CHAPTER 6
HYDROPOWER GENERATION OPTIONS EVALUATION

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City of Bend, Oregon
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CHAPTER 6

HYDROPOWER GENERATION OPTIONS EVALUATION

6.0 Background

This chapter assesses the feasibility of locating a hydrogeneration facility at the following potential sites:

- Bridge Creek Intake
- Outback Hydrogeneration Facility (Outback Facility)
- Aquifer Storage and Recovery (ASR) injection wells
- Distribution System sites including the following:
  - Awbrey Butte Feed (Pressure-Reducing Valve [PRV]-004)
  - Overturf Feed (PRV-003)
  - A number of the following potential locations:
    - Athletic Club (PRV-064)
    - Wild Rye and Wild Rye (PRV-038)
    - Summerhill (PRV-031)
    - Wichita (PRV-088)

6.1 Scope of Work and Objectives

This is the first of several chapters that develop an understanding of possible generation capabilities at each potential site, turbine cost, and critical issues such as permitting and financing of the project.

The scope of work for this chapter includes the following for each site:

- **Water Demand and Projections.** Identify key water demand and projection assumptions used to establish a basis for analysis.
- **Generation Site.** Identify the site and project flow and head available.
- **Energy Generation.** Identify turbine type, size, characteristics, efficiencies, minimum and maximum flow capacities, and hydrogeneration capacity/production.
- **Site Layout.** Identify, size, and locate hydropower equipment and required structures including turbine inlet piping and manifolds, energy dissipating valves, mechanical and electrical requirements, and connections to utility power lines.
- **Power Distribution.** Discuss the requirements for hydrogeneration interconnection into the existing power distribution.
- **Powerhouse Permitting.** Identify federal, state, and local building and land-use permitting requirements for hydrogeneration.
- **Cost Estimate.** Prepare turbine cost estimate.
- **Project Schedule.** Prepare a schedule through the project.
- **Recommended Alternative.** Discuss recommended alternatives.

6.2 Bridge Creek Intake Hydrogeneration Facility

The Bridge Creek Intake site was removed from consideration for hydroelectric generation due to environmental concerns. It was determined that the environmental effects of diverting Bridge Creek downstream of the intake and drying the channel for part of the year would be too detrimental to recommend the option.

6.3 Outback Hydrogeneration Facility

The following sections provide relevant details about the Outback Facility.

6.3.1 Water Demand and Projections

The hydrogeneration capacity analysis for the Outback and ASR wells sites will be based on the water rights, historical annual average water demand, and population for the City of Bend (City). The average annual daily demand projections from Year 2009 to Year 2030 were developed from the *City of Bend Water Master Plan Update* dated March 2007 by MSA and the *2000-2008 Water Graphs-Production-Meters* spreadsheet provided by the City. The demand projections were developed using a linear increase in water demand based on Water Service Area population growth of 52,941 to 103,000 from Year 2005 to Year 2030, respectively. The average annual daily demand projections from Year 2031 to Year 2062 were developed assuming a constant gallon per capita day demand and a population growth that would decrease at a linear rate to 0.5 percent at year 2062. Therefore, it is assumed that some redevelopment within the existing water service boundary and/or additional land will be incorporated into the existing boundary. Figure 6-1 shows the projected water service population and annual average demand from years 2009 to 2062, as well as the assumed population growth and demand over time.

