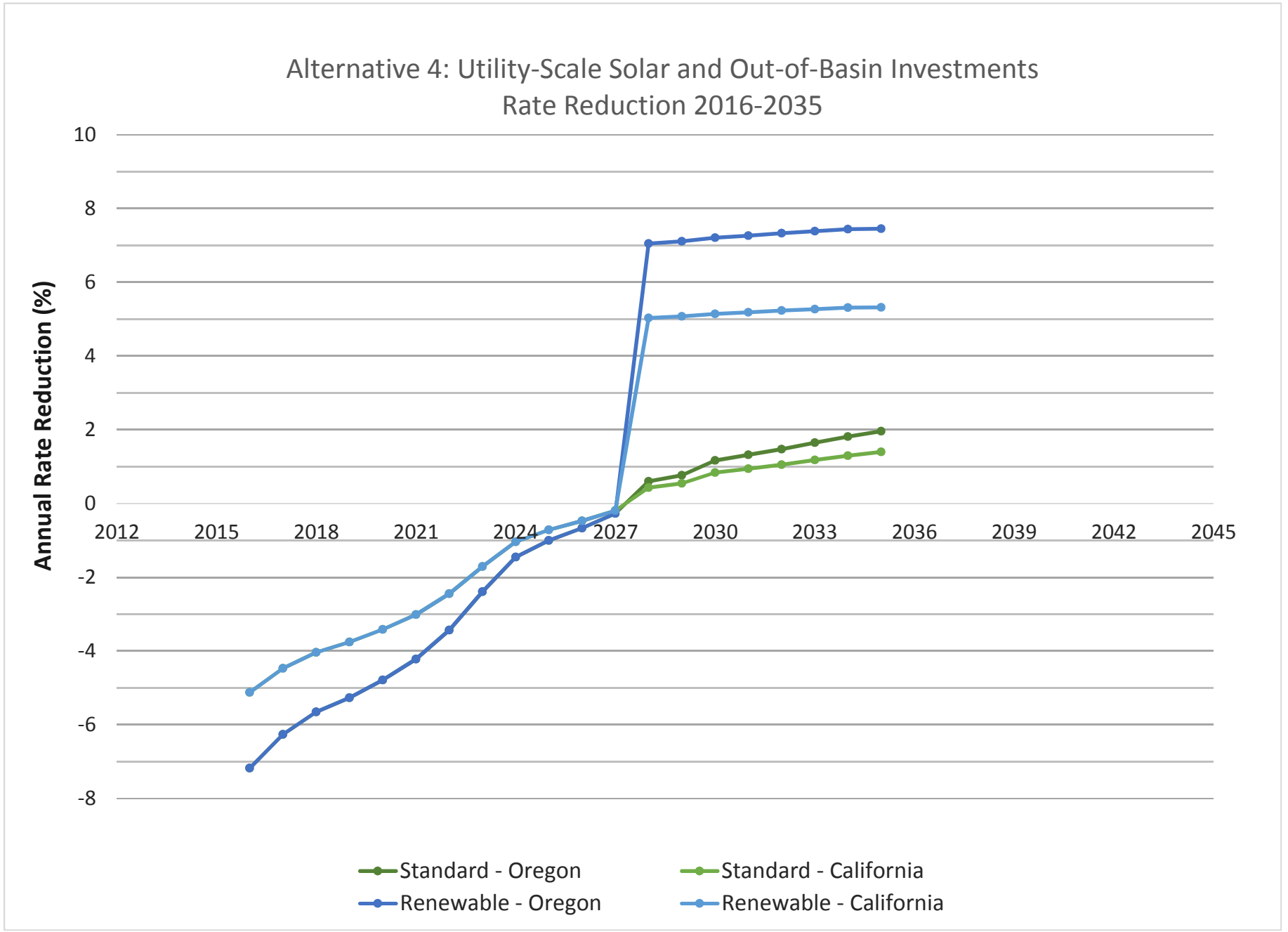
General Rate:	3.0%
Average Energy Rate:	3.0%

Yieldo Yield Assumptions:

Average Yield:	4%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Solar Gross Revenue ($)	Yieldco Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	779,526	800,000	(811,893)	10.284	14.089	-7.2	-5.1
2017	2.63	2.17	872,496	800,000	(729,443)	10.502	14.422	-6.3	-4.5
2018	2.82	2.30	934,066	800,000	(678,708)	10.756	14.793	-5.7	-4.0
2019	2.94	2.38	972,838	800,000	(651,097)	11.038	15.196	-5.3	-3.8
2020	3.10	2.51	1,025,807	800,000	(609,622)	11.317	15.601	-4.8	-3.4
2021	3.30	2.71	1,094,067	800,000	(553,202)	11.593	16.005	-4.2	-3.0
2022	3.60	3.00	1,195,911	800,000	(463,553)	11.851	16.396	-3.4	-2.4
2023	4.03	3.37	1,339,393	800,000	(332,632)	12.084	16.765	-2.4	-1.7
2024	4.44	3.73	1,476,595	800,000	(208,368)	12.333	17.155	-1.5	-1.0
2025	4.66	3.93	1,550,588	800,000	(147,700)	12.646	17.613	-1.0	-0.7
2026	4.84	4.09	1,610,930	800,000	(101,084)	12.982	18.098	-0.7	-0.5
2027	5.06	4.27	1,683,831	800,000	(42,320)	13.319	18.589	-0.3	-0.2
2028	8.78	6.60	2,877,558	800,000	1,136,845	12.718	18.148	7.0	5.0
2029	8.96	6.74	2,936,807	800,000	1,181,096	13.091	18.684	7.1	5.1
2030	9.17	6.87	3,004,111	800,000	1,232,952	13.469	19.231	7.2	5.1
2031	9.36	7.03	3,067,320	800,000	1,280,249	13.865	19.799	7.3	5.2
2032	9.56	7.20	3,133,941	800,000	1,330,482	14.271	20.383	7.3	5.2
2033	9.76	7.37	3,200,563	800,000	1,380,222	14.690	20.986	7.4	5.3
2034	9.97	7.55	3,270,597	800,000	1,432,870	15.122	21.606	7.4	5.3
2035	10.15	7.76	3,333,669	800,000	1,478,033	15.573	22.253	7.4	5.3
							average:	**0.8**	**0.6**


Alternative 4: Utility-Scale Solar and Out-of-Basin Investments
Net Revenue 2016-2035
Annual Net Revenue ($)
2,000,000
1,500,000
1,000,000
500,000
0
-500,000
-1,000,000
2015
2020
2025
2030
2035
2040
Standard
Renewable


Alternative 4: Utility-Scale Solar and Out-of-Basin Investments
Rate Reduction 2016-2035
Annual Rate Reduction (%)
10
8
6
4
2
0
-2
-4
-6
-8
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Standard - Oregon
Standard - California
Renewable - Oregon
Renewable - California

Alternative 5: Geothermal

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 Cost of geothermal development per kW: $5,900

3 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

4 On-peak hours are from 6AM to 10PM

5 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 5: Geothermal

Loan details

Principal - Amount Borrowed ($):	40,000,000.00
Interest Rate:	3.0%
Payback Period (years):	30
Annual Loan Payments ($):	2,040,770.37

Alternative 5: Geothermal
Based on Standard Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	6,780
Capacity Factor:	0.85
Project Annual Generation (kWh):	50481355.93
Estimated Well Cost ($):	500,000.00
Estimated O&M Costs ($/kW):	120
Project Annual O&M ($):	813,559.32
Annual Loan Payment ($):	2,040,770.37

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,103,522	(2,250,807)	11.504	15.306	-19.9	-14.2
2017	2.63	2.17	1,225,485	(1,653,251)	11.286	15.203	-14.2	-10.1
2018	2.82	2.30	1,308,073	(1,595,803)	11.534	15.568	-13.3	-9.5
2019	2.94	2.38	1,359,766	(1,570,003)	11.817	15.973	-12.7	-9.1
2020	3.10	2.51	1,433,872	(1,522,566)	12.091	16.372	-12.0	-8.5
2021	3.30	2.71	1,534,835	(1,449,073)	12.353	16.763	-11.0	-7.9
2022	3.60	3.00	1,684,058	(1,328,145)	12.584	17.127	-9.8	-7.0
2023	4.03	3.37	1,887,801	(1,153,545)	12.780	17.459	-8.3	-5.9
2024	4.44	3.73	2,083,668	(987,695)	12.993	17.814	-6.9	-4.9
2025	4.66	3.93	2,190,285	(911,996)	13.294	18.259	-6.2	-4.4
2026	4.84	4.09	2,276,709	(857,417)	13.623	18.737	-5.6	-4.0
2027	5.06	4.27	2,378,883	(788,043)	13.951	19.219	-5.0	-3.6
2028	6.28	3.25	2,497,212	(703,500)	14.278	19.704	-4.4	-3.1
2029	6.44	3.34	2,562,434	(673,076)	14.663	20.252	-4.0	-2.9
2030	6.71	3.55	2,685,406	(585,946)	15.012	20.769	-3.4	-2.4
2031	6.88	3.64	2,753,455	(554,814)	15.421	21.351	-3.1	-2.2
2032	7.04	3.74	2,820,898	(525,396)	15.844	21.952	-2.9	-2.1
2033	7.24	3.86	2,904,091	(481,369)	16.269	22.560	-2.6	-1.8
2034	7.43	3.98	2,984,458	(441,343)	16.711	23.191	-2.3	-1.6
2035	7.62	4.09	3,062,603	(404,749)	17.170	23.844	-2.0	-1.5
						average:	**-7.5**	**-5.3**

Alternative 5: Geothermal

Based on Renewable Fixed Avoided Cost Prices from Schedule 37

Project Size (kW):	6,780
Project Annual Generation (kWh):	50,481,356
Estimated Well Cost ($):	500,000
Estimated O&M Costs ($/kW):	120
Project Annual O&M ($):	813,559
Annual Loan Payment:	2,040,770.37

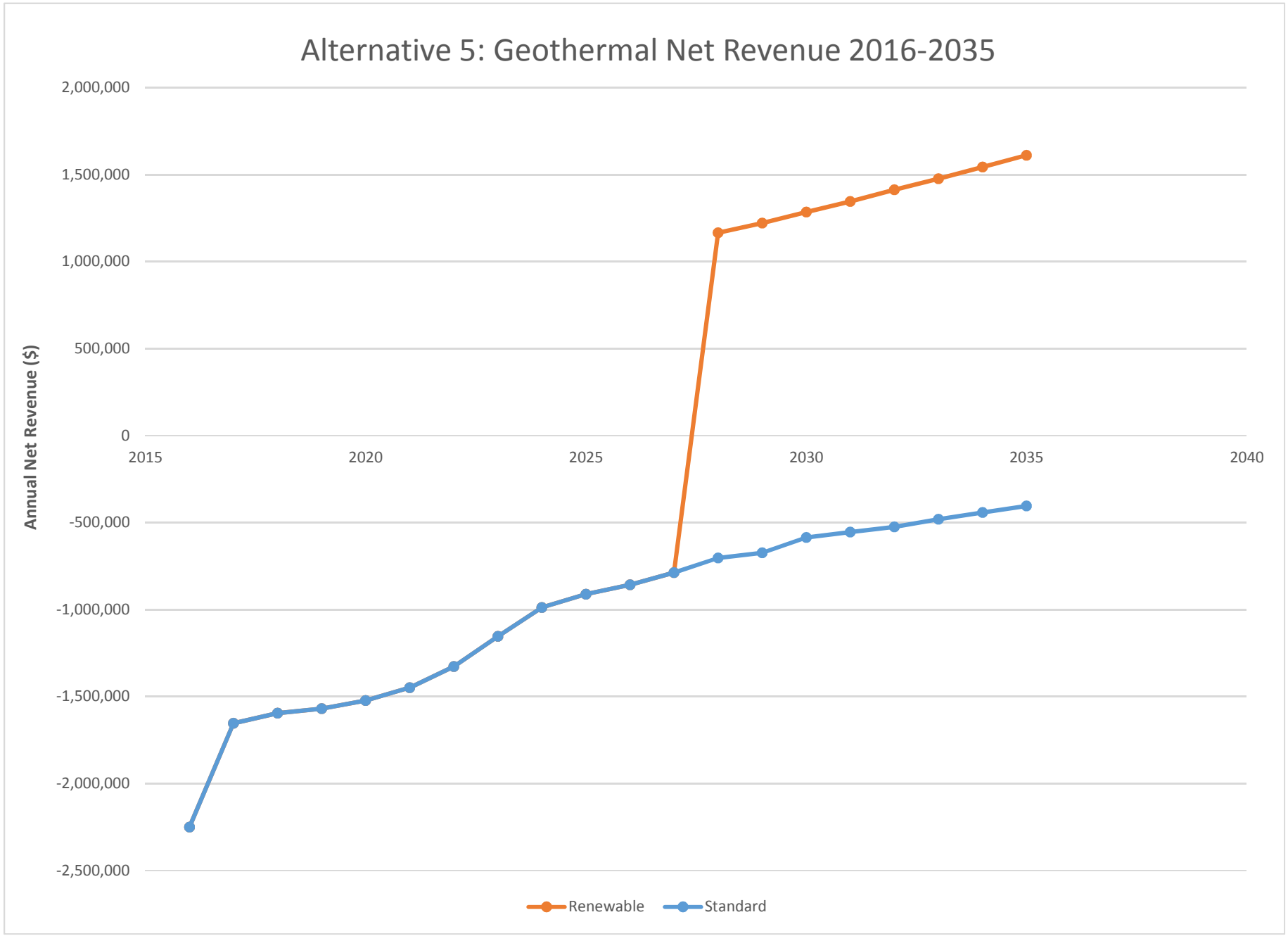
Current Cost Information

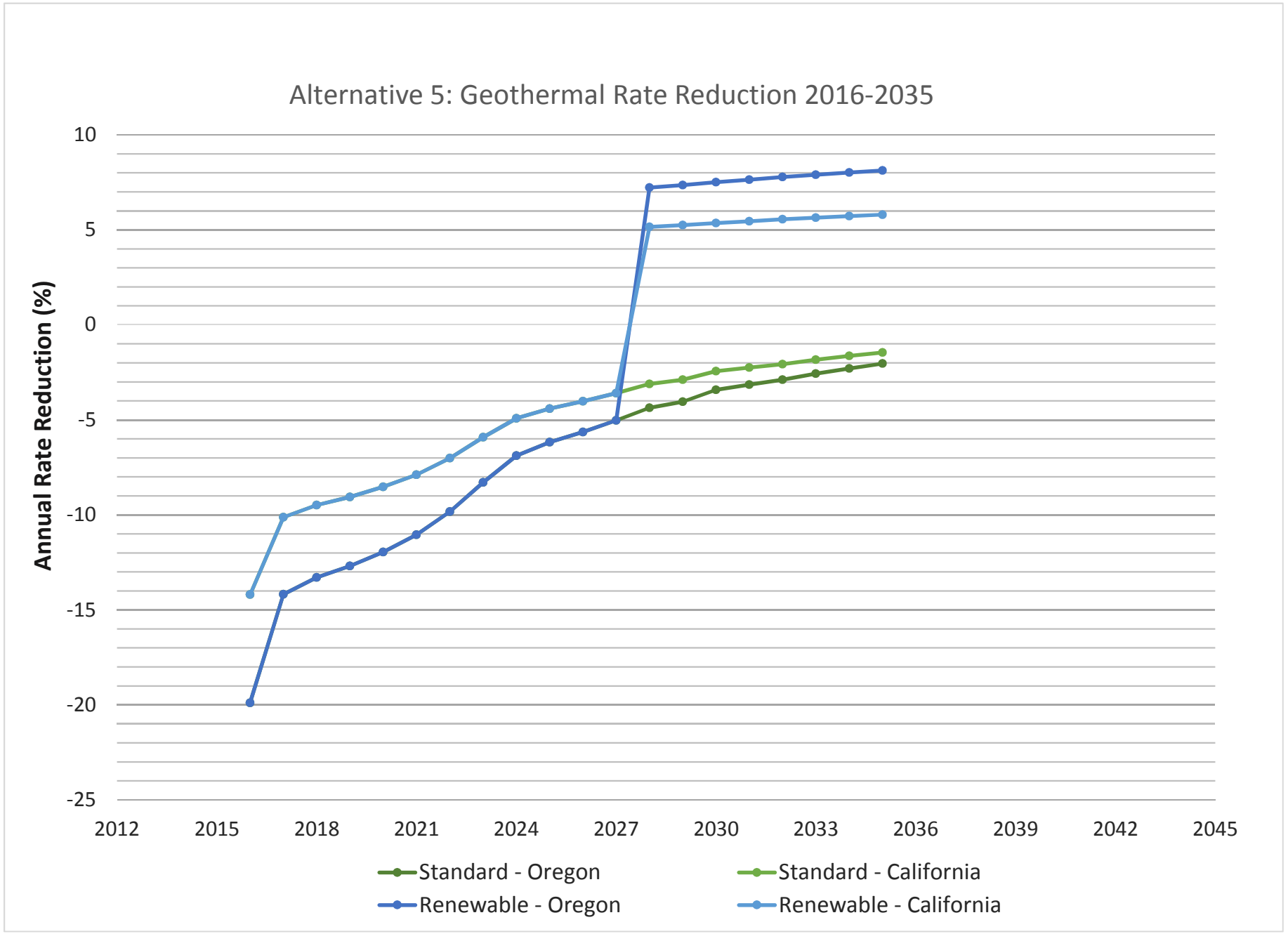
OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,103,522	(2,250,807)	11.504	15.306	-19.9	-14.2
2017	2.63	2.17	1,225,485	(1,653,251)	11.286	15.203	-14.2	-10.1
2018	2.82	2.30	1,308,073	(1,595,803)	11.534	15.568	-13.3	-9.5
2019	2.94	2.38	1,359,766	(1,570,003)	11.817	15.973	-12.7	-9.1
2020	3.10	2.51	1,433,872	(1,522,566)	12.091	16.372	-12.0	-8.5
2021	3.30	2.71	1,534,835	(1,449,073)	12.353	16.763	-11.0	-7.9
2022	3.60	3.00	1,684,058	(1,328,145)	12.584	17.127	-9.8	-7.0
2023	4.03	3.37	1,887,801	(1,153,545)	12.780	17.459	-8.3	-5.9
2024	4.44	3.73	2,083,668	(987,695)	12.993	17.814	-6.9	-4.9
2025	4.66	3.93	2,190,285	(911,996)	13.294	18.259	-6.2	-4.4
2026	4.84	4.09	2,276,709	(857,417)	13.623	18.737	-5.6	-4.0
2027	5.06	4.27	2,378,883	(788,043)	13.951	19.219	-5.0	-3.6
2028	10.26	6.60	4,366,435	1,165,724	12.693	18.124	7.2	5.2
2029	10.47	6.74	4,456,898	1,221,388	13.056	18.650	7.3	5.2
2030	10.72	6.87	4,556,447	1,285,095	13.425	19.187	7.5	5.4
2031	10.94	7.03	4,654,179	1,345,910	13.809	19.744	7.6	5.4
2032	11.18	7.20	4,759,786	1,413,492	14.200	20.313	7.8	5.6
2033	11.41	7.37	4,862,566	1,477,106	14.608	20.904	7.9	5.6
2034	11.65	7.55	4,970,394	1,544,594	15.027	21.512	8.0	5.7
2035	11.87	7.76	5,079,232	1,611,881	15.460	22.139	8.1	5.8
						average:	**-3.2**	**-2.3**


Alternative 5: Geothermal Net Revenue 2016-2035
Annual Net Revenue ($)
2,000,000
1,500,000
1,000,000
500,000
0
-500,000
-1,000,000
-1,500,000
-2,000,000
-2,500,000
2015
2020
2025
2030
2035
2040
Renewable
Standard


Alternative 5: Geothermal Rate Reduction 2016-2035
Annual Rate Reduction (%)
10
5
0
-5
-10
-15
-20
-25
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Standard - Oregon
Standard - California
Renewable - Oregon
Renewable - California

Alternative 6: Shared Solar

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 The full loan amount is used for project development.

4 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

5 On-peak hours are from 6AM to 10PM

Alternative 6: Shared Solar

Loan details

Principal - Amount Borrowed ($):	40,000,000.00
Interest Rate:	3.0%
Payback Period (years):	30
Annual Loan Payments ($):	2,040,770.37

Alternative 6: Shared Solar

Project Size (kW):	11,765
Capacity Factor:	0.28
Project Annual Generation (kWh):	28856470.59
Estimated O&M Costs ($/kW):	28
Project Annual O&M ($):	329,411.76
Annual Loan Payment ($):	2,040,770.37