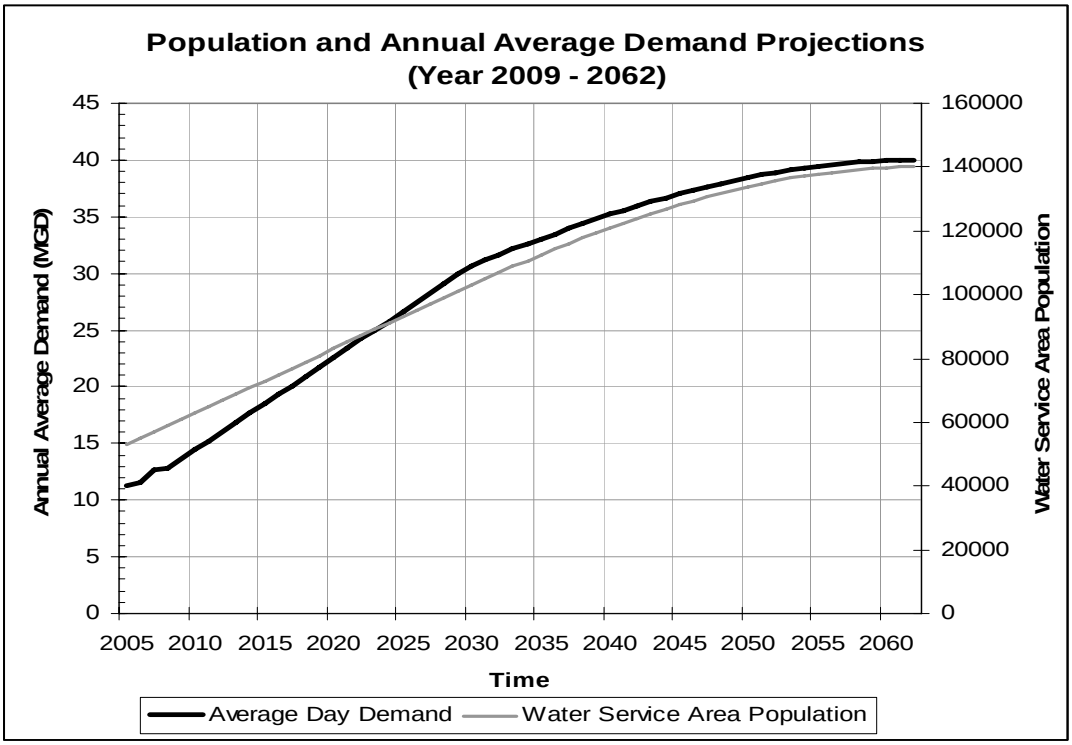


Figure 6-1. Population and Average Annual Demand Projections

In order to establish the flow available for hydrogeneration, the water rights available at the City's Outback Facility had to be projected. Calculating the generation potential for all possible permutations of flow was beyond the scope of this feasibility study; therefore two water rights scenarios were used. The scenarios represented the best available understanding of future water availability at the time this report was prepared.

Use of water under the City's water rights depend on a variety of factors including confirmation of existing rights, and were expected to increase during the life-cycle of the hydrogeneration facility. The water rights are discussed in detail in Chapter 11 – Water Rights Considerations and the letter submitted by GSI Water Solutions, Inc. on May 27, 2009 entitled *Daily Volume Graphs for Certified Water Rights (Irrigation Season)*. Briefly, two water rights scenarios were considered appropriate for analysis and comparison for their effect upon generation at the Outback and ASR Injection Wells Hydrogeneration Facilities. The first scenario (Scenario 3b) projected that up to 24 cubic feet per second (cfs) (16 million gallons per day [mgd]) of certificated water rights may be available, depending on the season. The second scenario (3c), was similar to Scenario 3b but then projected that beginning in year 2019, up to 36 cfs (24 mgd) of certificated water rights may be available, depending on the season. Based on consideration of the City's water right priority dates, streamflow and other appropriators on Tumalo Creek, the predicted maximum available in Scenario 3c is 26.99 cfs (17.4 mgd). Figure 6-2 shows the Annual Average Water Demand (AAD) for years 2009, 2013, and other years through the end-of-study year 2062.

The figure also shows the water rights for Scenarios 3b and 3c.

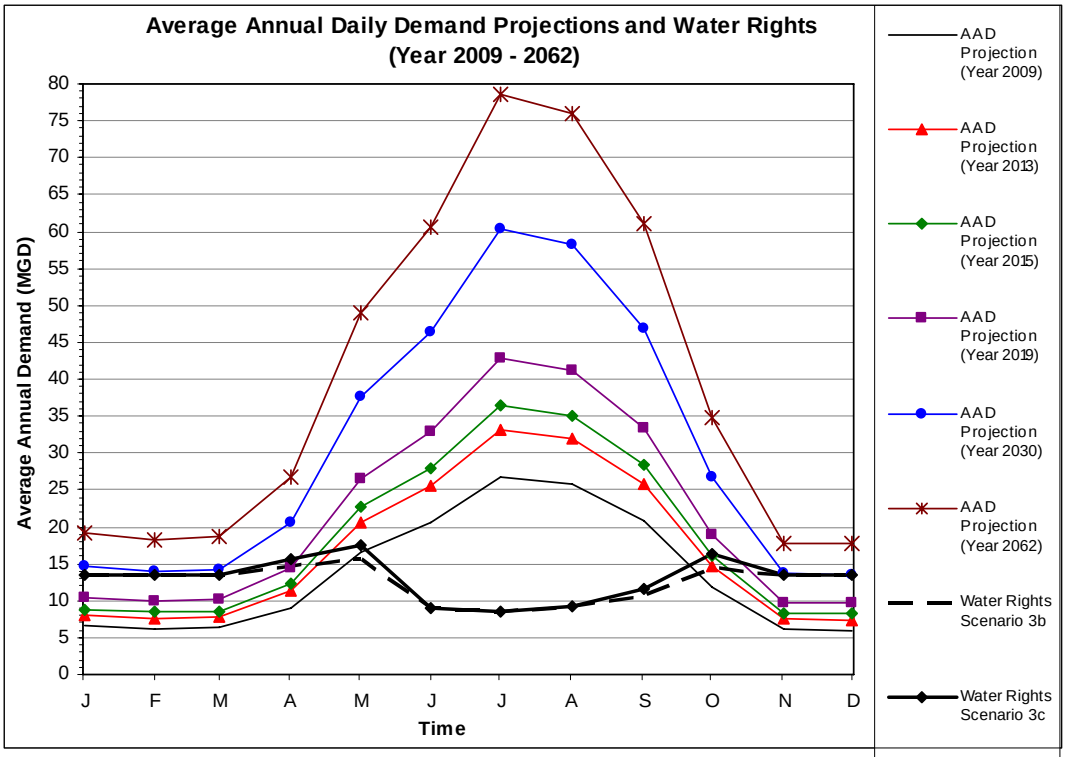


Figure 6-2. Average Annual Daily Demand Projection and Water Rights

The City's water rights scenarios and predicted system demands were used to determine the flow available for hydrogeneration at the Outback Facility and ASR injection well sites. Three flow scenarios were evaluated for the Outback and ASR Injection Well Hydrogeneration facilities. All of the scenarios assume the Outback Facility and ASR Injection Well Facilities will be online and have all the required permits by the end of December 2012.

- **Scenario I–Water Right Scenario 3b with full use**. The scenario assumed that all the water in the right will be used for generation through the Outback Facility. Water Right Scenario 3b is assumed to hold for 50-year project life-cycle. Any remaining water after the system water demand has been met will be injected into the ASR wells. Figure 6-3 shows the available hydrogeneration flow for both the Outback and ASR Injection Well Hydrogeneration Facilities in flow Scenario 1.