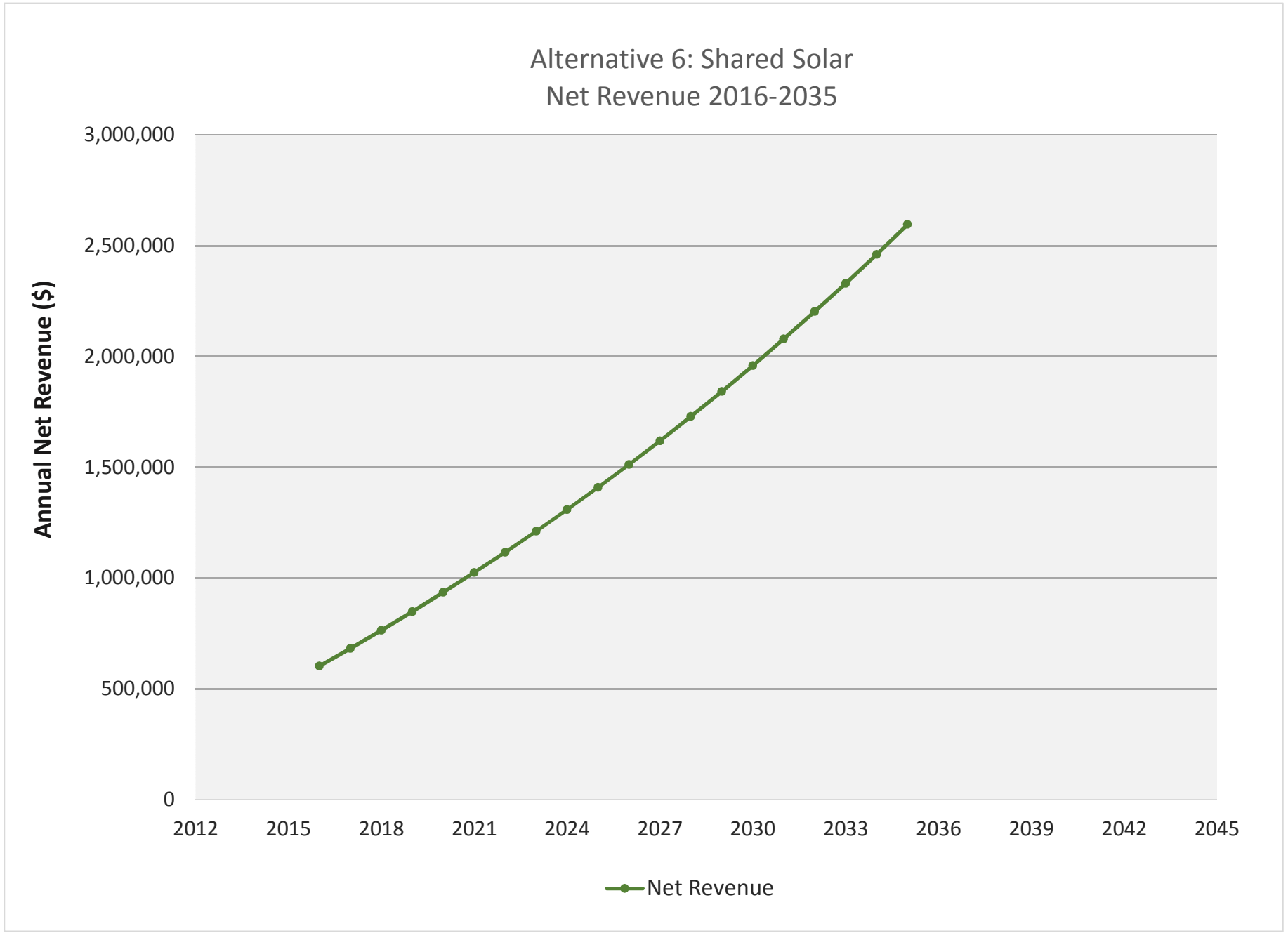
Current Cost Information

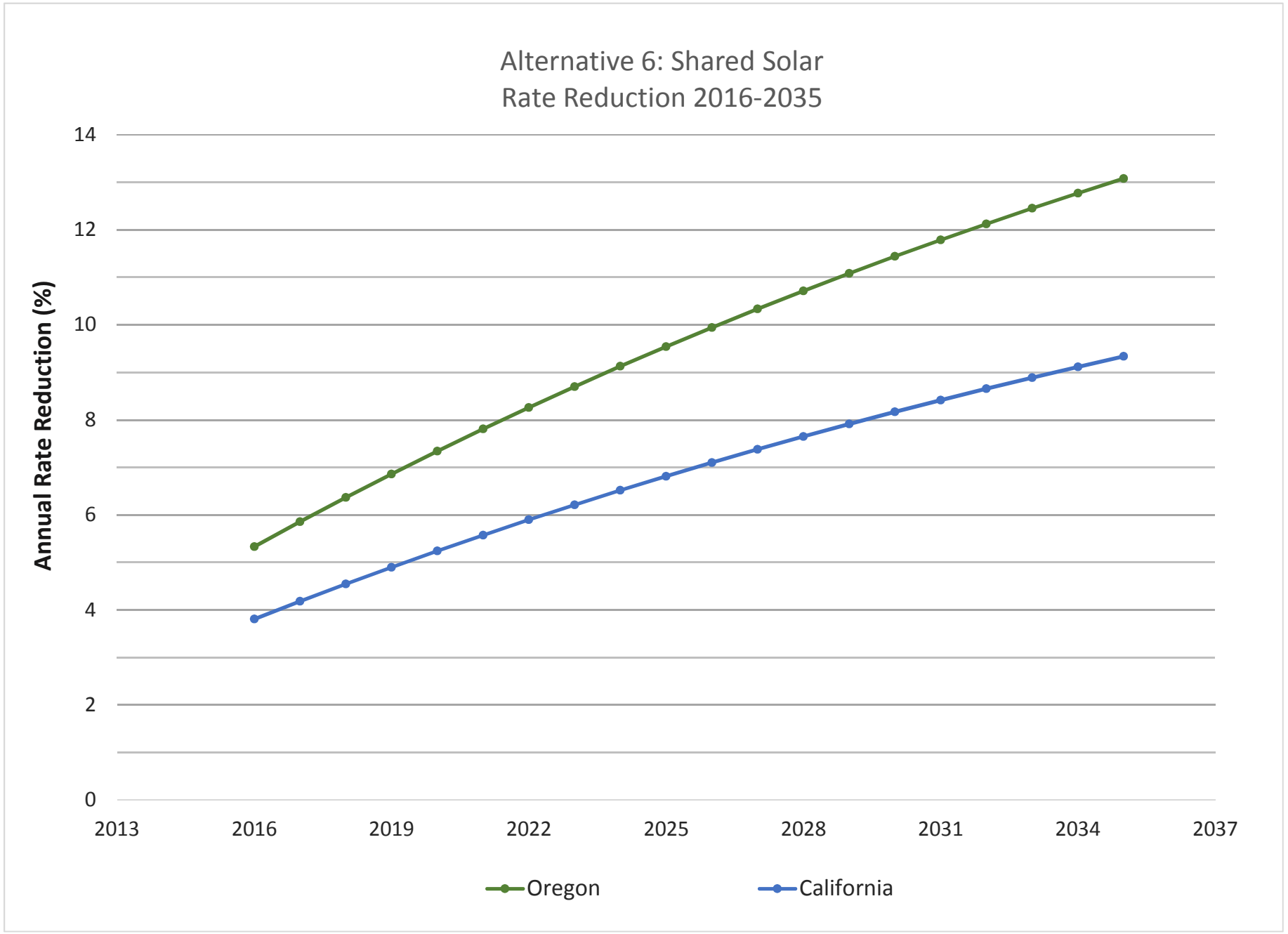
OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Energy Rate:	3.0%

Delivery Year	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2,973,400	603,218	9.085	12.893	5.3	3.8
2017	3,062,602	682,538	9.305	13.228	5.9	4.2
2018	3,154,480	764,237	9.532	13.573	6.4	4.5
2019	3,249,115	848,387	9.766	13.929	6.9	4.9
2020	3,346,588	935,062	10.008	14.295	7.3	5.2
2021	3,446,986	1,024,337	10.256	14.672	7.8	5.6
2022	3,550,395	1,116,290	10.512	15.060	8.3	5.9
2023	3,656,907	1,211,002	10.775	15.460	8.7	6.2
2024	3,766,614	1,308,555	11.046	15.872	9.1	6.5
2025	3,879,613	1,409,035	11.326	16.297	9.5	6.8
2026	3,996,001	1,512,529	11.614	16.734	9.9	7.1
2027	4,115,881	1,619,128	11.910	17.184	10.3	7.4
2028	4,239,358	1,728,925	12.216	17.648	10.7	7.6
2029	4,366,538	1,842,016	12.530	18.125	11.1	7.9
2030	4,497,535	1,958,499	12.854	18.617	11.4	8.2
2031	4,632,461	2,078,477	13.188	19.124	11.8	8.4
2032	4,771,434	2,202,055	13.532	19.646	12.1	8.7
2033	4,914,577	2,329,340	13.886	20.184	12.5	8.9
2034	5,062,015	2,460,443	14.250	20.738	12.8	9.1
2035	5,213,875	2,595,479	14.626	21.308	13.1	9.3
				average:	**9.5**	**6.8**


Alternative 6: Shared Solar
Net Revenue 2016-2035
Annual Net Revenue ($)
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Net Revenue


Alternative 6: Shared Solar
Rate Reduction 2016-2035
Annual Rate Reduction (%)
14
12
10
8
6
4
2
0
2013
2016
2019
2022
2025
2028
2031
2034
2037
Oregon
California

Alternative 7: Utility-Scale and Net Metered Solar

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 The full loan amount is used for project development.

4 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

5 On-peak hours are from 6AM to 10PM

6 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 7: Utility-Scale and Net Metered Solar

Loan details

Principal - Amount Borrowed ($):	40,000,000.00
OR Energy Trust Incentive* ($):	4,650,000.00
Interest Rate:	3.0%
Payback Period (years):	30
Annual Loan Payments ($):	1,803,530.82

**From the incentive rate calculation performed by EnergyTrust, based on system size (nonlinear calculations used for projects sized 16-300kW)*

Alternative 7: Utility-Scale and Net Metered Solar

Based on Standard Solar Fixed Avoided Cost Prices as provided in Schedule 37

On-Peak hours are 6 am to 10 pm

	Utility Scale	Net Metered
Portion of Funding Received:	50%	50%
Project Size (kW):	12,987.01	5.00
Capacity Factor:	0.3	0.2
Project Annual Generation (kWh):	34,129,870.13	8,360.00
Estimated O&M Costs ($/kW):	27	30
Project Annual O&M ($):	350,649.35	150.00

Annual Loan Payment ($): 1,803,530.82

No. of Units	
Oregon:	**930**
California:	**212**

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue -Utility Scale ($)	NEM Energy Credit OR ($)	NEM Energy Credit CA ($)	Net Revenue OR ($)	Net Revenue CA ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	779,526	746,070	237,544	(373,048)	(18,292)	9.985	13.486	-4.0	-0.6
2017	2.63	2.17	872,496	768,452	244,670	(283,556)	4,166	10.179	13.786	-3.0	0.1
2018	2.82	2.30	934,066	791,505	252,010	(219,209)	20,938	10.409	14.124	-2.2	0.7
2019	2.94	2.38	972,838	815,251	259,571	(172,993)	33,629	10.666	14.493	-1.7	1.0
2020	3.10	2.51	1,025,807	839,708	267,358	(114,780)	49,126	10.920	14.862	-1.1	1.5
2021	3.30	2.71	1,094,067	864,899	275,379	(43,668)	67,636	11.170	15.230	-0.4	2.0
2022	3.60	3.00	1,195,911	890,846	283,640	55,248	92,567	11.401	15.583	0.5	2.6
2023	4.03	3.37	1,339,393	917,572	292,149	188,538	125,422	11.605	15.914	1.7	3.5
2024	4.44	3.73	1,476,595	945,099	300,914	317,211	157,294	11.825	16.264	2.7	4.2
2025	4.66	3.93	1,550,588	973,452	309,941	394,941	177,600	12.109	16.681	3.3	4.6
2026	4.84	4.09	1,610,930	1,002,655	319,239	462,085	195,563	12.415	17.124	3.7	4.9
2027	5.06	4.27	1,683,831	1,032,735	328,817	539,992	216,064	12.721	17.571	4.2	5.3
2028	5.79	3.25	1,837,416	1,063,717	338,681	684,133	251,781	12.969	17.965	5.2	6.0
2029	5.93	3.34	1,882,467	1,095,629	348,841	740,501	267,524	13.321	18.467	5.5	6.2
2030	6.20	3.55	1,971,341	1,128,498	359,307	833,132	291,640	13.647	18.948	6.0	6.5
2031	6.35	3.64	2,019,260	1,162,352	370,086	893,034	308,366	14.020	19.480	6.2	6.7
2032	6.51	3.74	2,070,591	1,197,223	381,188	956,340	325,961	14.403	20.026	6.5	6.9
2033	6.69	3.86	2,128,748	1,233,140	392,624	1,025,849	345,067	14.792	20.585	6.7	7.1
2034	6.87	3.98	2,186,906	1,270,134	404,403	1,096,023	364,421	15.195	21.161	7.0	7.3
2035	7.05	4.09	2,244,517	1,308,238	416,535	1,166,437	383,930	15.612	21.757	7.2	7.4
									average:	**2.7**	**4.2**

Alternative 7: Utility-Scale and Net Metered Solar

Based on Renewable Solar Fixed Avoided Cost Prices as provided in Schedule 37

On-Peak hours are 6 am to 10 pm

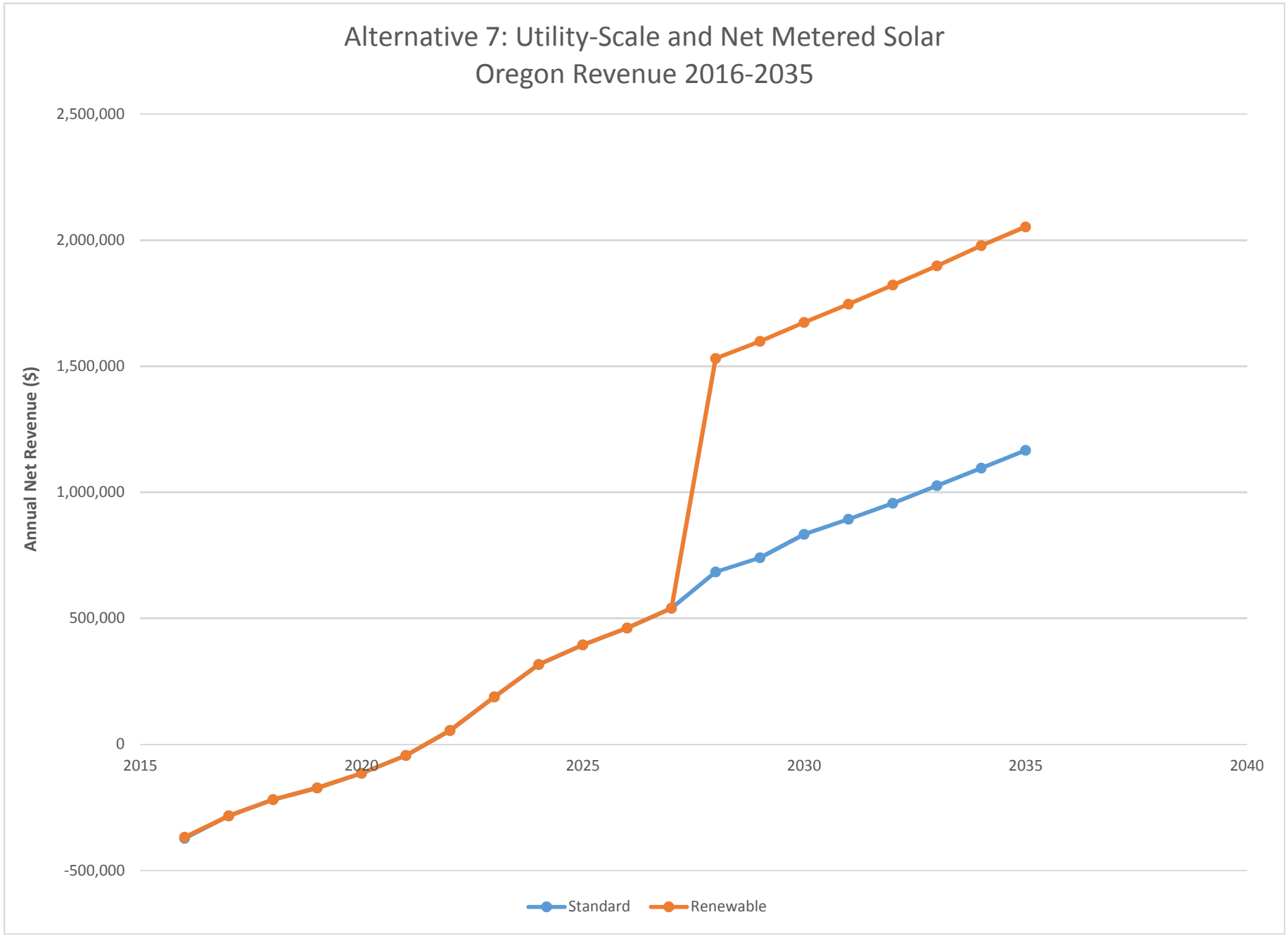
	Utility Scale	Net Metered
Project Size (kW):	12,987	5.00
Project Annual Generation (kWh):	34,129,870	8,360.00
Estimated O&M Costs ($/kW):	27	30
Project Annual O&M ($):	350,649.35	150.00
OR Energy Trust Incentive* ($):		5,000
Annual Loan Payment ($):	1,803,530.82	

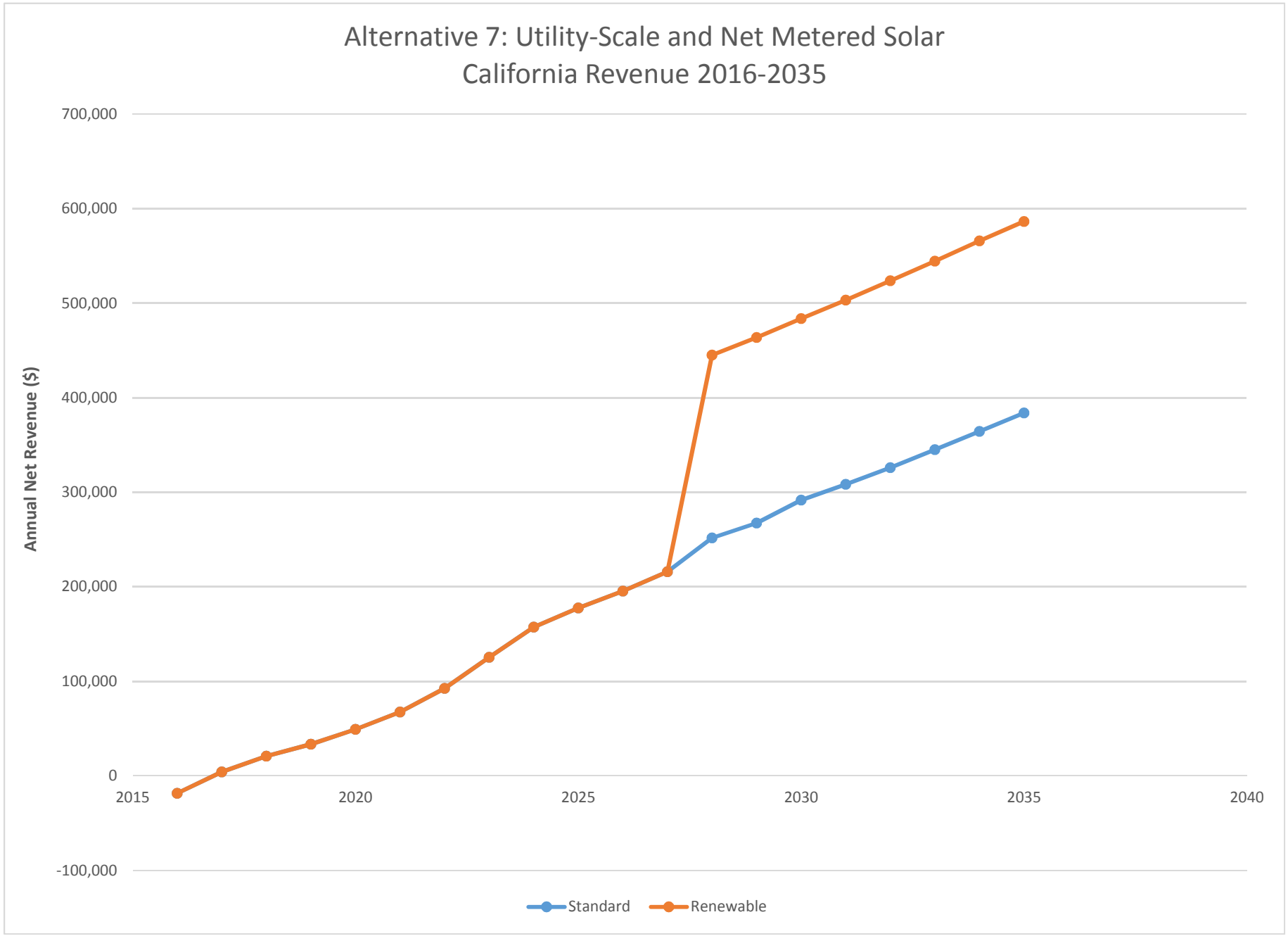
No. of Units	
Oregon:	**930**
California:	**212**

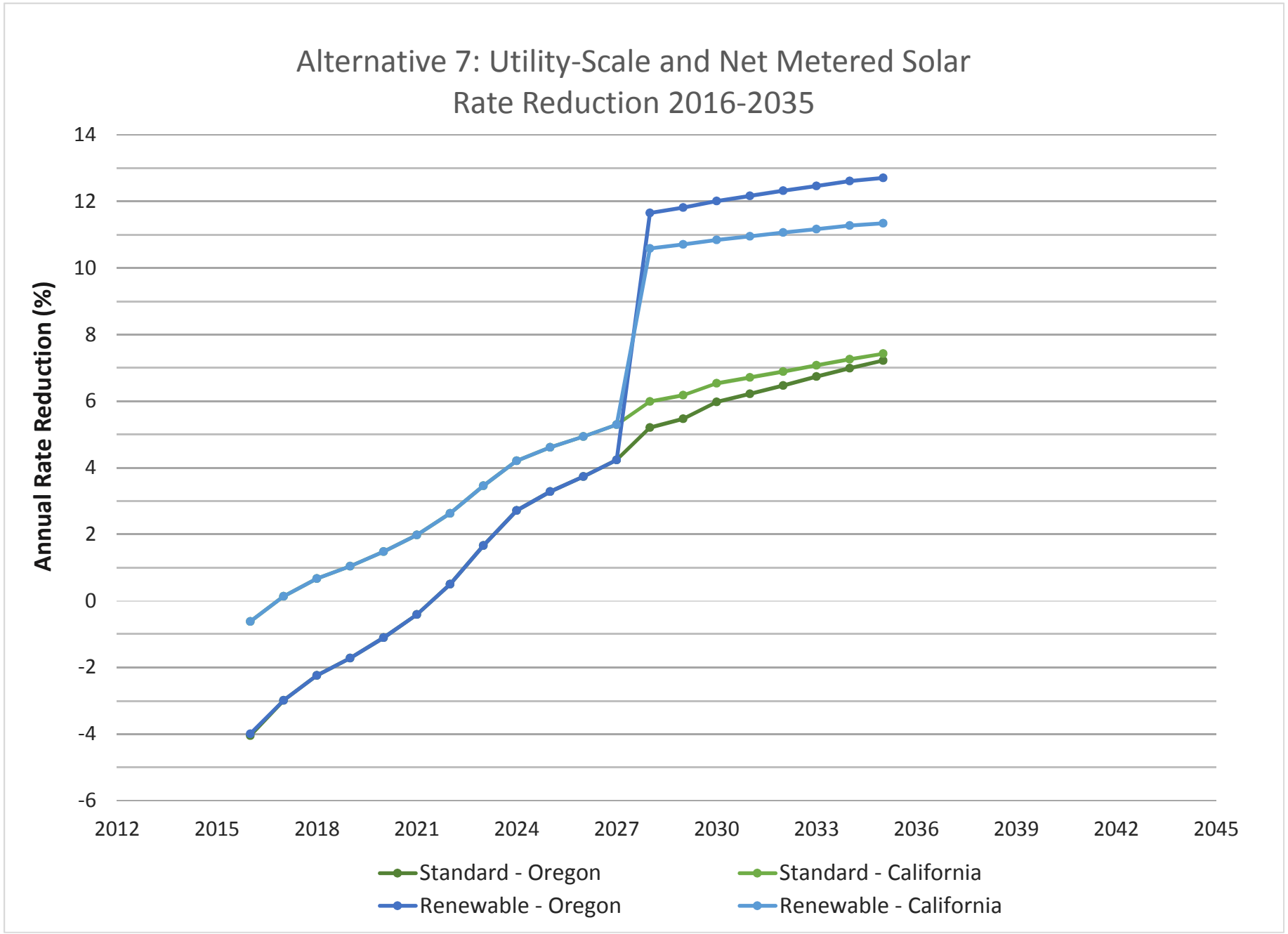
Current Cost Information	
OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:	
General Rate:	3.0%
Average Energy Rate:	3.0%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue -Utility Scale ($)	NEM Energy Credit OR ($)	NEM Energy Credit CA ($)	Net Revenue OR ($)	Net Revenue CA ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	779,526	746,070	237,544	(368,048.49)	(18,291.58)	9.979	13.486	-4.0	-0.6
2017	2.63	2.17	872,496	768,452	244,670	(283,556)	4,166	10.179	13.786	-3.0	0.1
2018	2.82	2.30	934,066	791,505	252,010	(219,209)	20,938	10.409	14.124	-2.2	0.7
2019	2.94	2.38	972,838	815,251	259,571	(172,993)	33,629	10.666	14.493	-1.7	1.0
2020	3.10	2.51	1,025,807	839,708	267,358	(114,780)	49,126	10.920	14.862	-1.1	1.5
2021	3.30	2.71	1,094,067	864,899	275,379	(43,668)	67,636	11.170	15.230	-0.4	2.0
2022	3.60	3.00	1,195,911	890,846	283,640	55,248	92,567	11.401	15.583	0.5	2.6
2023	4.03	3.37	1,339,393	917,572	292,149	188,538	125,422	11.605	15.914	1.7	3.5
2024	4.44	3.73	1,476,595	945,099	300,914	317,211	157,294	11.825	16.264	2.7	4.2
2025	4.66	3.93	1,550,588	973,452	309,941	394,941	177,600	12.109	16.681	3.3	4.6
2026	4.84	4.09	1,610,930	1,002,655	319,239	462,085	195,563	12.415	17.124	3.7	4.9
2027	5.06	4.27	1,683,831	1,032,735	328,817	539,992	216,064	12.721	17.571	4.2	5.3
2028	8.78	6.60	2,877,558	1,063,717	338,681	1,530,808	445,247	12.087	17.086	11.7	10.6
2029	8.96	6.74	2,936,807	1,095,629	348,841	1,598,734	463,632	12.427	17.575	11.8	10.7
2030	9.17	6.87	3,004,111	1,128,498	359,307	1,673,807	483,735	12.771	18.074	12.0	10.8
2031	9.36	7.03	3,067,320	1,162,352	370,086	1,746,154	503,305	13.131	18.594	12.2	11.0
2032	9.56	7.20	3,133,941	1,197,223	381,188	1,821,907	523,744	13.501	19.127	12.3	11.1
2033	9.76	7.37	3,200,563	1,233,140	392,624	1,898,306	544,424	13.883	19.678	12.5	11.2
2034	9.97	7.55	3,270,597	1,270,134	404,403	1,978,148	565,988	14.276	20.245	12.6	11.3
2035	10.15	7.76	3,333,669	1,308,238	416,535	2,053,007	586,513	14.688	20.836	12.7	11.3
									average:	**5.1**	**5.9**


Alternative 7: Utility-Scale and Net Metered Solar
Oregon Revenue 2016-2035
Annual Net Revenue ($)
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
-500,000
2015
2020
2025
2030
2035
2040
Standard
Renewable


Alternative 7: Utility-Scale and Net Metered Solar
California Revenue 2016-2035
Annual Net Revenue ($)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
-100,000
2015
2020
2025
2030
2035
2040
Standard
Renewable


Alternative 7: Utility-Scale and Net Metered Solar
Rate Reduction 2016-2035
Annual Rate Reduction (%)
14
12
10
8
6
4
2
0
-2
-4
-6
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Standard - Oregon
Standard - California
Renewable - Oregon
Renewable - California

Alternative 8: Net Metering

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 Fuel Cell Unit Cost: $20,000

4 The full loan amount is used for project development.

5 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

6 All generated energy is net metered to offset demand. Does not account for excess energy credit compesation.

7 Assumes irrigator negotiates to begin NEM services at the end of the irrigation season, which would allow energy credit accrual through the end of the irrigation season. (maximizes energy production and avoids excess credits being sent to low-income program instead of the PAC bill.)