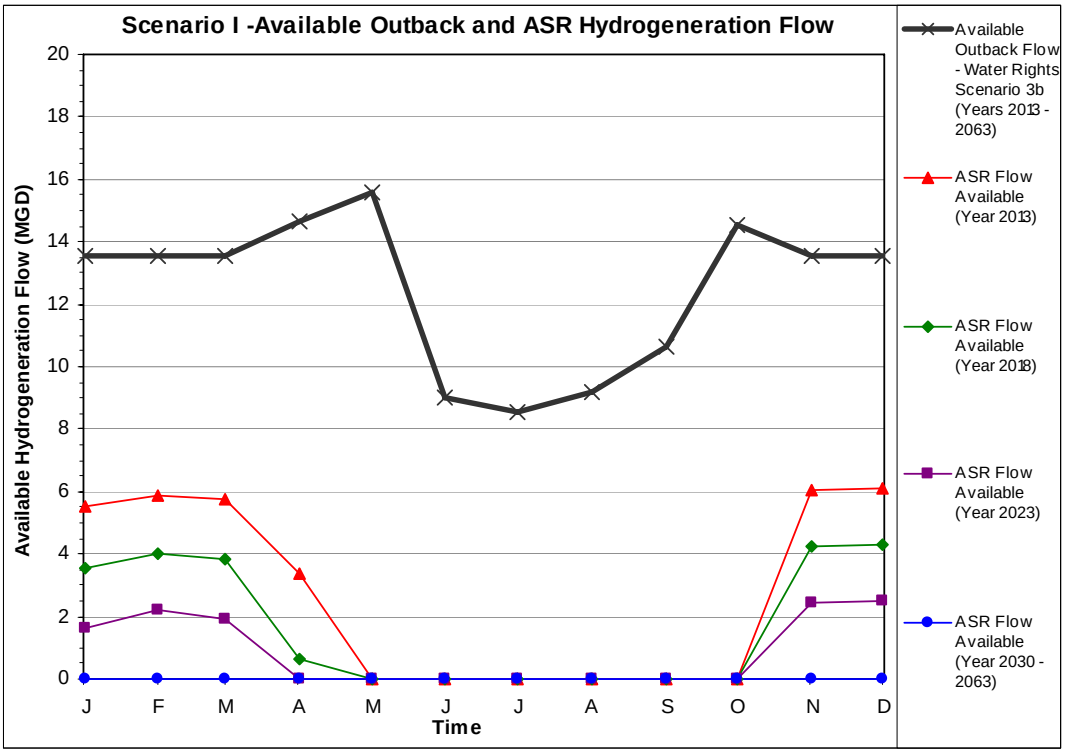


Figure 6-3. Scenario I – Available Flow for Hydropower at Outback and ASR Injection Wells Facilities

- **Scenario II–Water Right Scenario 3b without full use.** This scenario assumed that when the system demand is greater than the water right, all the surface water will be used for generation at the Outback Facility. When the system demand is less than the water right, only the system demand will be used for generation at the Outback Facility. This scenario evaluates hydrogeneration life-cycle costs without the use of ASR injection wells; the capital costs are lower, but the energy generated is less also. The Water Right Scenario 3b is assumed to hold for 50-year project life-cycle. Figure 6-4 shows the available hydrogeneration flow for the Outback Facility. Note that under this scenario, there is no water out of the Outback powerhouse available for injection in the ASR wells. Also note, that from Year 2031 forward, the system demand is predicted to be greater that the water rights.

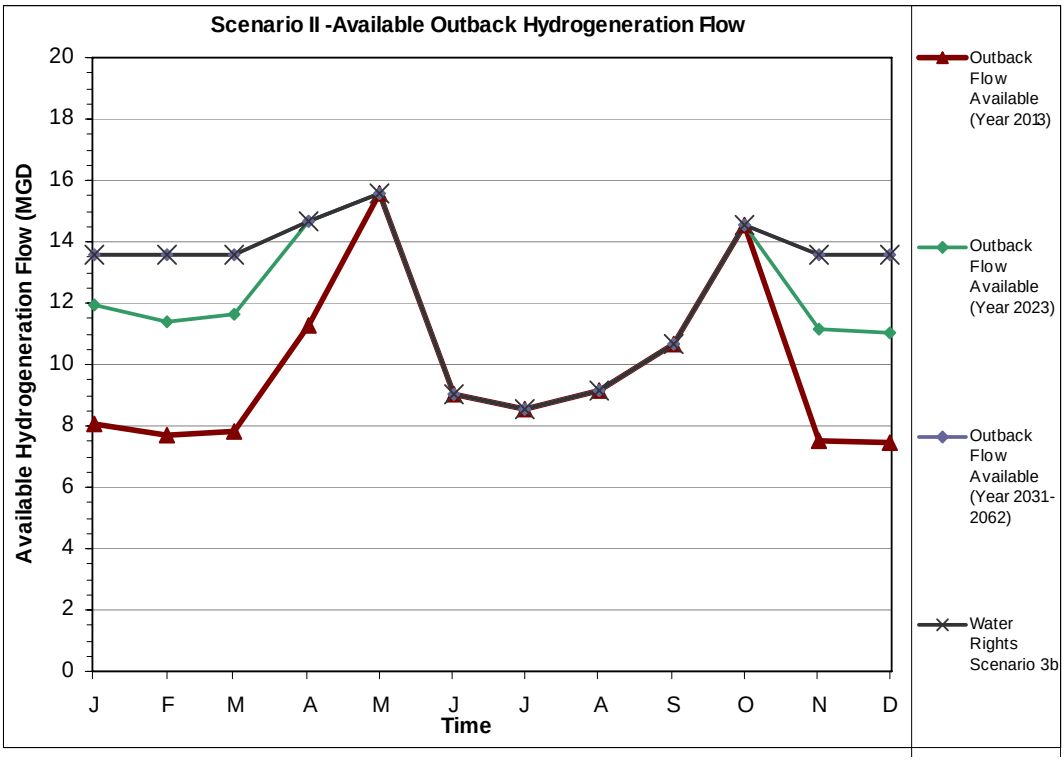


Figure 6-4. Scenario II - Available Flow for Hydropower at Outback Facility

- **Scenario III–Water Right Scenario 3b with full use from start-up Year 2012 through 2018, and Water Right Scenario 3c from Year 2019 through study end-year 2062.** This is Scenario I with the additional water rights coming online in Year 2019. All water in the right will be used for generation through the Outback Facility. Any remaining water after the system water demand has been met will be injected into the ASR wells. Figure 6-5 shows the available hydrogeneration flow for both the Outback Facility and ASR Injection Well Hydrogeneration Facilities. Of the three flow scenarios, Scenario III predicts the most water available for hydrogeneration at the Outback and ASR Injection Wells Hydrogeneration Facilities.

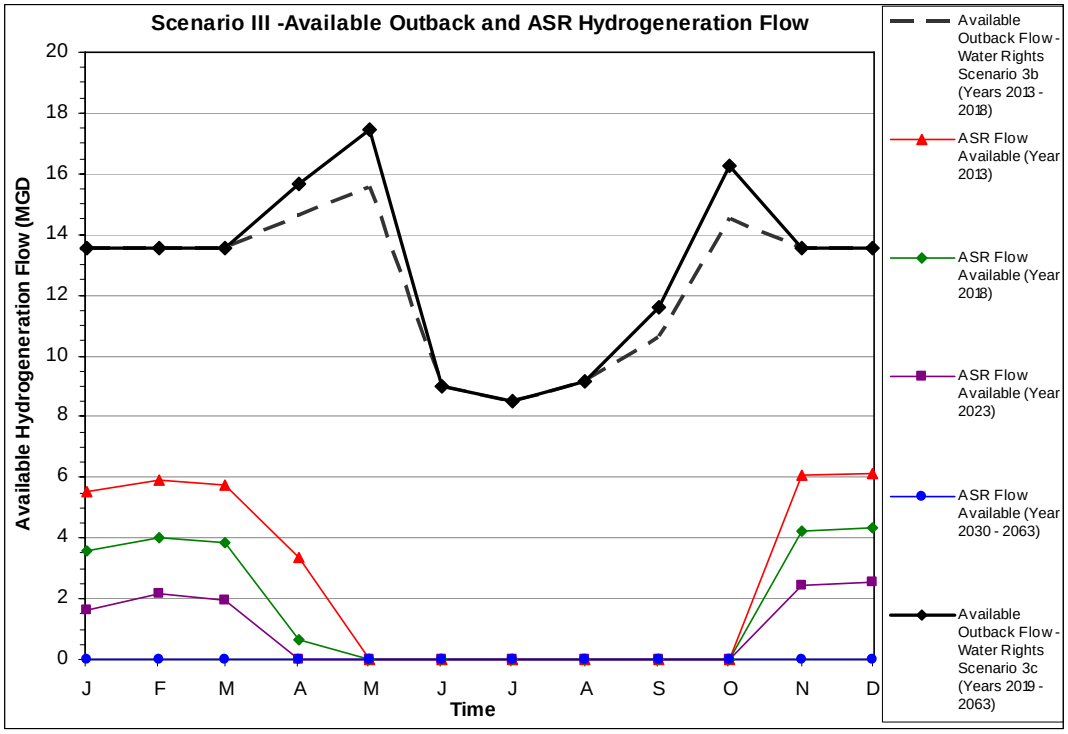


Figure 6-5. Scenario III - Available Flow for Hydropower at Outback and ASR Injection Wells Facilities

It is assumed that the future water supply and water rights are not limited beyond what is currently shown in these figures. Also, when demand is greater than the water rights, the additional water will be provided by the City's groundwater wells to the water distribution system.

6.4 Generation Site

The Outback Facility site was reviewed to determine the flow and head available for hydrogeneration for Years 2013 to 2063. The assumptions associated with this analysis are outlined below:

- Penstock will be 52,000 feet, approximately 10 miles long.
- Penstock will be a single steel pipe 36 inches inside diameter and epoxy-lined.
- Headloss in penstock is determined from the Hazen-Williams equation with a C factor equal to 140.
- There is no penstock restriction that might limit the water flow that can be used to generate power after the penstock construction is complete. For the purpose of calculating generation capacity, it is assumed that the penstock construction is complete when the hydrogeneration facility is built.