Alternative 8: Net Metering

Loan details

Principal - Amount Borrowed ($):	40,000,000.00
OR Energy Trust Incentive* ($):	6,445,000.00
Interest Rate:	3.0%
Payback Period (years):	30
Annual Loan Payments ($):	1,711,951.25

**From the incentive rate calculation performed by EnergyTrust, based on system size (nonlinear calculations used for projects sized 16-300kW)*

Alternative 8: Net Metering

	Solar	Fuel Cells
Project Size (kW):	5.00	8.00
Capacity Factor:	0.19	0.7
Project Annual Generation (kWh):	8,360	49,056
Estimated O&M Costs ($/kW):	30	35
Projected Annual O&M ($):	150	280
Estimated Fuel Costs ($/kWh):	--	0.030
Projected Annual Fuel Cost ($):	--	1471.68

Funding Distribution	Total	OR	CA
Total	40,000,000	32,560,000	7,440,000
Solar PVs	30,000,000	22,560,000	7,440,000
Fuel Cells	10,000,000	10,000,000	0

No. of Units	Total	OR	CA
Solar:	1,714	1,289	425
Fuel Cells:	500	500	0

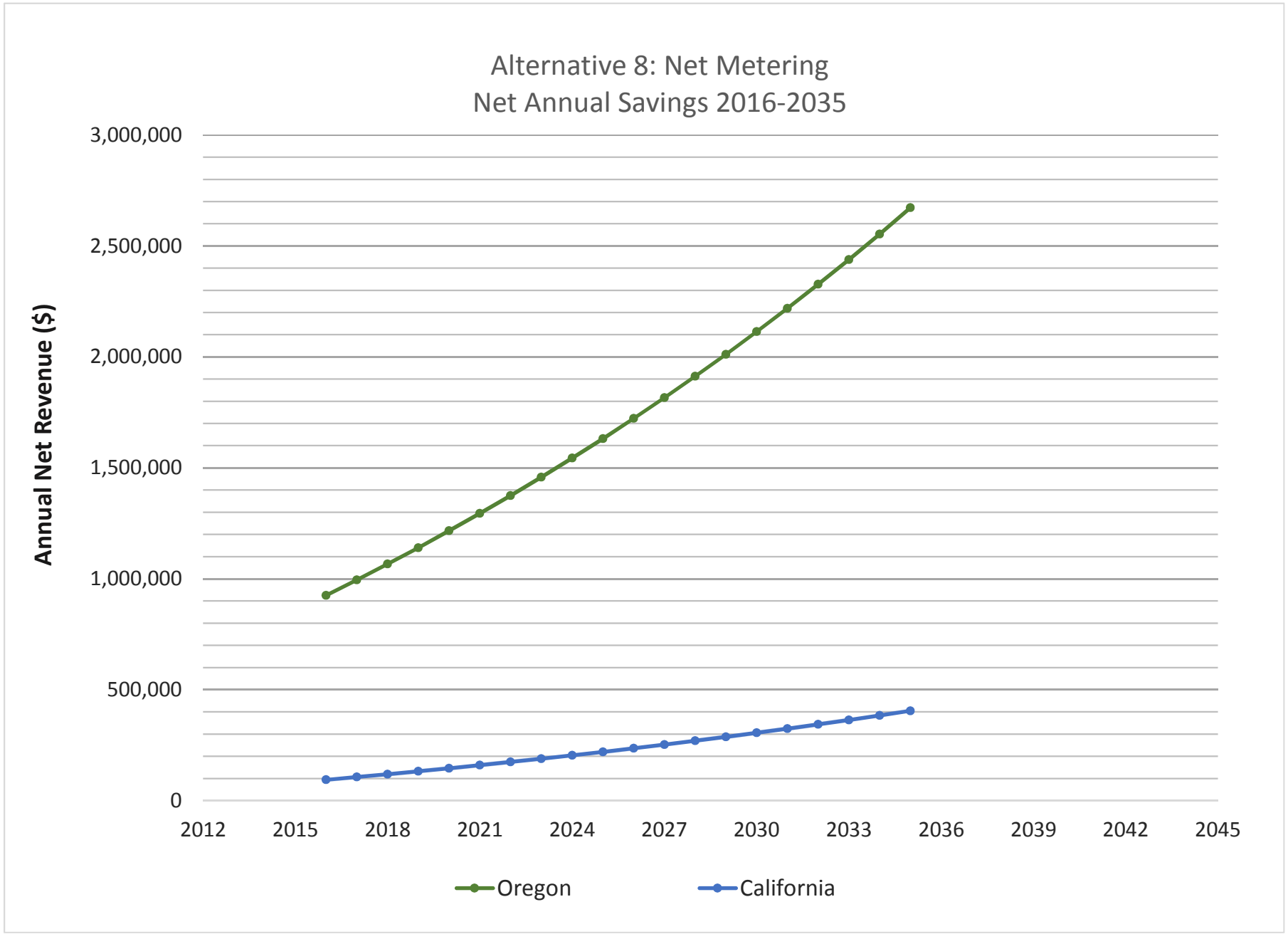
Current Cost Information	
OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

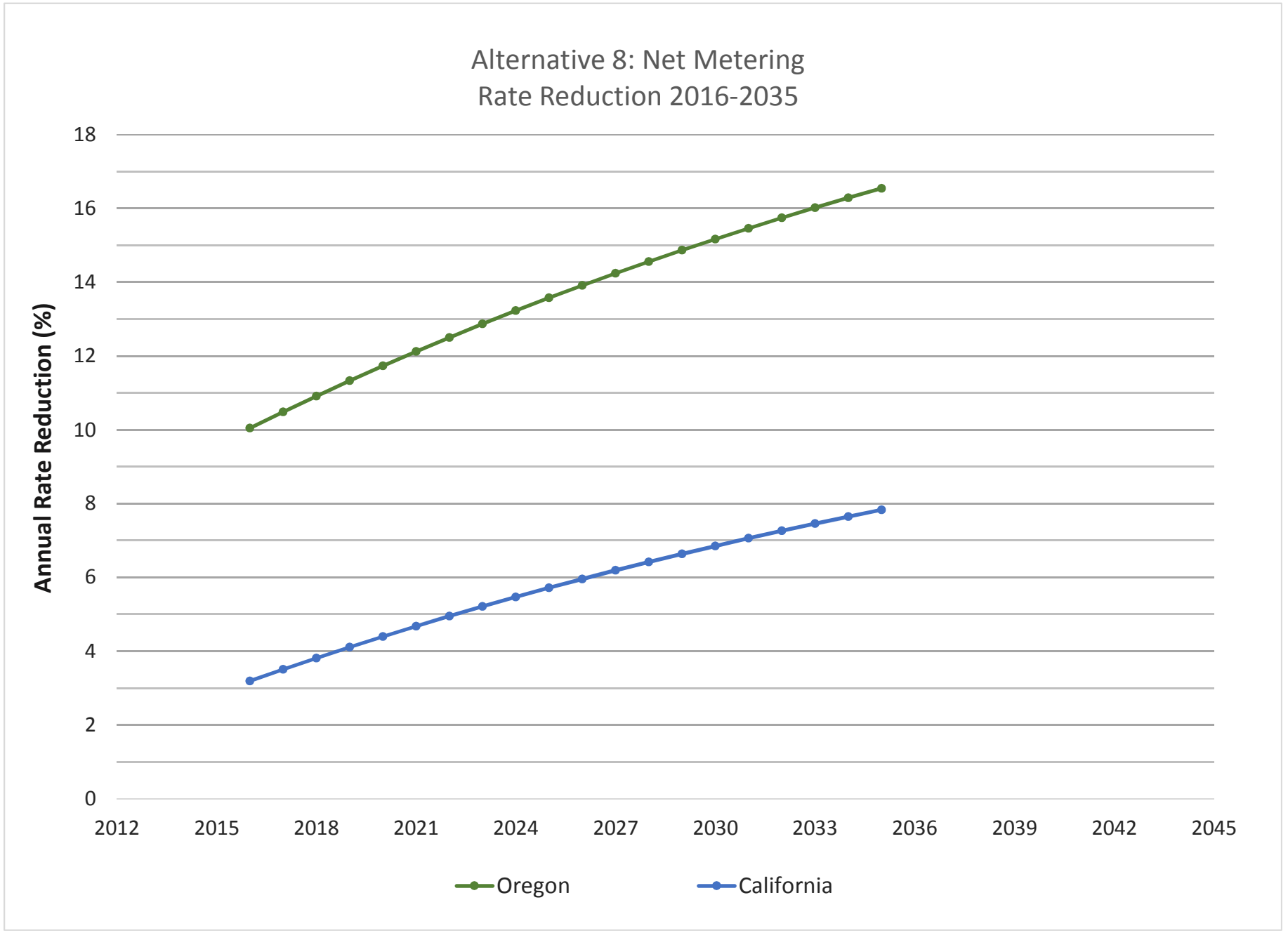
Loan Payment Distribution			
Total Annual Loan Payment ($):	1,711,951.25		
	Total	**Solar**	**Fuel Cells**
OR	1,393,528.31	965,540.50	427,987.81
CA	318,422.93	318,422.93	-

Inflation Rate:	
General Rate:	3.0%
Energy Rate:	3.0%

Fuel cells may not be eligible in California

	Solar Installations								Fuel Cell Installations						Combined Savings					
Delivery Year	**Energy Credit OR ($/unit)**	**Energy Credit CA ($/unit)**	**Annual Savings OR ($/unit)**	**Annual Savings CA ($/unit)**	**New Effective OR Rate (¢/kWh)**	**New Effective CA Rate (¢/kWh)**	**OR Cost Reduction (%)**	**CA Cost Reduction (%)**	**Energy Credit OR ($/unit)**	***Energy Credit CA* ($/unit)***	**New Effective OR Rate (¢/kWh)**	***New Effective CA Rate* (¢/kWh)***	**OR Cost Reduction (%)**	***CA Cost Reduction* (%)***	**Annual Savings OR ($)**	**Annual Savings CA ($)**	**New Effective OR Rate (¢/kWh)**	**New Effective CA Rate (¢/kWh)**	**OR Cost Reduction (%)**	**CA Cost Reduction (%)**
2016	802	1,120	(96.84)	221.26	9.726	12.976	-1.4	3.2	2,100	-	8.502	*13.403*	11.4	*0.0*	925,057.36	94,035.66	8.632	12.976	10.0	3.2
2017	826	1,154	(77.27)	250.38	9.988	13.321	-1.0	3.5	2,188	-	8.744	*13.805*	11.5	*0.0*	994,614.93	106,409.42	8.848	13.321	10.5	3.5
2018	851	1,189	(57.12)	280.36	10.257	13.678	-0.8	3.8	2,280	-	8.993	*14.219*	11.7	*0.0*	1,066,259.23	119,154.39	9.070	13.678	10.9	3.8
2019	877	1,224	(36.36)	311.25	10.535	14.045	-0.5	4.1	2,374	-	9.249	*14.646*	11.8	*0.0*	1,140,052.86	132,281.71	9.298	14.045	11.3	4.1
2020	903	1,261	(14.98)	343.07	10.820	14.422	-0.2	4.4	2,471	-	9.514	*15.085*	11.9	*0.0*	1,216,060.29	145,802.85	9.534	14.422	11.7	4.4
2021	930	1,299	7.05	375.83	11.115	14.812	0.1	4.7	2,571	-	9.786	*15.538*	12.0	*0.0*	1,294,347.95	159,729.62	9.776	14.812	12.1	4.7
2022	958	1,338	29.73	409.59	11.418	15.213	0.3	4.9	2,673	-	10.066	*16.004*	12.2	*0.0*	1,374,984.24	174,074.20	10.026	15.213	12.5	4.9
2023	987	1,378	53.09	444.35	11.731	15.626	0.6	5.2	2,779	-	10.354	*16.484*	12.3	*0.0*	1,458,039.62	188,849.11	10.283	15.626	12.9	5.2
2024	1,016	1,419	77.16	480.16	12.052	16.051	0.9	5.5	2,888	-	10.652	*16.979*	12.4	*0.0*	1,543,586.65	204,067.27	10.548	16.051	13.2	5.5
2025	1,047	1,462	101.94	517.04	12.384	16.489	1.1	5.7	3,001	-	10.958	*17.488*	12.5	*0.0*	1,631,700.10	219,741.98	10.821	16.489	13.6	5.7
2026	1,078	1,506	127.47	555.03	12.725	16.940	1.3	6.0	3,116	-	11.273	*18.013*	12.6	*0.0*	1,722,456.96	235,886.92	11.102	16.940	13.9	6.0
2027	1,110	1,551	153.77	594.16	13.077	17.405	1.6	6.2	3,235	-	11.598	*18.553*	12.7	*0.0*	1,815,936.51	252,516.22	11.392	17.405	14.2	6.2
2028	1,144	1,598	180.86	634.46	13.439	17.884	1.8	6.4	3,358	-	11.933	*19.109*	12.8	*0.0*	1,912,220.46	269,644.39	11.690	17.884	14.6	6.4
2029	1,178	1,645	208.75	675.97	13.812	18.377	2.0	6.6	3,485	-	12.277	*19.683*	12.9	*0.0*	2,011,392.92	287,286.41	11.997	18.377	14.9	6.6
2030	1,213	1,695	237.49	718.72	14.196	18.885	2.2	6.8	3,615	-	12.632	*20.273*	13.0	*0.0*	2,113,540.56	305,457.69	12.313	18.885	15.2	6.8
2031	1,250	1,746	267.08	762.76	14.592	19.408	2.4	7.1	3,749	-	12.998	*20.881*	13.1	*0.0*	2,218,752.63	324,174.11	12.639	19.408	15.5	7.1
2032	1,287	1,798	297.57	808.12	14.999	19.947	2.6	7.3	3,887	-	13.374	*21.508*	13.1	*0.0*	2,327,121.05	343,452.02	12.975	19.947	15.7	7.3
2033	1,326	1,852	328.97	854.84	15.419	20.502	2.8	7.5	4,029	-	13.762	*22.153*	13.2	*0.0*	2,438,740.53	363,308.27	13.320	20.502	16.0	7.5
2034	1,366	1,908	361.31	902.97	15.851	21.073	3.0	7.6	4,176	-	14.162	*22.818*	13.3	*0.0*	2,553,708.60	383,760.21	13.676	21.073	16.3	7.6
2035	1,407	1,965	394.62	952.53	16.297	21.662	3.1	7.8	4,327	-	14.573	*23.502*	13.4	*0.0*	2,672,125.71	404,825.70	14.043	21.662	16.5	7.8
																		average:	**13.6**	**5.7**


Alternative 8: Net Metering
Net Annual Savings 2016-2035
Annual Net Revenue ($)
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Oregon
California


Alternative 8: Net Metering
Rate Reduction 2016-2035
Annual Rate Reduction (%)
18
16
14
12
10
8
6
4
2
0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Oregon
California

Analysis with Non-Reimbursable Investment

Alternative 1: Utility-Scale Solar

List of Assumptions

1 This calculator assumes the project will be funded with $40Million of non-reimbursable funds.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

4 On-peak hours are from 6AM to 10PM

5 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 1: Utility-Scale Solar

Based on Standard Solar Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	25,974.03
Capacity Factor:	0.3
Project Annual Generation (kWh):	68,259,740.26
Estimated O&M Costs ($/kW):	27
Project Annual O&M ($):	701,298.70

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

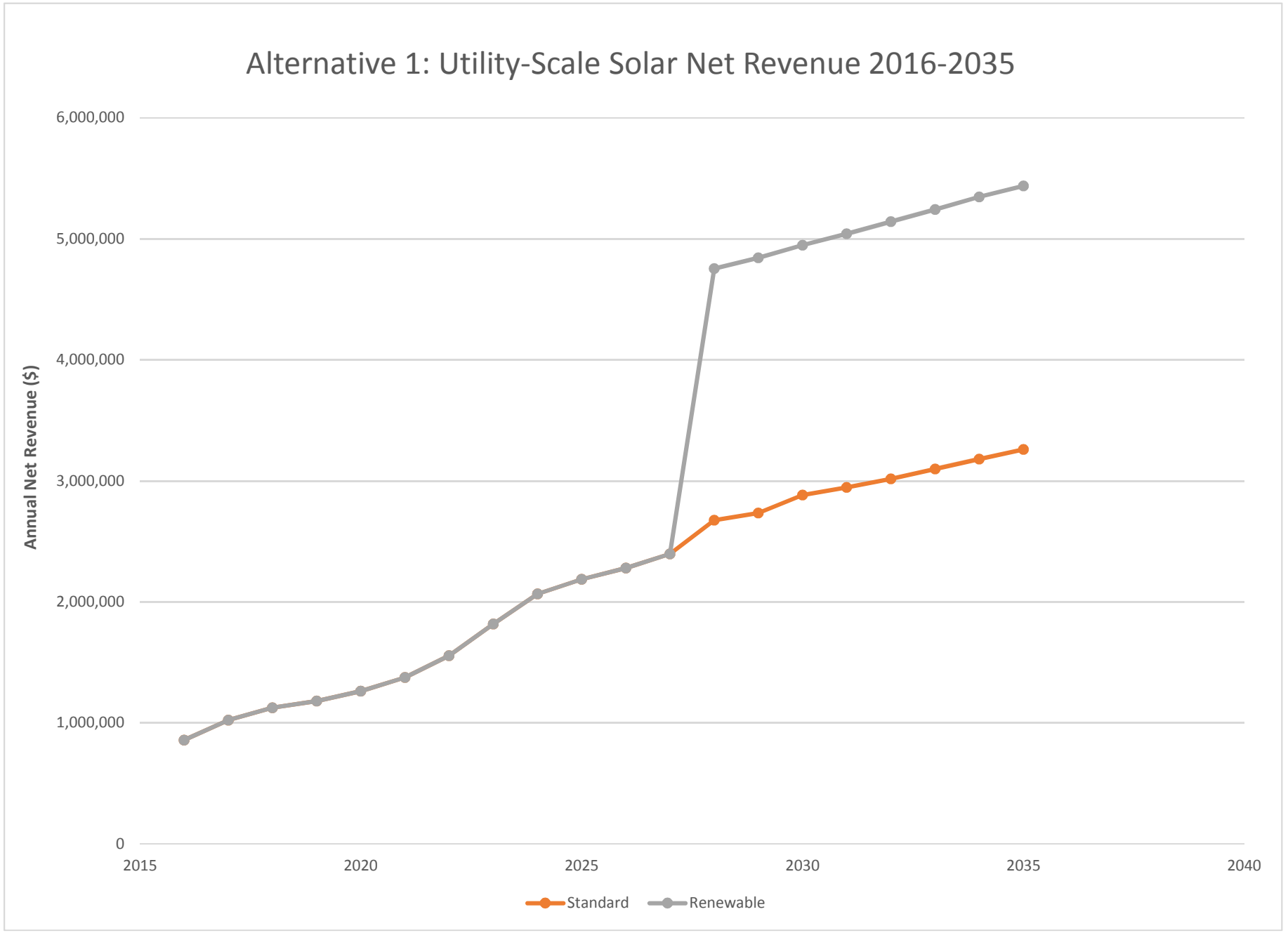
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,559,052	857,754	8.869	12.678	7.6	5.4
2017	2.63	2.17	1,744,992	1,022,654	9.017	12.940	8.8	6.3
2018	2.82	2.30	1,868,133	1,124,125	9.227	13.269	9.4	6.7
2019	2.94	2.38	1,945,676	1,179,348	9.486	13.649	9.5	6.8
2020	3.10	2.51	2,051,615	1,262,297	9.730	14.018	9.9	7.1
2021	3.30	2.71	2,188,134	1,375,137	9.958	14.375	10.5	7.5
2022	3.60	3.00	2,391,821	1,554,434	10.140	14.690	11.5	8.2
2023	4.03	3.37	2,678,785	1,816,276	10.262	14.948	13.0	9.3
2024	4.44	3.73	2,953,189	2,064,805	10.405	15.233	14.4	10.3
2025	4.66	3.93	3,101,177	2,186,141	10.667	15.640	14.8	10.6
2026	4.84	4.09	3,221,860	2,279,373	10.964	16.085	15.0	10.7
2027	5.06	4.27	3,367,663	2,396,901	11.251	16.526	15.3	10.9
2028	5.79	3.25	3,674,831	2,674,947	11.413	16.848	16.6	11.8
2029	5.93	3.34	3,764,934	2,735,053	11.773	17.370	16.5	11.7
2030	6.20	3.55	3,942,683	2,881,905	12.071	17.837	16.8	12.0
2031	6.35	3.64	4,038,519	2,945,919	12.452	18.391	16.7	11.9
2032	6.51	3.74	4,141,182	3,015,803	12.842	18.958	16.6	11.9
2033	6.69	3.86	4,257,497	3,098,357	13.234	19.534	16.6	11.8
2034	6.87	3.98	4,373,811	3,179,897	13.640	20.129	16.5	11.8
2035	7.05	4.09	4,489,034	3,259,302	14.063	20.747	16.4	11.7
						average	**13.6**	**9.7**

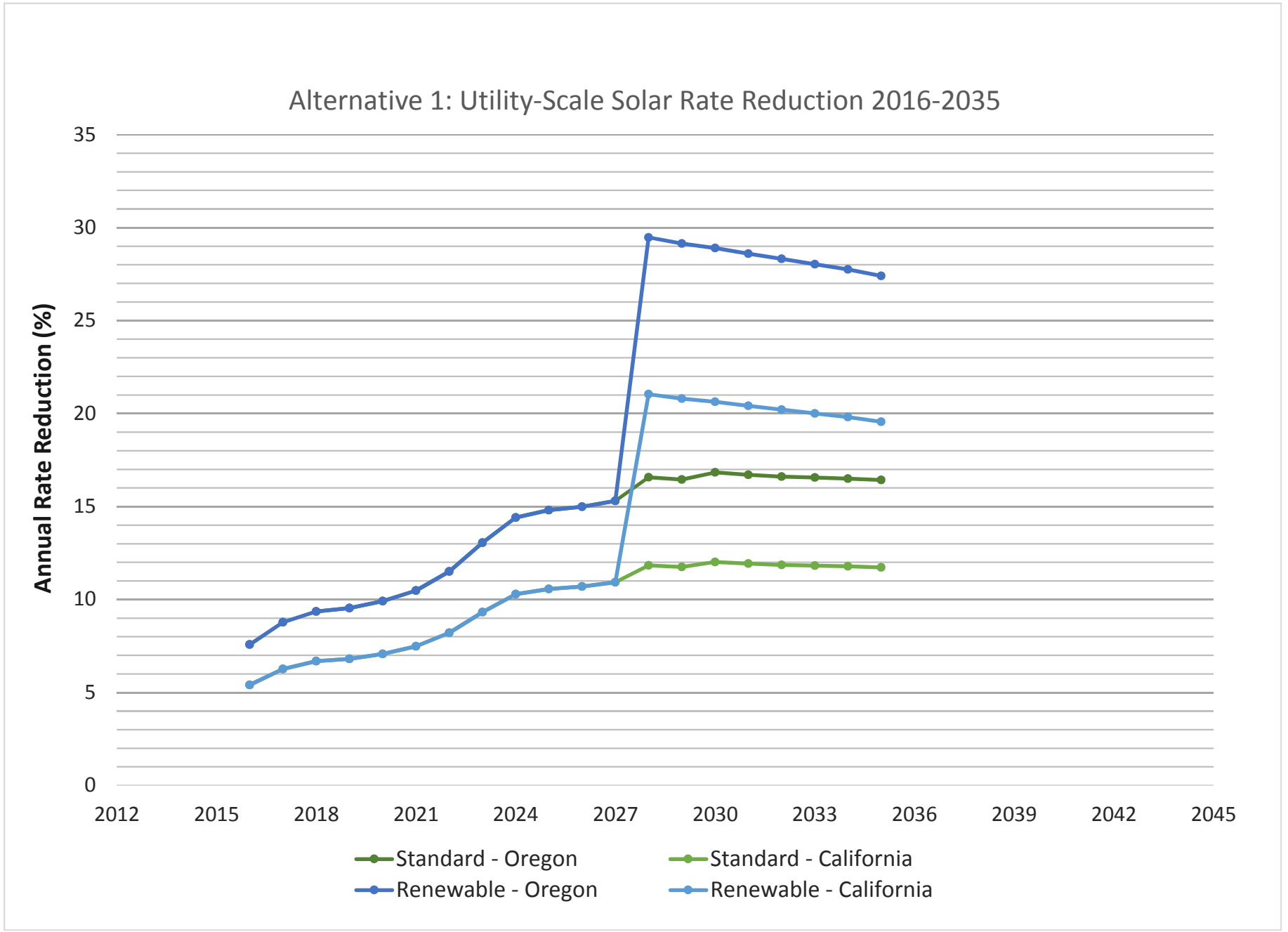
Alternative 1: Utility-Scale Solar

Based on Renewable Solar Fixed Avoided Cost Prices from Schedule 37

		Current Cost Information		Inflation Assumptions:	
Project Size (kW):	25,974	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	68,259,740	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	27	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	701,299	PAC PA-20 rate ($/kWh):	0.13403		

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,559,052	857,754	8.869	12.678	7.6	5.4
2017	2.63	2.17	1,744,992	1,022,654	9.017	12.940	8.8	6.3
2018	2.82	2.30	1,868,133	1,124,125	9.227	13.269	9.4	6.7
2019	2.94	2.38	1,945,676	1,179,348	9.486	13.649	9.5	6.8
2020	3.10	2.51	2,051,615	1,262,297	9.730	14.018	9.9	7.1
2021	3.30	2.71	2,188,134	1,375,137	9.958	14.375	10.5	7.5
2022	3.60	3.00	2,391,821	1,554,434	10.140	14.690	11.5	8.2
2023	4.03	3.37	2,678,785	1,816,276	10.262	14.948	13.0	9.3
2024	4.44	3.73	2,953,189	2,064,805	10.405	15.233	14.4	10.3
2025	4.66	3.93	3,101,177	2,186,141	10.667	15.640	14.8	10.6
2026	4.84	4.09	3,221,860	2,279,373	10.964	16.085	15.0	10.7
2027	5.06	4.27	3,367,663	2,396,901	11.251	16.526	15.3	10.9
2028	8.78	6.60	5,755,115	4,755,231	9.650	15.089	29.5	21.0
2029	8.96	6.74	5,873,614	4,843,733	9.985	15.588	29.1	20.8
2030	9.17	6.87	6,008,222	4,947,445	10.320	16.090	28.9	20.6
2031	9.36	7.03	6,134,639	5,042,039	10.675	16.619	28.6	20.4
2032	9.56	7.20	6,267,882	5,142,504	11.038	17.160	28.3	20.2
2033	9.76	7.37	6,401,125	5,241,986	11.416	17.721	28.0	20.0
2034	9.97	7.55	6,541,194	5,347,280	11.802	18.297	27.8	19.8
2035	10.15	7.76	6,667,338	5,437,607	12.216	18.905	27.4	19.6
						average:	**18.4**	**13.1**


Alternative 1: Utility-Scale Solar Net Revenue 2016-2035
Annual Net Revenue ($)
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
2015
2020
2025
2030
2035
2040
Standard
Renewable


Alternative 1: Utility-Scale Solar Rate Reduction 2016-2035
Annual Rate Reduction (%)
35
30
25
20
15
10
5
0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Standard - Oregon
Standard - California
Renewable - Oregon
Renewable - California

Alternative 2: Low-head Hydropower

List of Assumptions

1 This calculator assumes the project will be funded with non-reimbursable funds.

2 The full loan amount is used for project development.

3 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

4 On-peak hours are from 6AM to 10PM

5 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 2: Low-Head Hydro at Keno Dam

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	3,790.46
Capacity Factor:	0.825
Project Annual Generation (kWh):	27,393,680.80
Estimated O&M Costs ($/kW):	30
Project Annual O&M ($):	113,713.91

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	598,826	485,112	9.185	12.993	4.3	3.1	2.34	1.99	598,826	485,112	9.185	12.993	4.3	3.1
2017	2.63	2.17	665,009	547,884	9.419	13.342	4.7	3.4	2.63	2.17	665,009	547,884	9.419	13.342	4.7	3.4
2018	2.82	2.30	709,825	589,186	9.681	13.721	4.9	3.5	2.82	2.30	709,825	589,186	9.681	13.721	4.9	3.5
2019	2.94	2.38	737,876	613,618	9.966	14.127	5.0	3.5	2.94	2.38	737,876	613,618	9.966	14.127	5.0	3.5
2020	3.10	2.51	778,090	650,104	10.249	14.536	5.1	3.6	3.10	2.51	778,090	650,104	10.249	14.536	5.1	3.6
2021	3.30	2.71	832,877	701,052	10.530	14.945	5.3	3.8	3.30	2.71	832,877	701,052	10.530	14.945	5.3	3.8
2022	3.60	3.00	913,853	778,073	10.798	15.346	5.8	4.1	3.60	3.00	913,853	778,073	10.798	15.346	5.8	4.1
2023	4.03	3.37	1,024,414	884,560	11.052	15.736	6.4	4.5	4.03	3.37	1,024,414	884,560	11.052	15.736	6.4	4.5
2024	4.44	3.73	1,130,702	986,652	11.319	16.144	6.9	4.9	4.44	3.73	1,130,702	986,652	11.319	16.144	6.9	4.9
2025	4.66	3.93	1,188,557	1,040,186	11.639	16.608	7.0	5.0	4.66	3.93	1,188,557	1,040,186	11.639	16.608	7.0	5.0
2026	4.84	4.09	1,235,455	1,082,633	11.978	17.097	7.1	5.1	4.84	4.09	1,235,455	1,082,633	11.978	17.097	7.1	5.1
2027	5.06	4.27	1,290,900	1,133,493	12.322	17.595	7.2	5.2	5.06	4.27	1,290,900	1,133,493	12.322	17.595	7.2	5.2
2028	6.28	3.25	1,355,111	1,192,982	12.670	18.101	7.4	5.3	10.26	6.60	2,369,444	2,207,315	11.810	17.243	13.7	9.8
2029	6.44	3.34	1,390,503	1,223,511	13.055	18.648	7.4	5.3	10.47	6.74	2,418,533	2,251,541	12.183	17.779	13.5	9.7
2030	6.71	3.55	1,457,234	1,285,232	13.425	19.187	7.5	5.4	10.72	6.87	2,472,554	2,300,551	12.564	18.328	13.4	9.6
2031	6.88	3.64	1,494,161	1,316,998	13.834	19.768	7.5	5.3	10.94	7.03	2,525,588	2,348,425	12.959	18.896	13.3	9.5
2032	7.04	3.74	1,530,759	1,348,281	14.256	20.368	7.4	5.3	11.18	7.20	2,582,895	2,400,418	13.363	19.478	13.2	9.4
2033	7.24	3.86	1,575,904	1,387,952	14.684	20.980	7.4	5.3	11.41	7.37	2,638,669	2,450,717	13.783	20.081	13.1	9.4
2034	7.43	3.98	1,619,514	1,425,924	15.127	21.612	7.4	5.3	11.65	7.55	2,697,182	2,503,591	14.214	20.701	13.0	9.3
2035	7.62	4.09	1,661,920	1,462,522	15.587	22.266	7.4	5.3	11.87	7.76	2,756,243	2,556,845	14.659	21.341	12.9	9.2
						average	6.5	4.6						average	8.8	6.3

Alternative 2: Low-Head Hydro at Westside Powerhouse

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	526.45	**Current Cost Information**		**Inflation Assumptions:**	
Capacity Factor:	0.825	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	3,804,677.93	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	30	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	15,793.60	PAC PA-20 rate ($/kWh):	0.13403		

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	83,170	67,377	9.539	13.346	0.6	0.4	2.34	1.99	83,170	67,377	9.539	13.346	0.6	0.4
2017	2.63	2.17	92,362	76,095	9.819	13.741	0.7	0.5	2.63	2.17	92,362	76,095	9.819	13.741	0.7	0.5
2018	2.82	2.30	98,587	81,831	10.111	14.150	0.7	0.5	2.82	2.30	98,587	81,831	10.111	14.150	0.7	0.5
2019	2.94	2.38	102,483	85,225	10.414	14.574	0.7	0.5	2.94	2.38	102,483	85,225	10.414	14.574	0.7	0.5
2020	3.10	2.51	108,068	90,292	10.724	15.009	0.7	0.5	3.10	2.51	108,068	90,292	10.724	15.009	0.7	0.5
2021	3.30	2.71	115,677	97,368	11.042	15.455	0.7	0.5	3.30	2.71	115,677	97,368	11.042	15.455	0.7	0.5
2022	3.60	3.00	126,924	108,066	11.366	15.913	0.8	0.6	3.60	3.00	126,924	108,066	11.366	15.913	0.8	0.6
2023	4.03	3.37	142,280	122,856	11.698	16.380	0.9	0.6	4.03	3.37	142,280	122,856	11.698	16.380	0.9	0.6
2024	4.44	3.73	157,042	137,035	12.040	16.863	1.0	0.7	4.44	3.73	157,042	137,035	12.040	16.863	1.0	0.7
2025	4.66	3.93	165,077	144,470	12.398	17.366	1.0	0.7	4.66	3.93	165,077	144,470	12.398	17.366	1.0	0.7
2026	4.84	4.09	171,591	150,366	12.769	17.885	1.0	0.7	4.84	4.09	171,591	150,366	12.769	17.885	1.0	0.7
2027	5.06	4.27	179,292	157,430	13.150	18.420	1.0	0.7	5.06	4.27	179,292	157,430	13.150	18.420	1.0	0.7
2028	6.28	3.25	188,210	165,692	13.541	18.969	1.0	0.7	10.26	6.60	329,089	306,572	13.422	18.850	1.9	1.4
2029	6.44	3.34	193,125	169,932	13.948	19.539	1.0	0.7	10.47	6.74	335,907	312,714	13.827	19.418	1.9	1.3
2030	6.71	3.55	202,394	178,504	14.363	20.122	1.0	0.7	10.72	6.87	343,410	319,521	14.244	20.003	1.9	1.3
2031	6.88	3.64	207,522	182,916	14.795	20.727	1.0	0.7	10.94	7.03	350,776	326,170	14.674	20.606	1.8	1.3
2032	7.04	3.74	212,605	187,261	15.240	21.350	1.0	0.7	11.18	7.20	358,735	333,391	15.116	21.226	1.8	1.3
2033	7.24	3.86	218,876	192,771	15.697	21.990	1.0	0.7	11.41	7.37	366,482	340,377	15.572	21.865	1.8	1.3
2034	7.43	3.98	224,933	198,045	16.169	22.650	1.0	0.7	11.65	7.55	374,609	347,721	16.042	22.524	1.8	1.3
2035	7.62	4.09	230,822	203,128	16.654	23.331	1.0	0.7	11.87	7.76	382,811	355,117	16.526	23.202	1.8	1.3
						average	**1.0**	**0.7**						**average**	**1.5**	**1.1**

Alternative 2: Low-Head Hydro at Eastside Powerhouse

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	2,227.48	**Current Cost Information**		**Inflation Assumptions:**	
Capacity Factor:	0.765	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	14,927,250.15	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	30	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	66,824.47	PAC PA-20 rate ($/kWh):	0.13403		

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	326,310	259,485	9.376	13.184	2.3	1.6	2.34	1.99	326,310	259,485	9.376	13.184	2.3	1.6
2017	2.63	2.17	362,374	293,545	9.635	13.557	2.5	1.8	2.63	2.17	362,374	293,545	9.635	13.557	2.5	1.8
2018	2.82	2.30	386,795	315,901	9.913	13.952	2.6	1.9	2.82	2.30	386,795	315,901	9.913	13.952	2.6	1.9
2019	2.94	2.38	402,080	329,060	10.207	14.368	2.7	1.9	2.94	2.38	402,080	329,060	10.207	14.368	2.7	1.9
2020	3.10	2.51	423,994	348,782	10.505	14.790	2.7	2.0	3.10	2.51	423,994	348,782	10.505	14.790	2.7	2.0
2021	3.30	2.71	453,848	376,380	10.805	15.220	2.9	2.0	3.30	2.71	453,848	376,380	10.805	15.220	2.9	2.0
2022	3.60	3.00	497,973	418,181	11.104	15.650	3.1	2.2	3.60	3.00	497,973	418,181	11.104	15.650	3.1	2.2
2023	4.03	3.37	558,219	476,034	11.398	16.082	3.4	2.4	4.03	3.37	558,219	476,034	11.398	16.082	3.4	2.4
2024	4.44	3.73	616,137	531,486	11.705	16.529	3.7	2.6	4.44	3.73	616,137	531,486	11.705	16.529	3.7	2.6
2025	4.66	3.93	647,664	560,473	12.045	17.014	3.8	2.7	4.66	3.93	647,664	560,473	12.045	17.014	3.8	2.7
2026	4.84	4.09	673,219	583,412	12.402	17.519	3.8	2.7	4.84	4.09	673,219	583,412	12.402	17.519	3.8	2.7
2027	5.06	4.27	703,432	610,931	12.765	18.036	3.9	2.8	5.06	4.27	703,432	610,931	12.765	18.036	3.9	2.8
2028	6.28	3.25	738,421	643,145	13.136	18.566	4.0	2.8	10.26	6.60	1,291,147	1,195,872	12.668	18.098	7.4	5.3
2029	6.44	3.34	757,707	659,573	13.533	19.125	4.0	2.8	10.47	6.74	1,317,897	1,219,763	13.058	18.652	7.3	5.2
2030	6.71	3.55	794,070	692,992	13.927	19.687	4.0	2.9	10.72	6.87	1,347,334	1,246,256	13.458	19.220	7.3	5.2
2031	6.88	3.64	814,192	710,082	14.348	20.281	4.0	2.9	10.94	7.03	1,376,233	1,272,122	13.872	19.806	7.2	5.2
2032	7.04	3.74	834,135	726,901	14.782	20.893	4.0	2.9	11.18	7.20	1,407,461	1,300,227	14.296	20.409	7.2	5.1
2033	7.24	3.86	858,735	748,284	15.226	21.520	4.0	2.9	11.41	7.37	1,437,852	1,327,402	14.735	21.031	7.1	5.1
2034	7.43	3.98	882,499	768,735	15.685	22.168	4.0	2.8	11.65	7.55	1,469,737	1,355,973	15.187	21.671	7.0	5.0
2035	7.62	4.09	905,606	788,429	16.158	22.836	4.0	2.8	11.87	7.76	1,501,920	1,384,743	15.652	22.332	7.0	5.0
						average	**3.9**	**2.8**						**average**	**5.9**	**4.2**

Alternative 2: Low-Head Hydro at Eastside Powerhouse with A Canal Water

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	2,194.48	**Current Cost Information**		**Inflation Assumptions:**	
Capacity Factor:	0.6	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	11,534,181.41	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	30	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	65,834.37	PAC PA-20 rate ($/kWh):	0.13403		

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	252,137	186,303	9.438	13.245	1.6	1.2	2.34	1.99	252,137	186,303	9.438	13.245	1.6	1.2
2017	2.63	2.17	280,004	212,194	9.704	13.626	1.8	1.3	2.63	2.17	280,004	212,194	9.704	13.626	1.8	1.3
2018	2.82	2.30	298,874	229,030	9.986	14.026	1.9	1.4	2.82	2.30	298,874	229,030	9.986	14.026	1.9	1.4
2019	2.94	2.38	310,685	238,746	10.283	14.444	1.9	1.4	2.94	2.38	310,685	238,746	10.283	14.444	1.9	1.4
2020	3.10	2.51	327,617	253,520	10.585	14.871	2.0	1.4	3.10	2.51	327,617	253,520	10.585	14.871	2.0	1.4
2021	3.30	2.71	350,685	274,365	10.892	15.306	2.1	1.5	3.30	2.71	350,685	274,365	10.892	15.306	2.1	1.5
2022	3.60	3.00	384,780	306,171	11.199	15.745	2.3	1.6	3.60	3.00	384,780	306,171	11.199	15.745	2.3	1.6
2023	4.03	3.37	431,332	350,364	11.505	16.188	2.5	1.8	4.03	3.37	431,332	350,364	11.505	16.188	2.5	1.8
2024	4.44	3.73	476,085	392,688	11.823	16.647	2.7	2.0	4.44	3.73	476,085	392,688	11.823	16.647	2.7	2.0
2025	4.66	3.93	500,445	414,546	12.169	17.137	2.8	2.0	4.66	3.93	500,445	414,546	12.169	17.137	2.8	2.0
2026	4.84	4.09	520,192	431,716	12.530	17.648	2.8	2.0	4.84	4.09	520,192	431,716	12.530	17.648	2.8	2.0
2027	5.06	4.27	543,537	452,407	12.900	18.170	2.9	2.1	5.06	4.27	543,537	452,407	12.900	18.170	2.9	2.1
2028	6.28	3.25	570,573	476,709	13.277	18.706	3.0	2.1	10.26	6.60	997,661	903,796	12.915	18.345	5.6	4.0
2029	6.44	3.34	585,475	488,795	13.678	19.270	2.9	2.1	10.47	6.74	1,018,330	921,650	13.311	18.904	5.5	4.0
2030	6.71	3.55	613,572	513,992	14.079	19.839	3.0	2.1	10.72	6.87	1,041,075	941,495	13.717	19.477	5.5	3.9
2031	6.88	3.64	629,120	526,553	14.504	20.436	3.0	2.1	10.94	7.03	1,063,405	960,838	14.136	20.069	5.4	3.9
2032	7.04	3.74	644,530	538,885	14.942	21.052	3.0	2.1	11.18	7.20	1,087,535	981,890	14.566	20.678	5.4	3.9
2033	7.24	3.86	663,538	554,724	15.390	21.684	3.0	2.1	11.41	7.37	1,111,018	1,002,204	15.011	21.306	5.4	3.8
2034	7.43	3.98	681,901	569,822	15.853	22.336	3.0	2.1	11.65	7.55	1,135,656	1,023,577	15.469	21.952	5.3	3.8
2035	7.62	4.09	699,756	584,315	16.331	23.008	2.9	2.1	11.87	7.76	1,160,523	1,045,082	15.941	22.619	5.3	3.8
						average	**2.9**	**2.1**						**average**	**4.4**	**3.1**

Alternative 2: Low-Head Hydro at A Canal

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	926.56	**Current Cost Information**		**Inflation Assumptions:**	
Capacity Factor:	0.6	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	4,869,987.69	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	30	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	27,796.73	PAC PA-20 rate ($/kWh):	0.13403		

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	106,458	78,661	9.529	13.336	0.7	0.5	2.34	1.99	106,458	78,661	9.529	13.336	0.7	0.5
2017	2.63	2.17	118,224	89,593	9.808	13.729	0.8	0.5	2.63	2.17	118,224	89,593	9.808	13.729	0.8	0.5
2018	2.82	2.30	126,191	96,702	10.098	14.137	0.8	0.6	2.82	2.30	126,191	96,702	10.098	14.137	0.8	0.6
2019	2.94	2.38	131,178	100,804	10.400	14.561	0.8	0.6	2.94	2.38	131,178	100,804	10.400	14.561	0.8	0.6
2020	3.10	2.51	138,327	107,042	10.710	14.995	0.8	0.6	3.10	2.51	138,327	107,042	10.710	14.995	0.8	0.6
2021	3.30	2.71	148,067	115,843	11.026	15.440	0.9	0.6	3.30	2.71	148,067	115,843	11.026	15.440	0.9	0.6
2022	3.60	3.00	162,463	129,272	11.349	15.895	1.0	0.7	3.60	3.00	162,463	129,272	11.349	15.895	1.0	0.7
2023	4.03	3.37	182,118	147,932	11.676	16.359	1.1	0.8	4.03	3.37	182,118	147,932	11.676	16.359	1.1	0.8
2024	4.44	3.73	201,014	165,802	12.015	16.838	1.2	0.8	4.44	3.73	201,014	165,802	12.015	16.838	1.2	0.8
2025	4.66	3.93	211,299	175,031	12.372	17.340	1.2	0.8	4.66	3.93	211,299	175,031	12.372	17.340	1.2	0.8
2026	4.84	4.09	219,636	182,280	12.742	17.858	1.2	0.9	4.84	4.09	219,636	182,280	12.742	17.858	1.2	0.9
2027	5.06	4.27	229,493	191,016	13.121	18.391	1.2	0.9	5.06	4.27	229,493	191,016	13.121	18.391	1.2	0.9
2028	6.28	3.25	240,909	201,277	13.511	18.939	1.2	0.9	10.26	6.60	421,234	381,603	13.358	18.787	2.4	1.7
2029	6.44	3.34	247,201	206,380	13.917	19.508	1.2	0.9	10.47	6.74	429,961	389,141	13.762	19.354	2.3	1.7
2030	6.71	3.55	259,064	217,019	14.331	20.090	1.3	0.9	10.72	6.87	439,565	397,520	14.178	19.937	2.3	1.7
2031	6.88	3.64	265,629	222,322	14.762	20.693	1.3	0.9	10.94	7.03	448,993	405,687	14.606	20.538	2.3	1.6
2032	7.04	3.74	272,135	227,529	15.206	21.316	1.3	0.9	11.18	7.20	459,181	414,576	15.047	21.157	2.3	1.6
2033	7.24	3.86	280,161	234,217	15.662	21.955	1.3	0.9	11.41	7.37	469,097	423,153	15.502	21.795	2.3	1.6
2034	7.43	3.98	287,914	240,592	16.133	22.614	1.2	0.9	11.65	7.55	479,499	432,177	15.970	22.452	2.2	1.6
2035	7.62	4.09	295,452	246,711	16.617	23.294	1.2	0.9	11.87	7.76	489,999	441,257	16.452	23.129	2.2	1.6
						average	**1.2**	**0.9**						**average**	**1.9**	**1.3**

Alternative 2: Low-Head Hydro at G Canal

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	261.12	**Current Cost Information**		**Inflation Assumptions:**	
Capacity Factor:	0.6	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	1,372,451.08	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated O&M Costs ($/kW):	30	PAC 41 rate ($/kWh):	0.09596		
Project Annual O&M ($):	7,833.62	PAC PA-20 rate ($/kWh):	0.13403		

	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	30,002	22,168	9.577	13.384	0.2	0.1	2.34	1.99	30,002	22,168	9.577	13.384	0.2	0.1
2017	2.63	2.17	33,318	25,249	9.862	13.784	0.2	0.2	2.63	2.17	33,318	25,249	9.862	13.784	0.2	0.2
2018	2.82	2.30	35,563	27,252	10.157	14.196	0.2	0.2	2.82	2.30	35,563	27,252	10.157	14.196	0.2	0.2
2019	2.94	2.38	36,968	28,408	10.462	14.622	0.2	0.2	2.94	2.38	36,968	28,408	10.462	14.622	0.2	0.2
2020	3.10	2.51	38,983	30,166	10.775	15.060	0.2	0.2	3.10	2.51	38,983	30,166	10.775	15.060	0.2	0.2
2021	3.30	2.71	41,728	32,647	11.097	15.510	0.2	0.2	3.30	2.71	41,728	32,647	11.097	15.510	0.2	0.2
2022	3.60	3.00	45,785	36,431	11.427	15.973	0.3	0.2	3.60	3.00	45,785	36,431	11.427	15.973	0.3	0.2
2023	4.03	3.37	51,324	41,690	11.767	16.449	0.3	0.2	4.03	3.37	51,324	41,690	11.767	16.449	0.3	0.2
2024	4.44	3.73	56,649	46,726	12.116	16.939	0.3	0.2	4.44	3.73	56,649	46,726	12.116	16.939	0.3	0.2
2025	4.66	3.93	59,548	49,327	12.479	17.446	0.3	0.2	4.66	3.93	59,548	49,327	12.479	17.446	0.3	0.2
2026	4.84	4.09	61,898	51,370	12.853	17.969	0.3	0.2	4.84	4.09	61,898	51,370	12.853	17.969	0.3	0.2
2027	5.06	4.27	64,675	53,832	13.237	18.507	0.3	0.2	5.06	4.27	64,675	53,832	13.237	18.507	0.3	0.2
2028	6.28	3.25	67,892	56,724	13.634	19.062	0.4	0.3	10.26	6.60	118,712	107,543	13.590	19.019	0.7	0.5
2029	6.44	3.34	69,666	58,162	14.043	19.634	0.3	0.2	10.47	6.74	121,171	109,667	13.999	19.590	0.7	0.5
2030	6.71	3.55	73,009	61,160	14.463	20.222	0.4	0.3	10.72	6.87	123,877	112,028	14.420	20.179	0.7	0.5
2031	6.88	3.64	74,859	62,654	14.897	20.828	0.4	0.3	10.94	7.03	126,535	114,330	14.853	20.785	0.6	0.5
2032	7.04	3.74	76,693	64,122	15.344	21.454	0.4	0.3	11.18	7.20	129,406	116,835	15.300	21.409	0.6	0.5
2033	7.24	3.86	78,954	66,007	15.805	22.097	0.4	0.3	11.41	7.37	132,200	119,252	15.760	22.052	0.6	0.5
2034	7.43	3.98	81,139	67,803	16.279	22.760	0.4	0.3	11.65	7.55	135,132	121,795	16.233	22.715	0.6	0.5
2035	7.62	4.09	83,264	69,528	16.768	23.443	0.4	0.3	11.87	7.76	138,091	124,354	16.721	23.397	0.6	0.4
						average	**0.3**	**0.2**						**average**	**0.5**	**0.4**

Alternative 2: Low-Head Hydro at G Canal

Based on Baseload Fixed Avoided Cost Prices as provided in Schedule 37

Includes Eastside Powerhouse with A-Canal Water

Project Size (kW):	7,699.07
Capacity Factor:	varies
Project Annual Generation (kWh):	48,974,978.91
Estimated O&M Costs ($/kW):	30
Project Annual O&M ($):	230,972.24

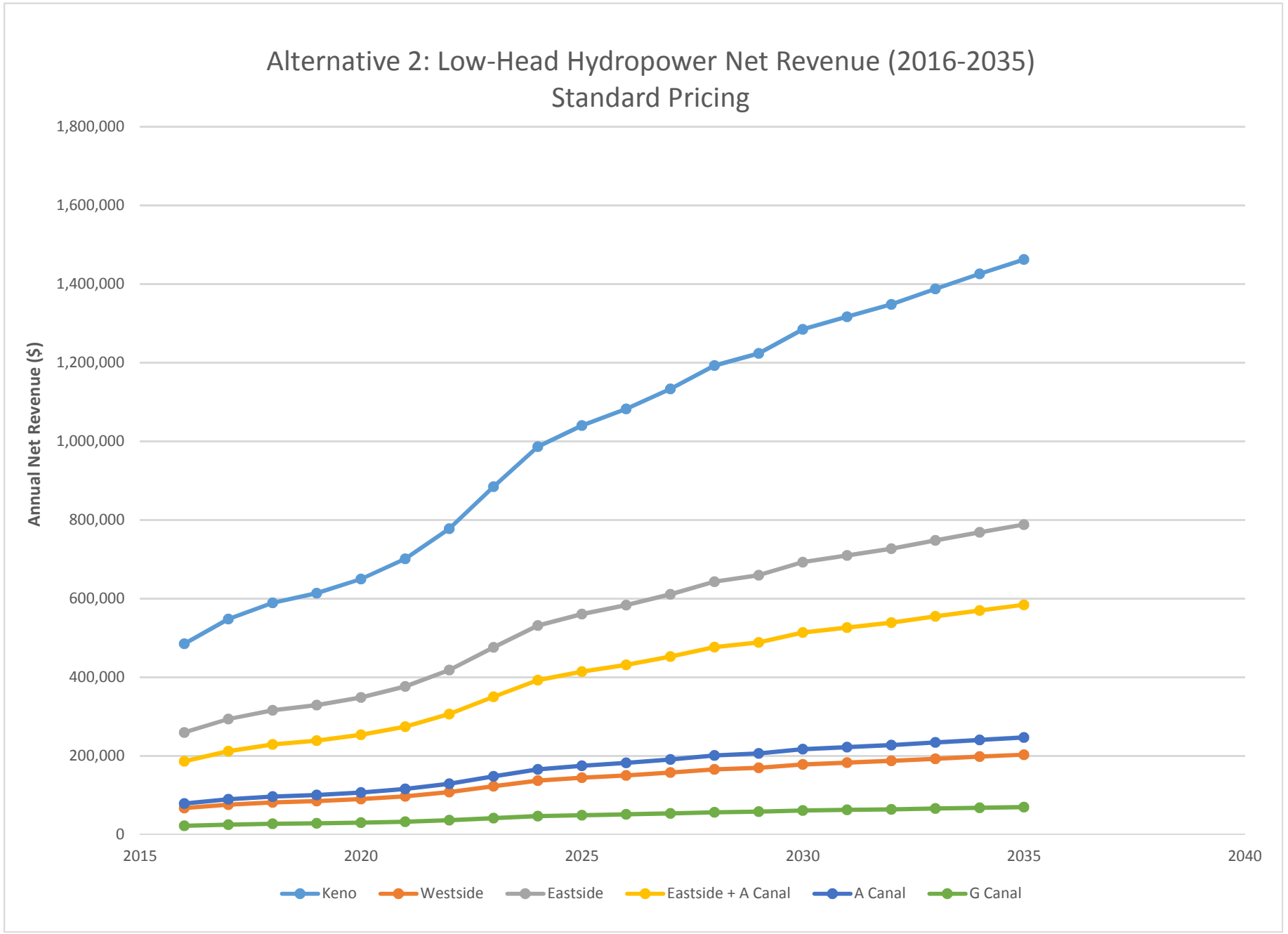
Current Cost Information

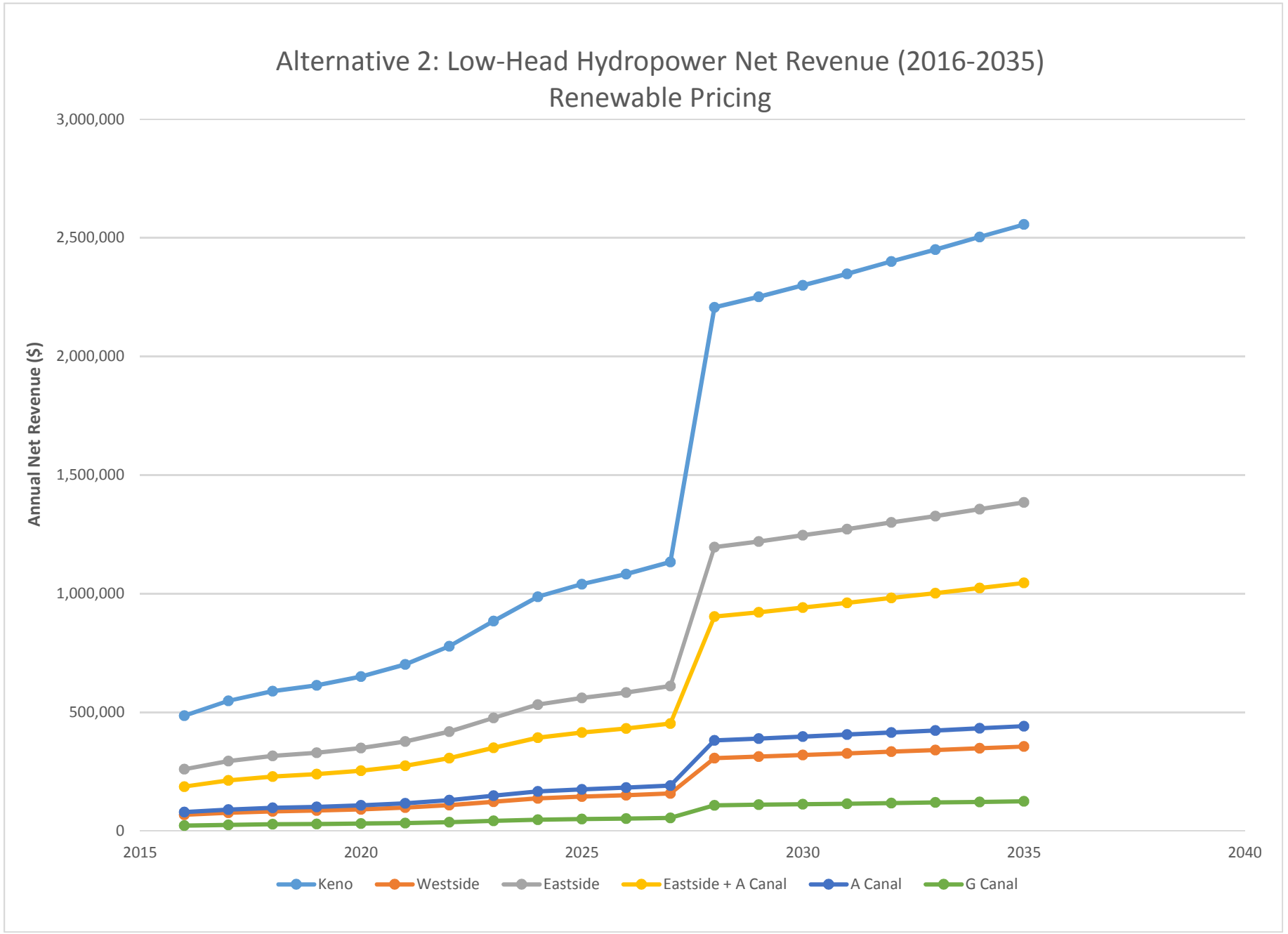
OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

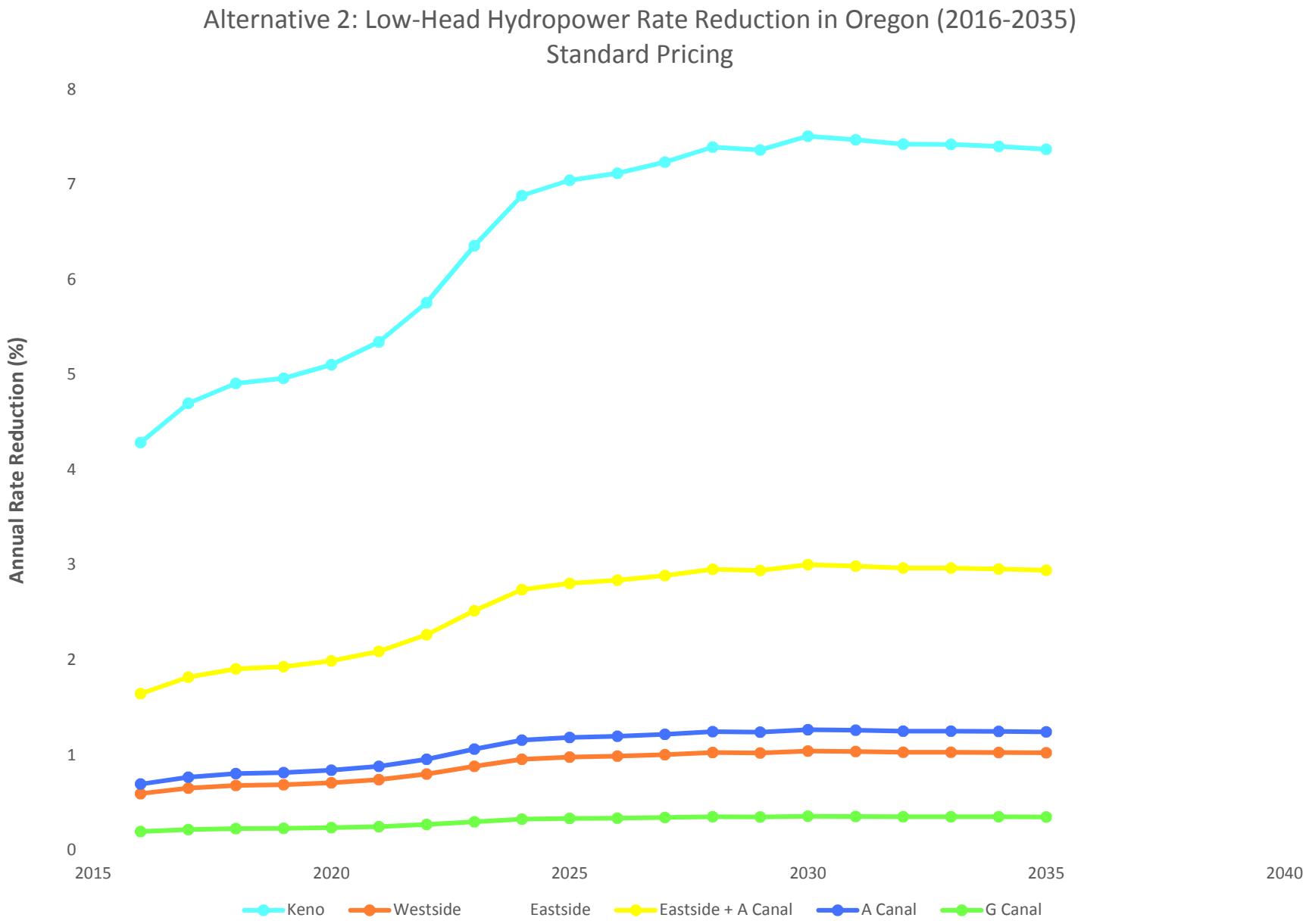
Inflation Assumptions:

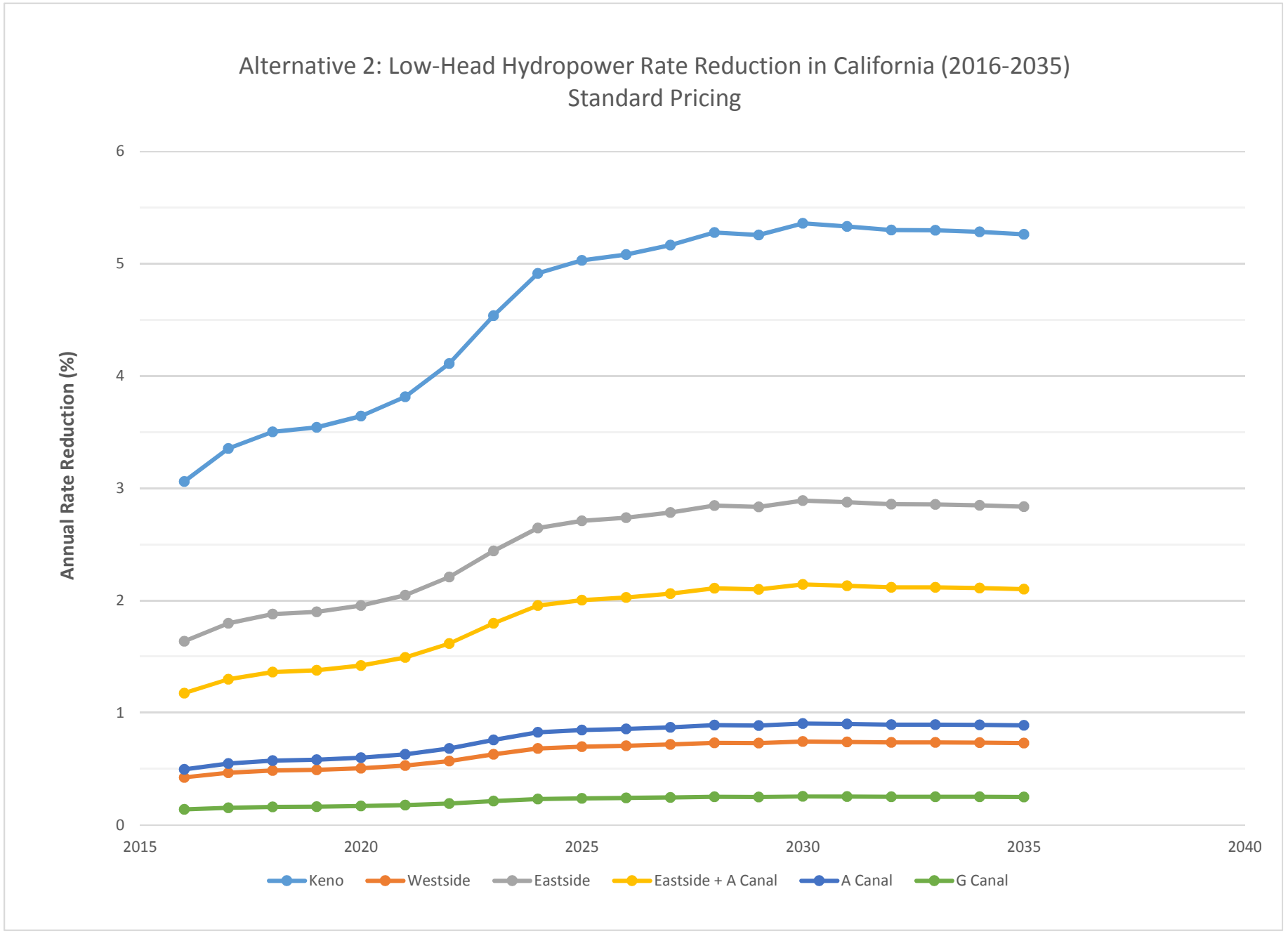
General Rate:	3.0%
Average Energy Rate:	3.0%

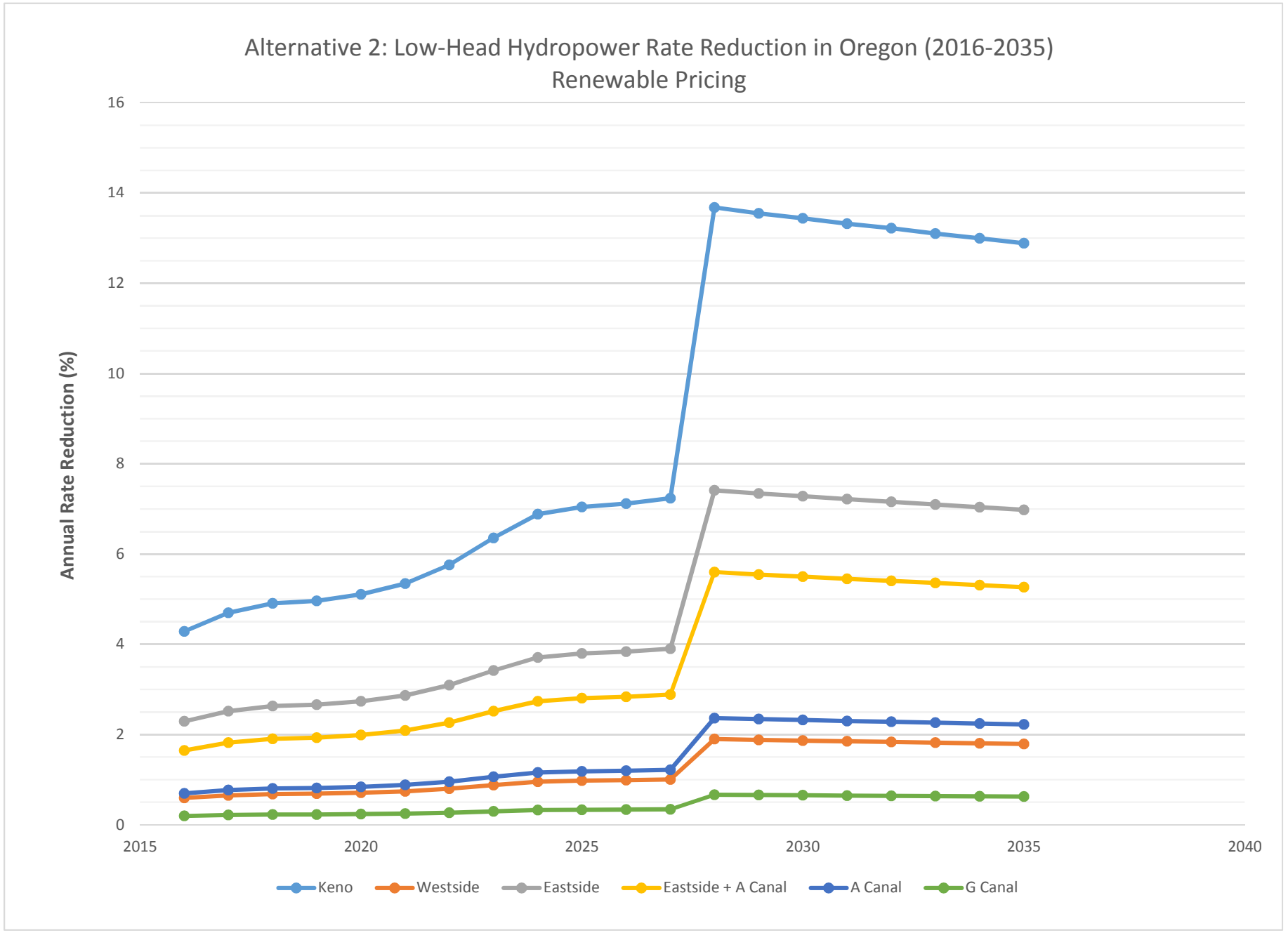
	Standard								Renewable							
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,070,593	839,621	8.884	12.693	7.4	5.3	2.34	1.99	1,070,593	839,621	8.884	12.693	7.4	5.3
2017	2.63	2.17	1,188,917	951,015	9.077	13.001	8.2	5.8	2.63	2.17	1,188,917	951,015	9.077	13.001	8.2	5.8
2018	2.82	2.30	1,269,040	1,024,001	9.312	13.353	8.5	6.1	2.82	2.30	1,269,040	1,024,001	9.312	13.353	8.5	6.1
2019	2.94	2.38	1,319,190	1,066,800	9.581	13.744	8.6	6.2	2.94	2.38	1,319,190	1,066,800	9.581	13.744	8.6	6.2
2020	3.10	2.51	1,391,085	1,131,124	9.841	14.129	8.9	6.3	3.10	2.51	1,391,085	1,131,124	9.841	14.129	8.9	6.3
2021	3.30	2.71	1,489,035	1,221,275	10.089	14.505	9.3	6.6	3.30	2.71	1,489,035	1,221,275	10.089	14.505	9.3	6.6
2022	3.60	3.00	1,633,805	1,358,012	10.307	14.856	10.0	7.2	3.60	3.00	1,633,805	1,358,012	10.307	14.856	10.0	7.2
2023	4.03	3.37	1,831,468	1,547,402	10.490	15.176	11.1	7.9	4.03	3.37	1,831,468	1,547,402	10.490	15.176	11.1	7.9
2024	4.44	3.73	2,021,491	1,728,903	10.690	15.517	12.1	8.6	4.44	3.73	2,021,491	1,728,903	10.690	15.517	12.1	8.6
2025	4.66	3.93	2,124,926	1,823,560	10.974	15.946	12.3	8.8	4.66	3.93	2,124,926	1,823,560	10.974	15.946	12.3	8.8
2026	4.84	4.09	2,208,772	1,898,364	11.287	16.408	12.5	8.9	4.84	4.09	2,208,772	1,898,364	11.287	16.408	12.5	8.9
2027	5.06	4.27	2,307,897	1,988,177	11.597	16.872	12.7	9.1	5.06	4.27	2,307,897	1,988,177	11.597	16.872	12.7	9.1
2028	6.28	3.25	2,422,694	2,093,383	11.907	17.340	13.0	9.3	10.26	6.60	4,236,140	3,906,829	10.369	15.806	24.2	17.3
2029	6.44	3.34	2,485,970	2,146,779	12.272	17.868	12.9	9.2	10.47	6.74	4,323,903	3,984,712	10.713	16.314	24.0	17.1
2030	6.71	3.55	2,605,273	2,255,907	12.602	18.366	13.2	9.4	10.72	6.87	4,420,482	4,071,115	11.063	16.831	23.8	17.0
2031	6.88	3.64	2,671,291	2,311,444	12.990	18.927	13.1	9.4	10.94	7.03	4,515,297	4,155,450	11.427	17.368	23.6	16.8
2032	7.04	3.74	2,736,722	2,366,079	13.393	19.507	13.0	9.3	11.18	7.20	4,617,753	4,247,110	11.798	17.917	23.4	16.7
2033	7.24	3.86	2,817,433	2,435,671	13.795	20.094	13.0	9.3	11.41	7.37	4,717,466	4,335,704	12.184	18.487	23.2	16.5
2034	7.43	3.98	2,895,401	2,502,186	14.215	20.702	13.0	9.3	11.65	7.55	4,822,076	4,428,862	12.581	19.073	23.0	16.4
2035	7.62	4.09	2,971,214	2,566,203	14.651	21.333	12.9	9.2	11.87	7.76	4,927,666	4,522,655	12.992	19.679	22.8	16.3
						average	**11.3**	**8.1**						average	**15.5**	**11.0**

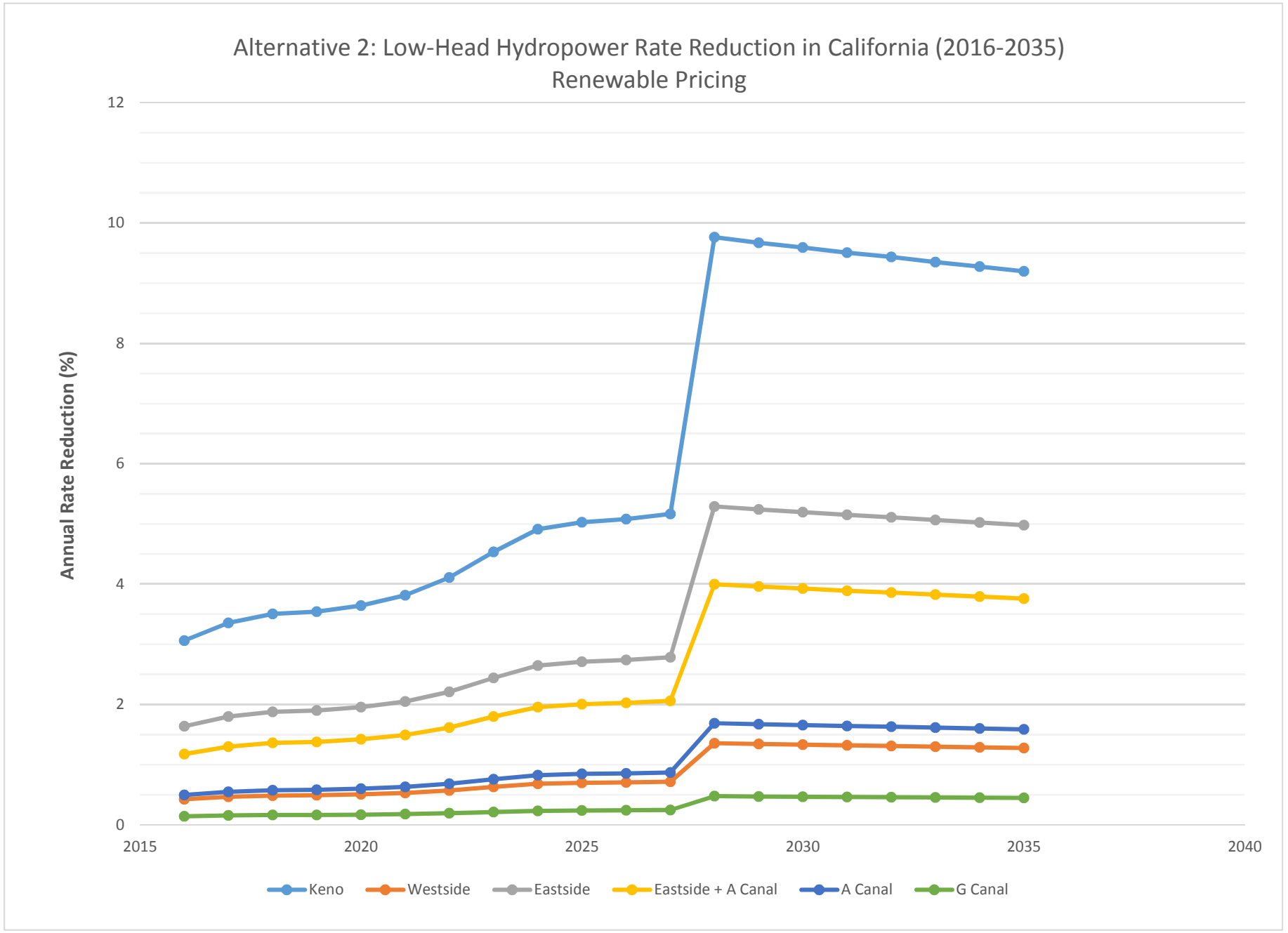

Alternative 2: Low-Head Hydropower Net Revenue (2016-2035)
Standard Pricing
Annual Net Revenue ($)
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Net Revenue (2016-2035)
Renewable Pricing
Annual Net Revenue ($)
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Rate Reduction in Oregon (2016-2035)
Standard Pricing
Annual Rate Reduction (%)
0
1
2
3
4
5
6
7
8
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Rate Reduction in California (2016-2035)
Standard Pricing
Annual Rate Reduction (%)
0
1
2
3
4
5
6
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Rate Reduction in Oregon (2016-2035)
Renewable Pricing
Annual Rate Reduction (%)
16
14
12
10
8
6
4
2
0
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal


Alternative 2: Low-Head Hydropower Rate Reduction in California (2016-2035)
Renewable Pricing
Annual Rate Reduction (%)
12
10
8
6
4
2
0
2015
2020
2025
2030
2035
2040
Keno
Westside
Eastside
Eastside + A Canal
A Canal
G Canal

Alternative 3: Out-of-Basin Investment

List of Assumptions

1 This calculator assumes the project will be funded with $40Million of non-reimbursable funds.

2 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

Alternative 3: Out-of-Basin Investment

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Yieldco Yield Assumptions:

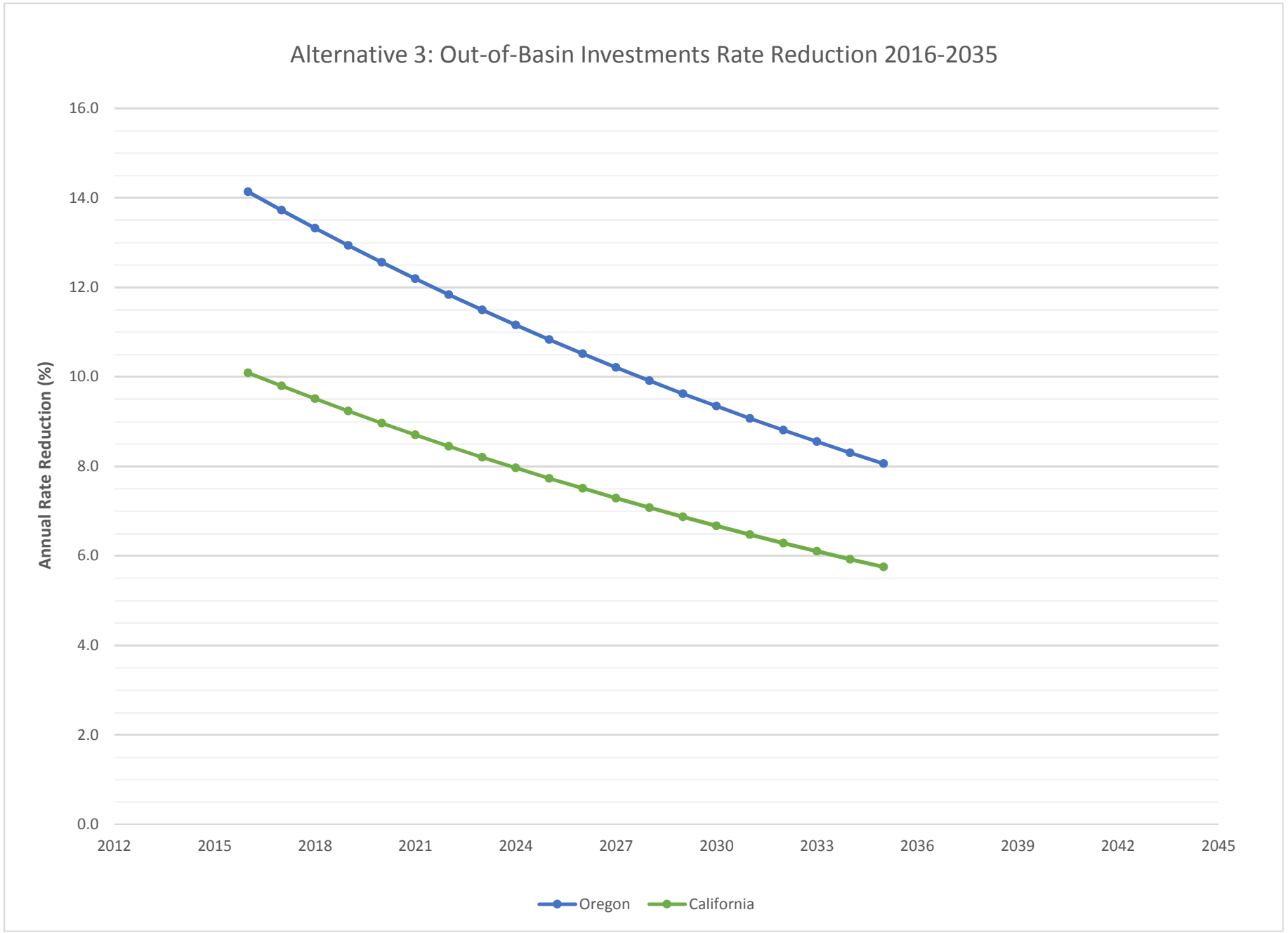
Average Yield:	4.0%

Inflation Assumptions:

Energy Rate:	3.0%

Initial Investment ($): 40,000,000.00

Delivery Year	Dividend (Revenue) ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	1,600,000.00	8.239	12.050	14.1	10.1
2017	1,600,000.00	8.527	12.452	13.7	9.8
2018	1,600,000.00	8.824	12.867	13.3	9.5
2019	1,600,000.00	9.129	13.293	12.9	9.2
2020	1,600,000.00	9.444	13.732	12.6	9.0
2021	1,600,000.00	9.768	14.185	12.2	8.7
2022	1,600,000.00	10.101	14.651	11.8	8.5
2023	1,600,000.00	10.445	15.131	11.5	8.2
2024	1,600,000.00	10.799	15.626	11.2	8.0
2025	1,600,000.00	11.164	16.135	10.8	7.7
2026	1,600,000.00	11.540	16.660	10.5	7.5
2027	1,600,000.00	11.926	17.200	10.2	7.3
2028	1,600,000.00	12.325	17.757	9.9	7.1
2029	1,600,000.00	12.735	18.330	9.6	6.9
2030	1,600,000.00	13.158	18.921	9.3	6.7
2031	1,600,000.00	13.594	19.529	9.1	6.5
2032	1,600,000.00	14.042	20.155	8.8	6.3
2033	1,600,000.00	14.504	20.800	8.6	6.1
2034	1,600,000.00	14.980	21.465	8.3	5.9
2035	1,600,000.00	15.470	22.150	8.1	5.8
			average:	**10.8**	**7.7**


Alternative 3: Out-of-Basin Investments Rate Reduction 2016-2035
Annual Rate Reduction (%)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Oregon
California

Alternative 4: Utility-Scale Solar and Out-of-Basin Investment

List of Assumptions

1 This calculator assumes the project will be funded with $40Million of non-reimbursable funds.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

4 On-peak hours are from 6AM to 10PM

5 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 4: Utility-Scale Solar and Out-of-Basin Investment

Based on Standard Solar Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	12,987.01
Capacity Factor:	0.3
Project Annual Generation (kWh):	34,129,870.13
Estimated O&M Costs ($/kW):	27
Project Annual O&M ($):	350,649.35
Yieldco Initial Investment ($):	20,000,000.00

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Average Energy Rate:	3.0%

Yieldco Yield Assumptions:

Average Yield:	4.0%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Solar Gross Revenue ($)	Yieldco Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	779,526	800,000	1,228,877	8.554	12.364	10.9	7.8
2017	2.63	2.17	872,496	800,000	1,311,327	8.772	12.696	11.2	8.0
2018	2.82	2.30	934,066	800,000	1,362,062	9.025	13.068	11.3	8.1
2019	2.94	2.38	972,838	800,000	1,389,674	9.307	13.471	11.2	8.0
2020	3.10	2.51	1,025,807	800,000	1,431,148	9.587	13.875	11.2	8.0
2021	3.30	2.71	1,094,067	800,000	1,487,568	9.863	14.280	11.3	8.1
2022	3.60	3.00	1,195,911	800,000	1,577,217	10.121	14.670	11.7	8.3
2023	4.03	3.37	1,339,393	800,000	1,708,138	10.354	15.040	12.3	8.8
2024	4.44	3.73	1,476,595	800,000	1,832,403	10.602	15.429	12.8	9.1
2025	4.66	3.93	1,550,588	800,000	1,893,070	10.915	15.887	12.8	9.2
2026	4.84	4.09	1,610,930	800,000	1,939,686	11.252	16.373	12.8	9.1
2027	5.06	4.27	1,683,831	800,000	1,998,451	11.589	16.863	12.8	9.1
2028	5.79	3.25	1,837,416	800,000	2,137,474	11.869	17.302	13.2	9.5
2029	5.93	3.34	1,882,467	800,000	2,167,527	12.254	17.850	13.0	9.3
2030	6.20	3.55	1,971,341	800,000	2,240,953	12.615	18.379	13.1	9.3
2031	6.35	3.64	2,019,260	800,000	2,272,959	13.023	18.960	12.9	9.2
2032	6.51	3.74	2,070,591	800,000	2,307,902	13.442	19.557	12.7	9.1
2033	6.69	3.86	2,128,748	800,000	2,349,178	13.869	20.167	12.6	9.0
2034	6.87	3.98	2,186,906	800,000	2,389,949	14.310	20.797	12.4	8.9
2035	7.05	4.09	2,244,517	800,000	2,429,651	14.767	21.448	12.2	8.7
							Average (%)	**12.2**	**8.7**

Alternative 4: Utility-Scale Solar and Out-of-Basin Investment

Based on Renewable Solar Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	12,987
Project Annual Generation (kWh):	34,129,870
Estimated O&M Costs ($/kW):	27
Project Annual O&M ($):	350,649
Yieldco Initial Investment ($):	20,000,000

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

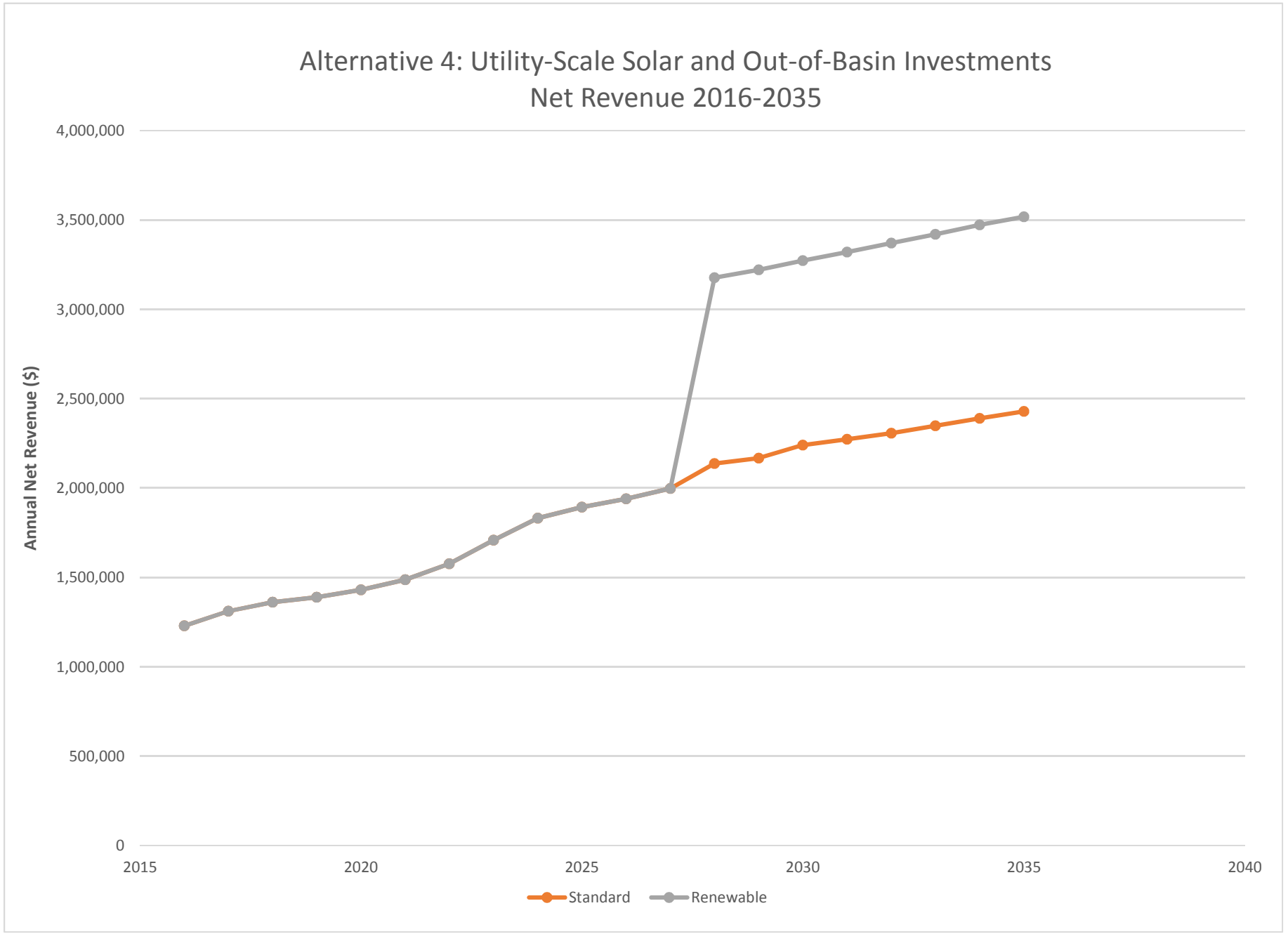
Inflation Assumptions:

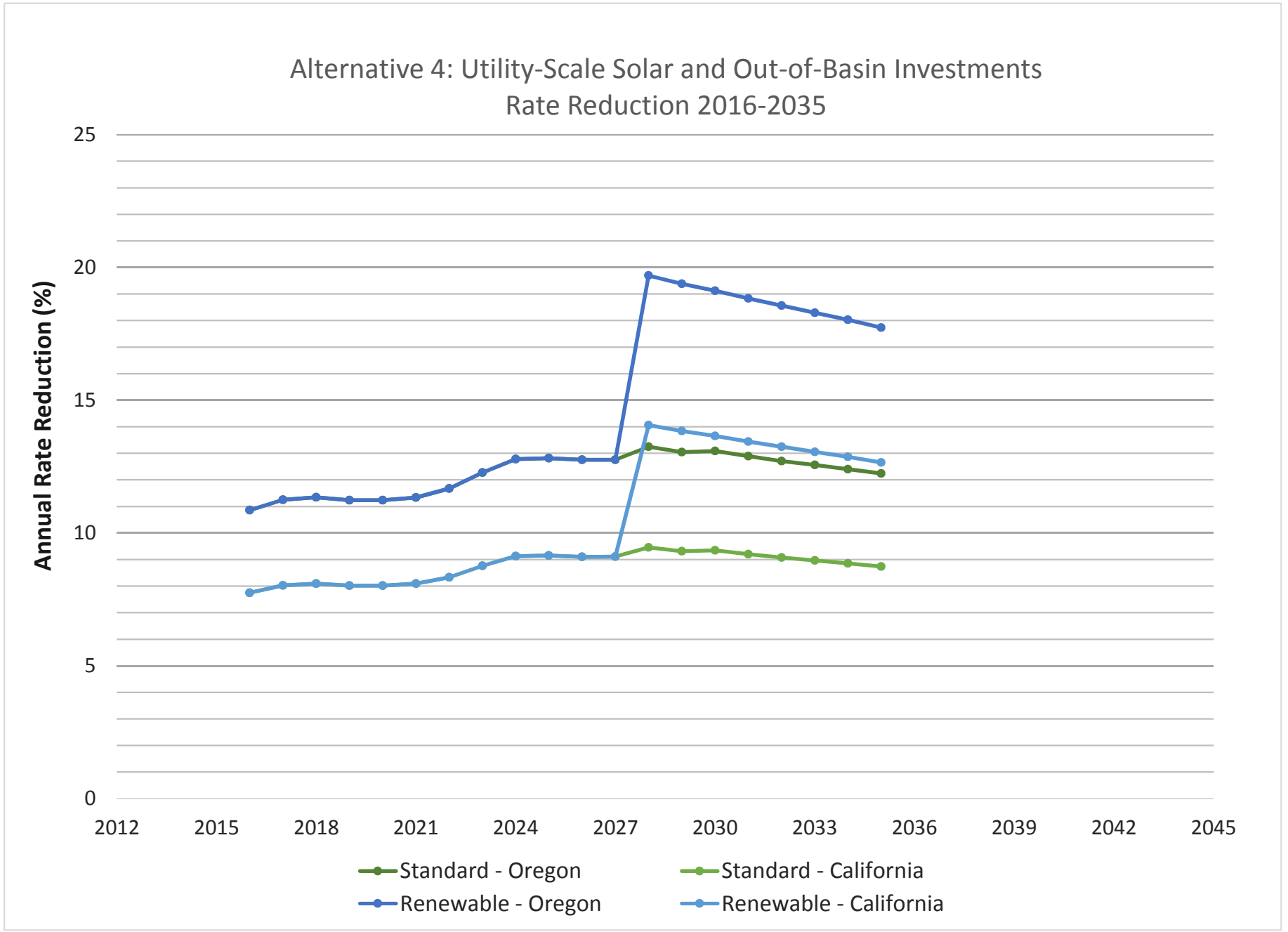
General Rate:	3.0%
Average Energy Rate:	3.0%

Yieldo Yield Assumptions:

Average Yield:	4%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Solar Gross Revenue ($)	Yieldco Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	779,526	800,000	1,228,877	8.554	12.364	10.9	7.8
2017	2.63	2.17	872,496	800,000	1,311,327	8.772	12.696	11.2	8.0
2018	2.82	2.30	934,066	800,000	1,362,062	9.025	13.068	11.3	8.1
2019	2.94	2.38	972,838	800,000	1,389,674	9.307	13.471	11.2	8.0
2020	3.10	2.51	1,025,807	800,000	1,431,148	9.587	13.875	11.2	8.0
2021	3.30	2.71	1,094,067	800,000	1,487,568	9.863	14.280	11.3	8.1
2022	3.60	3.00	1,195,911	800,000	1,577,217	10.121	14.670	11.7	8.3
2023	4.03	3.37	1,339,393	800,000	1,708,138	10.354	15.040	12.3	8.8
2024	4.44	3.73	1,476,595	800,000	1,832,403	10.602	15.429	12.8	9.1
2025	4.66	3.93	1,550,588	800,000	1,893,070	10.915	15.887	12.8	9.2
2026	4.84	4.09	1,610,930	800,000	1,939,686	11.252	16.373	12.8	9.1
2027	5.06	4.27	1,683,831	800,000	1,998,451	11.589	16.863	12.8	9.1
2028	8.78	6.60	2,877,558	800,000	3,177,615	10.987	16.423	19.7	14.1
2029	8.96	6.74	2,936,807	800,000	3,221,867	11.360	16.959	19.4	13.8
2030	9.17	6.87	3,004,111	800,000	3,273,723	11.739	17.505	19.1	13.7
2031	9.36	7.03	3,067,320	800,000	3,321,019	12.134	18.074	18.8	13.4
2032	9.56	7.20	3,133,941	800,000	3,371,252	12.540	18.658	18.6	13.3
2033	9.76	7.37	3,200,563	800,000	3,420,993	12.960	19.261	18.3	13.1
2034	9.97	7.55	3,270,597	800,000	3,473,640	13.391	19.881	18.0	12.9
2035	10.15	7.76	3,333,669	800,000	3,518,803	13.843	20.527	17.7	12.7
							average:	**14.6**	**10.4**


Alternative 4: Utility-Scale Solar and Out-of-Basin Investments
Net Revenue 2016-2035
Annual Net Revenue ($)
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
2015
2020
2025
2030
2035
2040
Standard
Renewable


Alternative 4: Utility-Scale Solar and Out-of-Basin Investments
Rate Reduction 2016-2035
Annual Rate Reduction (%)
25
20
15
10
5
0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Standard - Oregon
Standard - California
Renewable - Oregon
Renewable - California

Alternative 5: Geothermal

List of Assumptions

1 This calculator assumes the project will be funded with $40Million of non-reimbursable funds.

2 The full loan amount is used for project development.

3 Cost of geothermal development per kW: $5,900

4 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

5 On-peak hours are from 6AM to 10PM

6 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 5: Geothermal
Based on Standard Fixed Avoided Cost Prices as provided in Schedule 37

Project Size (kW):	6,779.66
Capacity Factor:	0.85
Project Annual Generation (kWh):	50,481,355.93
Estimated Well Cost ($):	500,000.00
Estimated O&M Costs ($/kW):	120
Project Annual O&M ($):	813,559.32

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

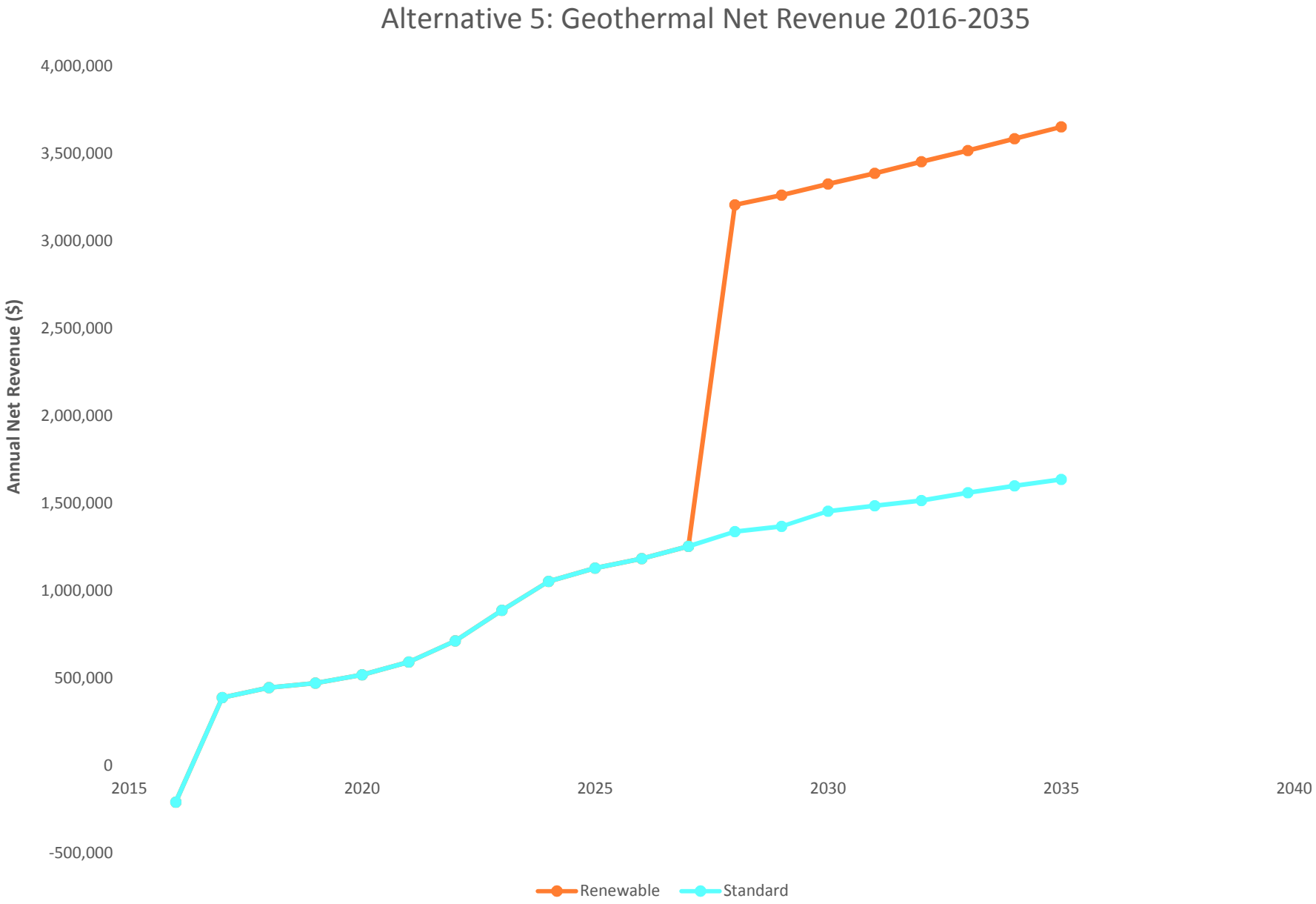
General Rate:	3.0%
Average Energy Rate:	3.0%

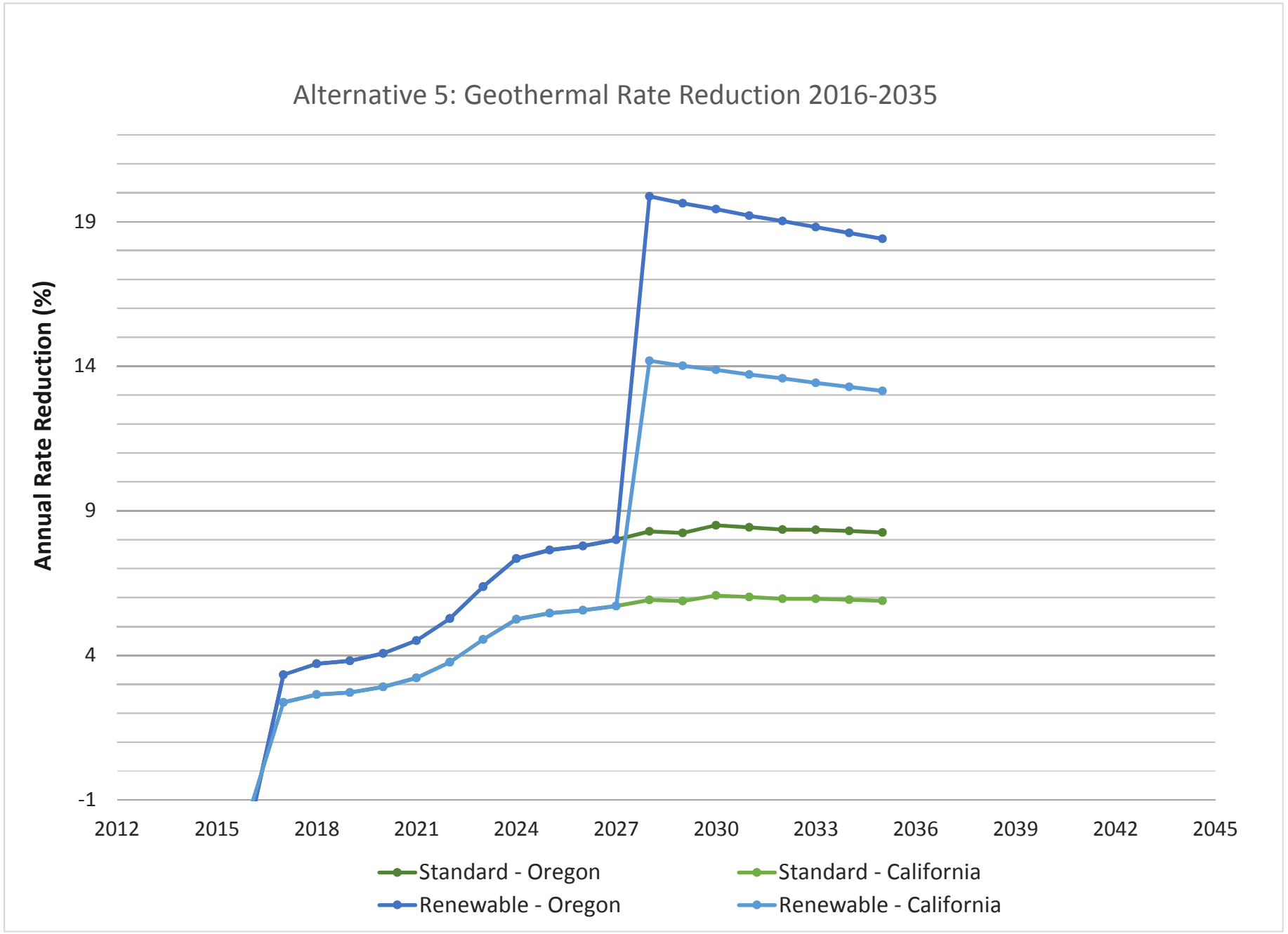
Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,103,522	(210,037)	9.774	13.581	-1.9	-1.3
2017	2.63	2.17	1,225,485	387,519	9.555	13.477	3.3	2.4
2018	2.82	2.3	1,308,073	444,968	9.803	13.843	3.7	2.6
2019	2.94	2.38	1,359,766	470,768	10.087	14.248	3.8	2.7
2020	3.1	2.51	1,433,872	518,204	10.361	14.647	4.1	2.9
2021	3.3	2.71	1,534,835	591,697	10.623	15.037	4.5	3.2
2022	3.6	3	1,684,058	712,626	10.854	15.401	5.3	3.8
2023	4.03	3.37	1,887,801	887,225	11.050	15.734	6.4	4.6
2024	4.44	3.73	2,083,668	1,053,076	11.263	16.088	7.3	5.2
2025	4.66	3.93	2,190,285	1,128,775	11.563	16.534	7.6	5.5
2026	4.84	4.09	2,276,709	1,183,353	11.893	17.012	7.8	5.6
2027	5.06	4.27	2,378,883	1,252,727	12.221	17.494	8.0	5.7
2028	6.28	3.25	2,497,212	1,337,271	12.548	17.979	8.3	5.9
2029	6.44	3.34	2,562,434	1,367,694	12.932	18.526	8.2	5.9
2030	6.71	3.55	2,685,406	1,454,825	13.281	19.043	8.5	6.1
2031	6.88	3.64	2,753,455	1,485,956	13.690	19.625	8.4	6.0
2032	7.04	3.74	2,820,898	1,515,374	14.114	20.227	8.3	6.0
2033	7.24	3.86	2,904,091	1,559,402	14.538	20.835	8.3	6.0
2034	7.43	3.98	2,984,458	1,599,427	14.980	21.465	8.3	5.9
2035	7.62	4.09	3,062,603	1,636,022	15.439	22.119	8.2	5.9
						average	**6.3**	**4.5**

Based on Renewable Fixed Avoided Cost Prices from Schedule 37

		Current Cost Information		Inflation Assumptions:	
Project Size (kW):	6,780	OR Energy Use (kWh):	96000000	General Rate:	3.0%
Project Annual Generation (kWh):	50,481,356	CA Energy Use (kWh):	22000000	Average Energy Rate:	3.0%
Estimated Well Cost ($):	500,000	PAC 41 rate ($/kWh):	0.09596		
Estimated O&M Costs ($/kW):	120	PAC PA-20 rate ($/kWh):	0.13403		
Project Annual O&M ($):	813,559				

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	1,103,522	(210,037)	9.774	13.581	-1.9	-1.3
2017	2.63	2.17	1,225,485	387,519	9.555	13.477	3.3	2.4
2018	2.82	2.30	1,308,073	444,968	9.803	13.843	3.7	2.6
2019	2.94	2.38	1,359,766	470,768	10.087	14.248	3.8	2.7
2020	3.10	2.51	1,433,872	518,204	10.361	14.647	4.1	2.9
2021	3.30	2.71	1,534,835	591,697	10.623	15.037	4.5	3.2
2022	3.60	3.00	1,684,058	712,626	10.854	15.401	5.3	3.8
2023	4.03	3.37	1,887,801	887,225	11.050	15.734	6.4	4.6
2024	4.44	3.73	2,083,668	1,053,076	11.263	16.088	7.3	5.2
2025	4.66	3.93	2,190,285	1,128,775	11.563	16.534	7.6	5.5
2026	4.84	4.09	2,276,709	1,183,353	11.893	17.012	7.8	5.6
2027	5.06	4.27	2,378,883	1,252,727	12.221	17.494	8.0	5.7
2028	10.26	6.60	4,366,435	3,206,494	10.963	16.399	19.9	14.2
2029	10.47	6.74	4,456,898	3,262,159	11.326	16.925	19.6	14.0
2030	10.72	6.87	4,556,447	3,325,866	11.695	17.461	19.4	13.9
2031	10.94	7.03	4,654,179	3,386,680	12.079	18.018	19.2	13.7
2032	11.18	7.20	4,759,786	3,454,262	12.470	18.587	19.0	13.6
2033	11.41	7.37	4,862,566	3,517,877	12.878	19.179	18.8	13.4
2034	11.65	7.55	4,970,394	3,585,364	13.296	19.786	18.6	13.3
2035	11.87	7.76	5,079,232	3,652,651	13.730	20.414	18.4	13.1
						average	**10.6**	**7.6**


Alternative 5: Geothermal Net Revenue 2016-2035
Annual Net Revenue ($)
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
-500,000
2015
2020
2025
2030
2035
2040
Renewable
Standard


Alternative 5: Geothermal Rate Reduction 2016-2035
Annual Rate Reduction (%)
19
14
9
4
-1
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Standard - Oregon
Standard - California
Renewable - Oregon
Renewable - California

Alternative 6: Shared Solar

List of Assumptions

1 This calculator assumes the project will be funded with $40Million of non-reimbursable funds.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

4 On-peak hours are from 6AM to 10PM

Alternative 6: Shared Solar

Project Size (kW):	11,764.71
Capacity Factor:	0.28
Project Annual Generation (kWh):	28,856,470.59
Estimated O&M Costs ($/kW):	28
Project Annual O&M ($):	329,411.76

Current Cost Information

OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:

General Rate:	3.0%
Energy Rate:	3.0%

Delivery Year	Gross Revenue ($)	Net Revenue ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2,973,400	2,643,988	7.354	11.168	23.4	16.7
2017	3,062,602	2,723,308	7.575	11.503	23.4	16.7
2018	3,154,480	2,805,007	7.802	11.848	23.4	16.7
2019	3,249,115	2,889,158	8.036	12.203	23.4	16.7
2020	3,346,588	2,975,832	8.277	12.569	23.4	16.7
2021	3,446,986	3,065,107	8.525	12.946	23.4	16.7
2022	3,550,395	3,157,060	8.781	13.335	23.4	16.7
2023	3,656,907	3,251,772	9.045	13.735	23.4	16.7
2024	3,766,614	3,349,325	9.316	14.147	23.4	16.7
2025	3,879,613	3,449,805	9.595	14.571	23.4	16.7
2026	3,996,001	3,553,299	9.883	15.008	23.4	16.7
2027	4,115,881	3,659,898	10.180	15.459	23.4	16.7
2028	4,239,358	3,769,695	10.485	15.922	23.4	16.7
2029	4,366,538	3,882,786	10.800	16.400	23.4	16.7
2030	4,497,535	3,999,270	11.124	16.892	23.4	16.7
2031	4,632,461	4,119,248	11.457	17.399	23.4	16.7
2032	4,771,434	4,242,825	11.801	17.921	23.4	16.7
2033	4,914,577	4,370,110	12.155	18.458	23.4	16.7
2034	5,062,015	4,501,213	12.520	19.012	23.4	16.7
2035	5,213,875	4,636,250	12.895	19.583	23.4	16.7
				average	**23.4**	**16.7**

Alternative 7: Utility-Scale and Net Metered Solar

List of Assumptions

1 This calculator assumes the project will be funded with $40Million of non-reimbursable funds.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

4 On-peak hours are from 6AM to 10PM

5 All generated power is either sold back to PacifiCorp in a Power Purchase Agreement or net metered.

Alternative 7: Utility-Scale and Net Metered Solar

Based on Standard Solar Fixed Avoided Cost Prices as provided in Schedule 37

On-Peak hours are 6 am to 10 pm

	Utility Scale	Net Metered
Project Size (kW):	12,987.01	5.00
Capacity Factor:	0.3	0.2
Project Annual Generation (kWh):	34,129,870.13	8,360.00
Estimated O&M Costs ($/kW):	27	30
Project Annual O&M ($):	350,649.35	150.00
OR Energy Trust Incentive* ($):	0	5,000

No. of Units	
Oregon:	
930	
California:	
212	

Current Cost Information	
OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:	
General Rate:	3.0%
Average Energy Rate:	3.0%

**From the incentive rate calculation performed by EnergyTrust, based on system size (nonlinear calculations used for projects sized 16-300kW)*

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue -Utility Scale ($)	NEM Energy Credit OR ($)	NEM Energy Credit CA ($)	Net Revenue OR ($)	Net Revenue CA ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	779,526	746,070	237,544	5,745,026	317,165	3.612	11.961	62.4	10.8
2017	2.63	2.17	872,496	768,452	244,670	1,184,518	339,623	8.650	12.261	12.5	11.2
2018	2.82	2.30	934,066	791,505	252,010	1,248,865	356,395	8.879	12.599	12.8	11.4
2019	2.94	2.38	972,838	815,251	259,571	1,295,081	369,086	9.137	12.968	12.9	11.5
2020	3.10	2.51	1,025,807	839,708	267,358	1,353,294	384,583	9.391	13.337	13.1	11.6
2021	3.30	2.71	1,094,067	864,899	275,379	1,424,406	403,092	9.641	13.706	13.3	11.8
2022	3.60	3.00	1,195,911	890,846	283,640	1,523,322	428,023	9.871	14.058	13.8	12.2
2023	4.03	3.37	1,339,393	917,572	292,149	1,656,612	460,878	10.076	14.389	14.6	12.7
2024	4.44	3.73	1,476,595	945,099	300,914	1,785,285	492,751	10.296	14.739	15.3	13.2
2025	4.66	3.93	1,550,588	973,452	309,941	1,863,015	513,056	10.580	15.156	15.5	13.3
2026	4.84	4.09	1,610,930	1,002,655	319,239	1,930,159	531,019	10.886	15.599	15.6	13.4
2027	5.06	4.27	1,683,831	1,032,735	328,817	2,008,066	551,521	11.191	16.046	15.7	13.5
2028	5.79	3.25	1,837,416	1,063,717	338,681	2,152,207	587,237	11.440	16.440	16.4	14.0
2029	5.93	3.34	1,882,467	1,095,629	348,841	2,208,575	602,981	11.791	16.942	16.3	13.9
2030	6.20	3.55	1,971,341	1,128,498	359,307	2,301,206	627,097	12.118	17.423	16.5	14.1
2031	6.35	3.64	2,019,260	1,162,352	370,086	2,361,108	643,823	12.491	17.955	16.5	14.0
2032	6.51	3.74	2,070,591	1,197,223	381,188	2,424,414	661,417	12.873	18.501	16.4	14.0
2033	6.69	3.86	2,128,748	1,233,140	392,624	2,493,923	680,523	13.263	19.060	16.4	14.0
2034	6.87	3.98	2,186,906	1,270,134	404,403	2,564,097	699,878	13.666	19.636	16.3	13.9
2035	7.05	4.09	2,244,517	1,308,238	416,535	2,634,511	719,387	14.082	20.232	16.3	13.9
									average	**17.4**	**12.9**

Alternative 7: Utility-Scale and Net Metered Solar

Based on Renewable Solar Fixed Avoided Cost Prices as provided in Schedule 37

On-Peak hours are 6 am to 10 pm

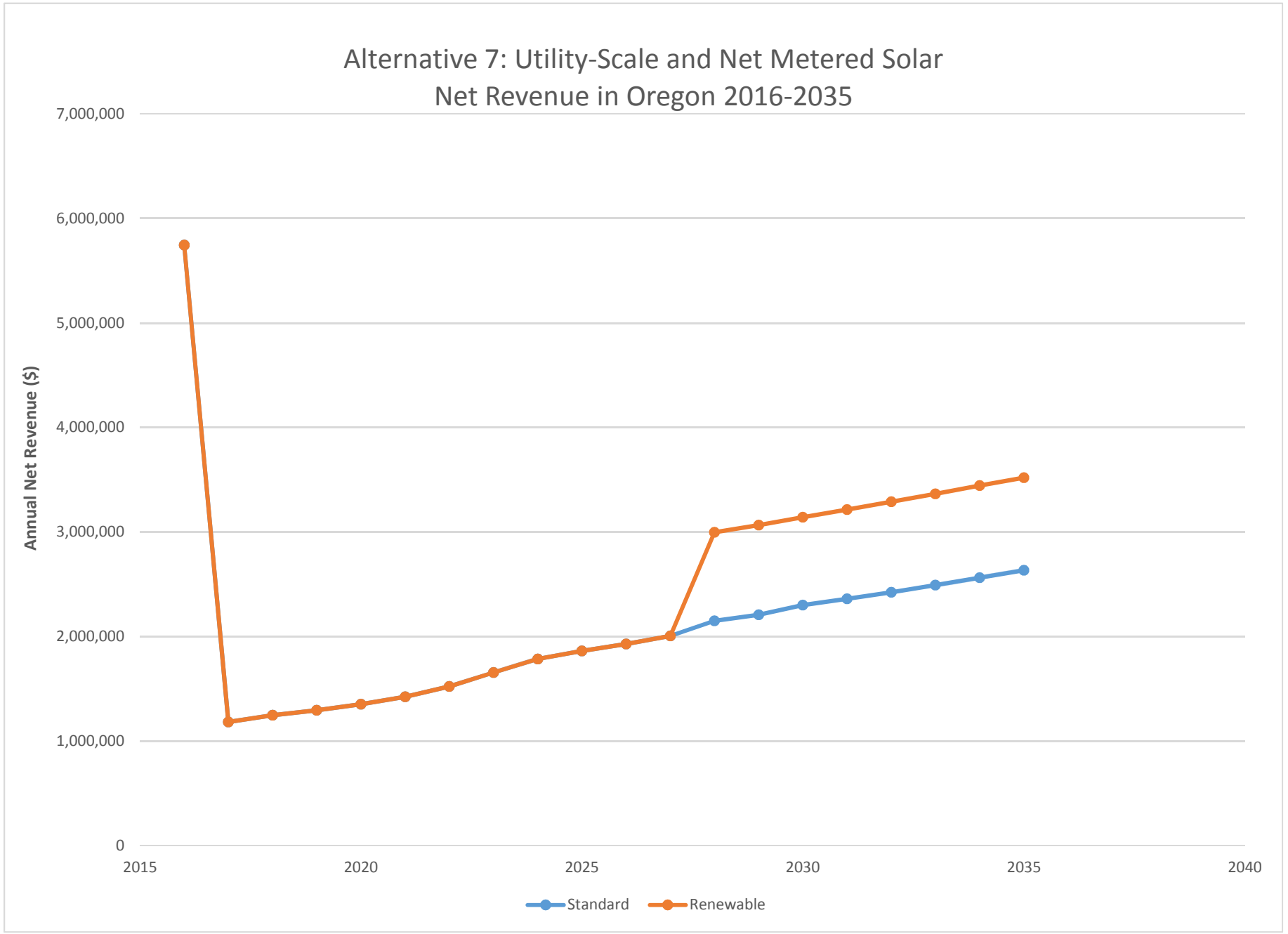
	Utility Scale	Net Metered
Project Size (kW):	12,987	5.00
Project Annual Generation (kWh):	34,129,870	8,360.00
Estimated O&M Costs ($/kW):	27	30
Project Annual O&M ($):	350,649	150
OR Energy Trust Incentive* ($):	0	5,000

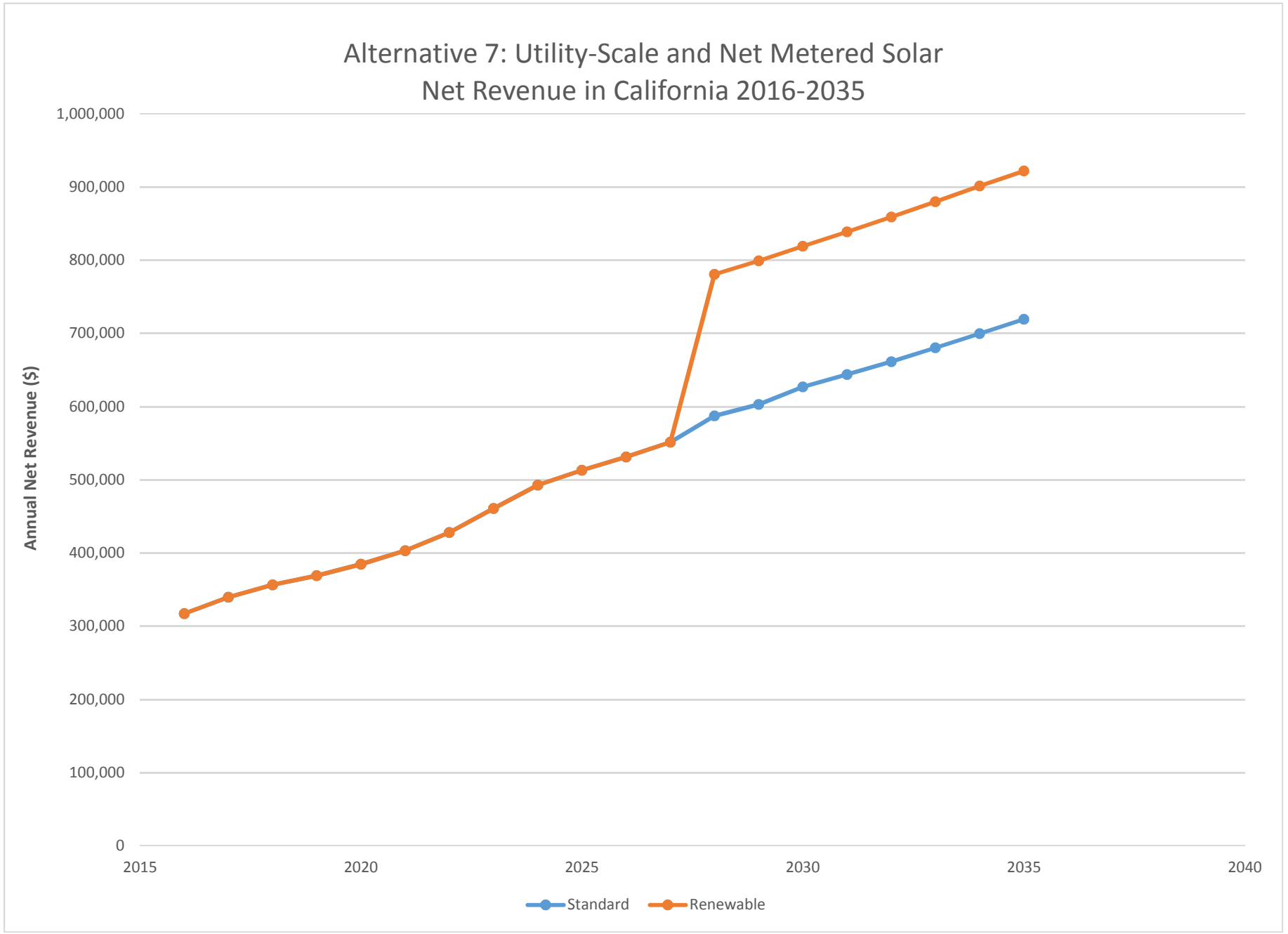
No. of Units	
Oregon:	**930**
California:	**212**

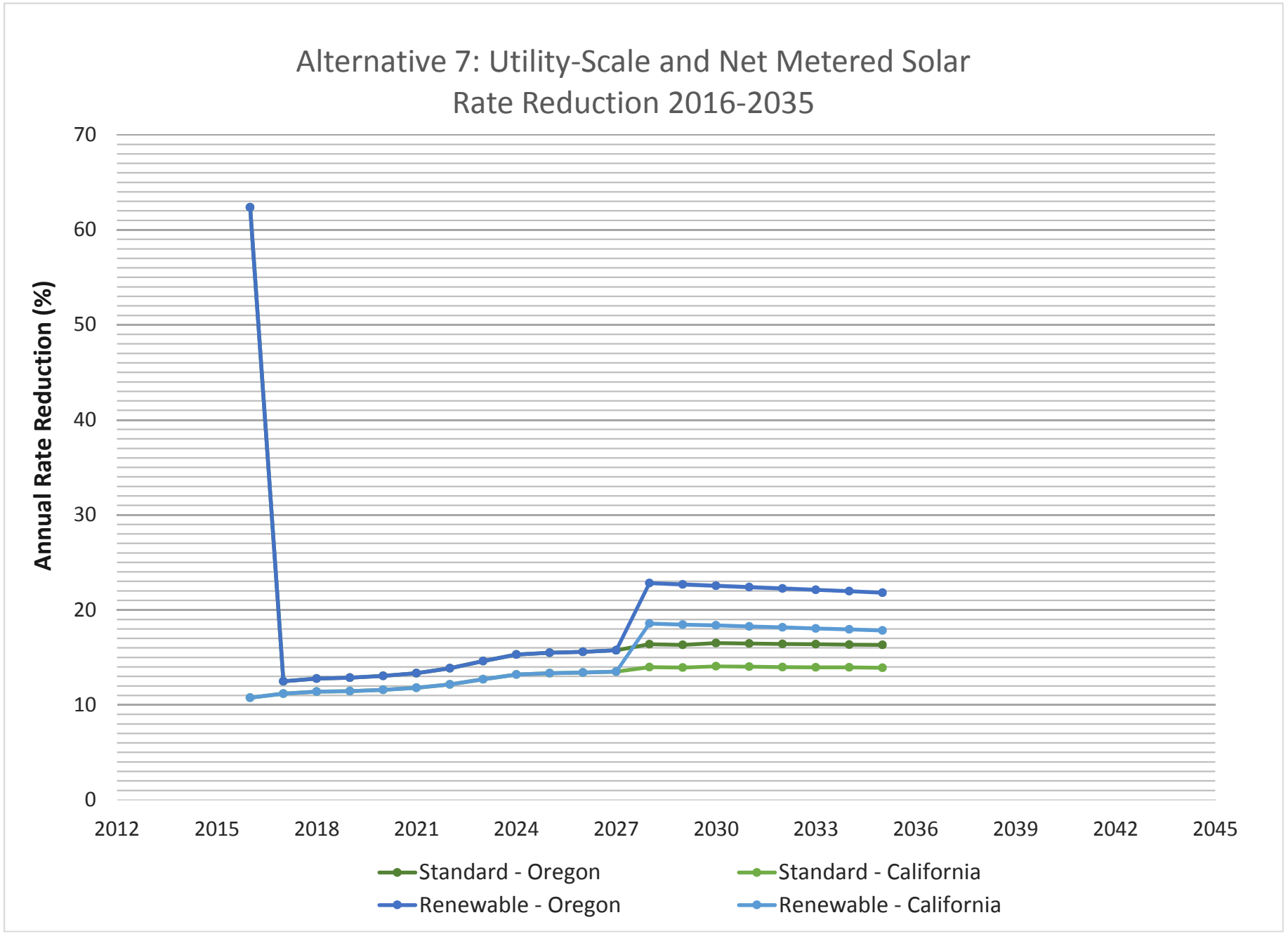
Current Cost Information	
OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

Inflation Assumptions:	
General Rate:	3.0%
Average Energy Rate:	3.0%

Delivery Year	On-Peak Price (¢/kWh)	Off-Peak Price (¢/kWh)	Gross Revenue -Utility Scale ($)	NEM Energy Credit OR ($)	NEM Energy Credit CA ($)	Net Revenue OR ($)	Net Revenue CA ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	2.34	1.99	779,526	746,070	237,544	5,745,026	317,165	3.612	11.961	62.4	10.8
2017	2.63	2.17	872,496	768,452	244,670	1,184,518	339,623	8.650	12.261	12.5	11.2
2018	2.82	2.30	934,066	791,505	252,010	1,248,865	356,395	8.879	12.599	12.8	11.4
2019	2.94	2.38	972,838	815,251	259,571	1,295,081	369,086	9.137	12.968	12.9	11.5
2020	3.10	2.51	1,025,807	839,708	267,358	1,353,294	384,583	9.391	13.337	13.1	11.6
2021	3.30	2.71	1,094,067	864,899	275,379	1,424,406	403,092	9.641	13.706	13.3	11.8
2022	3.60	3.00	1,195,911	890,846	283,640	1,523,322	428,023	9.871	14.058	13.8	12.2
2023	4.03	3.37	1,339,393	917,572	292,149	1,656,612	460,878	10.076	14.389	14.6	12.7
2024	4.44	3.73	1,476,595	945,099	300,914	1,785,285	492,751	10.296	14.739	15.3	13.2
2025	4.66	3.93	1,550,588	973,452	309,941	1,863,015	513,056	10.580	15.156	15.5	13.3
2026	4.84	4.09	1,610,930	1,002,655	319,239	1,930,159	531,019	10.886	15.599	15.6	13.4
2027	5.06	4.27	1,683,831	1,032,735	328,817	2,008,066	551,521	11.191	16.046	15.7	13.5
2028	8.78	6.60	2,877,558	1,063,717	338,681	2,998,882	780,704	10.558	15.561	22.8	18.6
2029	8.96	6.74	2,936,807	1,095,629	348,841	3,066,808	799,088	10.897	16.051	22.7	18.5
2030	9.17	6.87	3,004,111	1,128,498	359,307	3,141,881	819,192	11.242	16.550	22.5	18.4
2031	9.36	7.03	3,067,320	1,162,352	370,086	3,214,229	838,762	11.602	17.069	22.4	18.3
2032	9.56	7.20	3,133,941	1,197,223	381,188	3,289,981	859,201	11.972	17.602	22.3	18.2
2033	9.76	7.37	3,200,563	1,233,140	392,624	3,366,380	879,881	12.354	18.154	22.1	18.1
2034	9.97	7.55	3,270,597	1,270,134	404,403	3,446,222	901,445	12.747	18.720	22.0	18.0
2035	10.15	7.76	3,333,669	1,308,238	416,535	3,521,081	921,969	13.159	19.311	21.8	17.8
									average:	**19.8**	**14.6**


Alternative 7: Utility-Scale and Net Metered Solar
Net Revenue in Oregon 2016-2035
Annual Net Revenue ($)
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
2015
2020
2025
2030
2035
2040
Standard
Renewable


Alternative 7: Utility-Scale and Net Metered Solar
Net Revenue in California 2016-2035
Annual Net Revenue ($)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
2015
2020
2025
2030
2035
2040
Standard
Renewable


Alternative 7: Utility-Scale and Net Metered Solar
Rate Reduction 2016-2035
Annual Rate Reduction (%)
70
60
50
40
30
20
10
0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Standard - Oregon
Standard - California
Renewable - Oregon
Renewable - California

Alternative 8: Net Metering

List of Assumptions

1 This calculator assumes project will be funded by a loan. Loan details provided in 'Loan' tab.

2 According to the report recently published by GTM Research and Solar Energy Industries Association titled U.S. Solar Market Insight 2015 Year in Review, residential (net metered) solar prices are about $3.50/ Watt and utility-scale tracking PV solar prices are about $1.54/Watt.

NEM Solar Price ($/kW):	$3,500
Utility Solar, Tracking ($/kW):	$1,540

3 Fuel Cell Unit Cost: $20,000

4 The full loan amount is used for project development.

5 Energy Rates will increase at 3 percent annually. This assumption matches the one used in the solar calculator operated by Energy Trust of Oregon.

6 All generated energy is net metered to offset demand. Does not account for excess energy credit compesation.

7 Assumes irrigator negotiates to begin NEM services at the end of the irrigation season, which would allow energy credit accrual through the end of the irrigation season. (maximizes energy production and avoids excess credits being sent to low-income program instead of the PAC bill.)

Alternative 8: Net Metering

	Solar	Fuel Cells
Project Size (kW):	5.00	8.00
Capacity Factor:	0.19	0.7
Project Annual Generation (kWh):	8,360.00	49,056.00
Estimated O&M Costs ($/kW):	30	35
Projected Annual O&M ($):	150	280
Estimated Fuel Costs ($/kWh):	--	0.030
Projected Annual Fuel Cost ($):	--	1471.68
Total No. of Units (Installations):	1714.29 1714	500.00 500

Funding ($)	OR	CA
Total	40000000	32560000	7440000
Solar PVs	30000000	22560000	7440000
Fuel Cells	10000000	10000000	0
No. of Solar Panels		1289	425
No. of Fuel Cells		500	0

***Fuel cells may not be eligible in California**

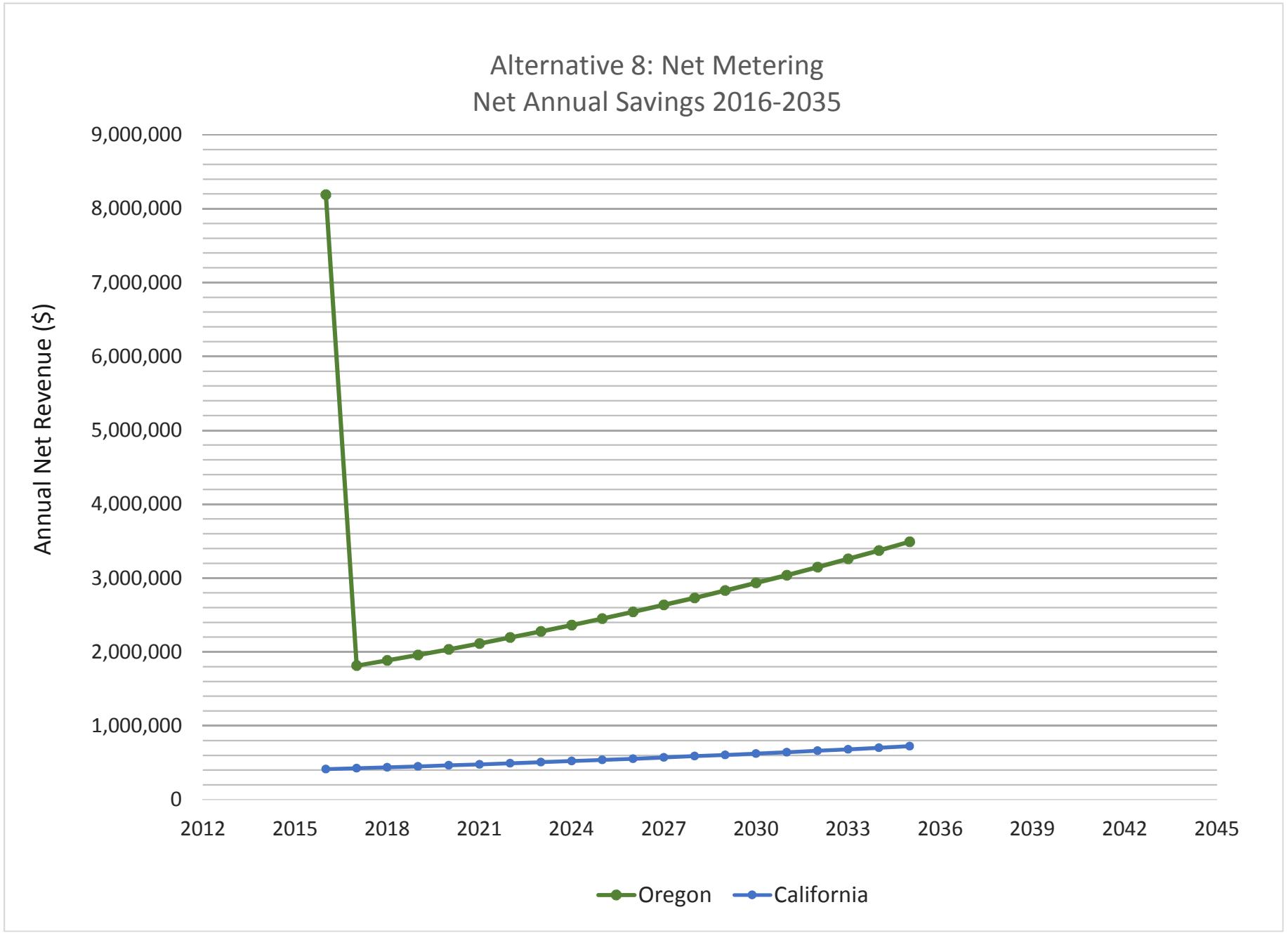
Current Cost Information	
OR Energy Use (kWh):	96000000
CA Energy Use (kWh):	22000000
PAC 41 rate ($/kWh):	0.09596
PAC PA-20 rate ($/kWh):	0.13403

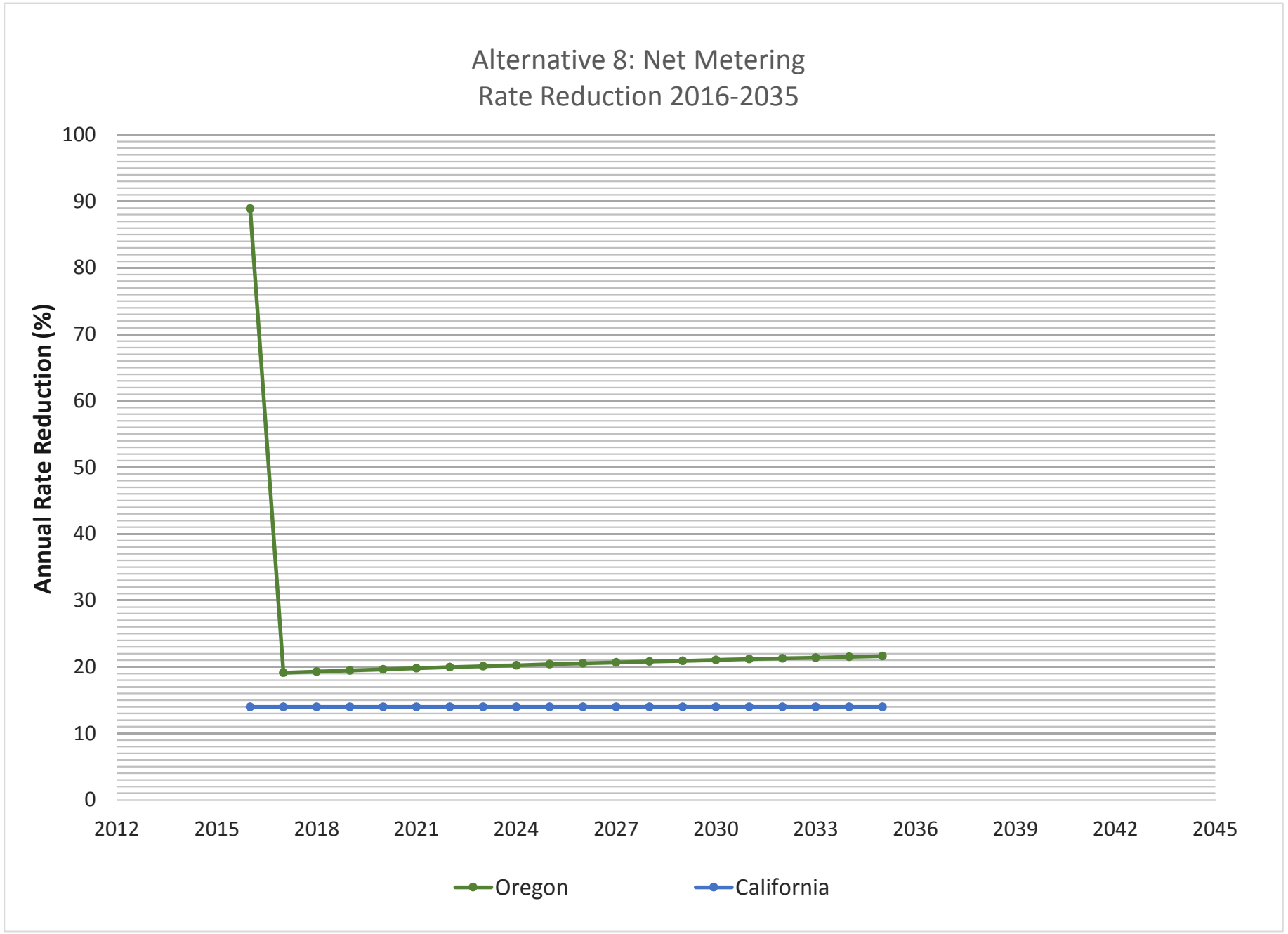
Energy Trust Incentive*:
OR Solar ($): 5,000
**From the incentive rate calculation performed by EnergyTrust, based on system size (nonlinear calculations used for projects sized 16-300kW)*

Fuel Cell Loan Repayment	
Individual Loan ($):	20,000.00
Term (years):	25
Interest Rate:	3%

Inflation Rates:	
General Rate:	3%
Energy Rate:	3.0%

	Solar Installations						Fuel Cell Installations						Combined Savings					
Delivery Year	Energy Credit OR - O&M ($/unit)	Energy Credit CA - O&M ($/unit)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)	Energy Credit OR ($/unit)	*Energy Credit CA* ($/unit)*	New Effective OR Rate (¢/kWh)	*New Effective CA Rate* (¢/kWh)*	OR Cost Reduction (%)	*CA Cost Reduction* (%)*	Annual Savings OR ($)	Annual Savings CA ($)	New Effective OR Rate (¢/kWh)	New Effective CA Rate (¢/kWh)	OR Cost Reduction (%)	CA Cost Reduction (%)
2016	5,652	970	2.007	11.528	79.1	14.0	1,807	*3,675*	8.655	*13.403*	9.8	*0.0*	8,189,307	412,459	1.065	11.528	88.9	14.0
2017	672	1,000	8.982	11.874	9.1	14.0	1,896	3,819	8.896	*13.805*	10.0	*0.0*	1,813,865	424,832	7.994	11.874	19.1	14.0
2018	692	1,030	9.251	12.230	9.1	14.0	1,987	3,968	9.145	*14.219*	10.2	*0.0*	1,885,509	437,577	8.216	12.230	19.3	14.0
2019	713	1,060	9.529	12.597	9.1	14.0	2,081	4,122	9.402	*14.646*	10.3	*0.0*	1,959,302	450,705	8.445	12.597	19.5	14.0
2020	734	1,092	9.815	12.975	9.1	14.0	2,178	4,280	9.666	*15.085*	10.5	*0.0*	2,035,310	464,226	8.680	12.975	19.6	14.0
2021	756	1,125	10.109	13.364	9.1	14.0	2,278	4,443	9.938	*15.538*	10.7	*0.0*	2,113,598	478,153	8.923	13.364	19.8	14.0
2022	779	1,159	10.412	13.765	9.1	14.0	2,381	4,611	10.218	*16.004*	10.8	*0.0*	2,194,234	492,497	9.172	13.765	19.9	14.0
2023	802	1,194	10.725	14.178	9.1	14.0	2,487	4,783	10.507	*16.484*	11.0	*0.0*	2,277,289	507,272	9.430	14.178	20.1	14.0
2024	826	1,229	11.047	14.604	9.1	14.0	2,596	4,961	10.804	*16.979*	11.1	*0.0*	2,362,836	522,490	9.695	14.604	20.2	14.0
2025	851	1,266	11.378	15.042	9.1	14.0	2,708	5,145	11.110	*17.488*	11.3	*0.0*	2,450,950	538,165	9.968	15.042	20.4	14.0
2026	877	1,304	11.719	15.493	9.1	14.0	2,824	5,334	11.426	*18.013*	11.4	*0.0*	2,541,707	554,310	10.249	15.493	20.5	14.0
2027	903	1,343	12.071	15.958	9.1	14.0	2,943	5,528	11.750	*18.553*	11.5	*0.0*	2,635,186	570,939	10.538	15.958	20.7	14.0
2028	930	1,384	12.433	16.436	9.1	14.0	3,066	5,728	12.085	*19.109*	11.7	*0.0*	2,731,470	588,067	10.836	16.436	20.8	14.0
2029	958	1,425	12.806	16.930	9.1	14.0	3,192	5,935	12.430	*19.683*	11.8	*0.0*	2,830,643	605,709	11.143	16.930	20.9	14.0
2030	987	1,468	13.190	17.437	9.1	14.0	3,322	6,147	12.784	*20.273*	11.9	*0.0*	2,932,790	623,881	11.460	17.437	21.0	14.0
2031	1,016	1,512	13.586	17.961	9.1	14.0	3,456	6,366	13.150	*20.881*	12.0	*0.0*	3,038,002	642,597	11.786	17.961	21.2	14.0
2032	1,047	1,557	13.993	18.499	9.1	14.0	3,595	6,591	13.527	*21.508*	12.2	*0.0*	3,146,371	661,875	12.121	18.499	21.3	14.0
2033	1,078	1,604	14.413	19.054	9.1	14.0	3,737	6,824	13.914	*22.153*	12.3	*0.0*	3,257,990	681,731	12.467	19.054	21.4	14.0
2034	1,110	1,652	14.846	19.626	9.1	14.0	3,883	7,063	14.314	*22.818*	12.4	*0.0*	3,372,958	702,183	12.823	19.626	21.5	14.0
2035	1,144	1,702	15.291	20.215	9.1	14.0	4,034	7,309	14.725	*23.502*	12.5	*0.0*	3,491,375	723,249	13.190	20.215	21.6	14.0
																average	**23.9**	**14.0**


Alternative 8: Net Metering
Net Annual Savings 2016-2035
Annual Net Revenue ($)
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Oregon
California


Alternative 8: Net Metering
Rate Reduction 2016-2035
Annual Rate Reduction (%)
100
90
80
70
60
50
40
30
20
10
0
2012
2015
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
Oregon
California