- The dam crest elevation at the intake is 4,992 feet.
- Outback Facility grade varies from 3,976 feet to 3,985 feet. The grade is approximately 3,981.5 feet at the proposed powerhouse location.
- Turbine centerline elevation is 3,977 feet.
- The gross head available for hydrogeneration is 1,015 feet.
- The interval basis for calculating hydrogeneration capacity will be monthly. This interval is assumed appropriate for the City's water supply system feasibility study.
- Since sizing of the turbine-generator is a one-time event, the design flow was used in determining the size of the turbine-generator. For the purpose of calculating generation capacity, the design flow was based on water right Scenarios 3b and 3c. A turbine can provide efficient operation at the flows found in Scenarios 3b and 3c. An alternative of using two smaller turbines each with a capacity for Scenarios 3b and 3c was also evaluated. The calculation of the generation capacity is in this chapter. The development of the present worth of the alternatives is in Chapter 7.
- Generator efficiency is 0.94.
- Transformer efficiency is 0.99.
- Annual planned outage efficiency is 0.97 or 11 days per year. Forced or unplanned outages are assumed at 3 months every 15 years. This has been accounted for as five extra outage days per year.
- The Bend Water Treatment Plant (WTP) will have two electrical feeds: a main feed from the power grid, and another feed from the Outback Facility. Thus, it is acceptable for periodic power interruptions from the Outback Facility and it is not required to provide constant reliable power. This outage will allow equipment to be maintained, any necessary equipment repairs, and equipment refurbishing.
- Life-cycle span of the Outback Facility is 50 years from Years 2013 to 2063.

These assumptions were incorporated to provide the net head and flow used in the hydrogeneration calculations for Scenario I, Scenario II, and Scenarios III as listed in Tables 6-1 through 6-3, respectively.

Table 6-1. Scenario I - Flow and Head Available for Outback Hydrogeneration Facility

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Years 2013 – 2063 Water Rights Scenario 3b												
Flow, mgd	13.57	13.57	13.57	14.64	15.57	9.01	8.54	9.16	10.64	14.54	13.57	13.57
Head, feet	999	999	999	997	995	1008	1008	1007	1005	997	999	999

Table 6-2. Scenario II - Flow and Head Available for the Outback Hydrogeneration Facility

	January		February		March		April		May		June		July		August		September		October		November		December	
Year	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft	Flow, mgd	Head, ft
2013	8.07	1009	7.68	1010	7.85	1009	11.28	1004	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	7.52	1010	7.45	1010
2014	8.45	1009	8.06	1009	8.22	1009	11.83	1003	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	7.88	1009	7.81	1009
2015	8.84	1008	8.43	1009	8.60	1008	12.37	1002	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	8.25	1009	8.17	1009
2016	9.23	1007	8.80	1008	8.98	1008	12.92	1001	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	8.61	1008	8.53	1008
2017	9.62	1007	9.17	1007	9.36	1007	13.46	1000	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	8.97	1008	8.89	1008
2018	10.01	1006	9.54	1007	9.74	1007	14.00	999	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	9.34	1007	9.25	1007
2019	10.40	1006	9.91	1006	10.12	1006	14.55	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	9.70	1007	9.61	1007
2020	10.79	1005	10.28	1006	10.49	1005	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	10.06	1006	9.97	1006
2021	11.18	1004	10.65	1005	10.87	1005	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	10.42	1005	10.33	1006
2022	11.57	1003	11.02	1004	11.25	1004	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	10.79	1005	10.69	1005
2023	11.96	1003	11.39	1004	11.63	1003	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	11.15	1004	11.05	1004
2024	12.34	1002	11.76	1003	12.01	1003	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	11.51	1004	11.41	1004
2025	12.73	1001	12.13	1002	12.39	1002	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	11.87	1003	11.77	1003
2026	13.12	1000	12.50	1002	12.77	1001	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	12.24	1002	12.12	1002
2027	13.51	1000	12.87	1001	13.14	1000	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	12.60	1001	12.48	1002
2028	13.57	999	13.24	1000	13.52	1000	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	12.96	1001	12.84	1001
2029	13.57	999	13.57	999	13.57	999	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	13.33	1000	13.20	1000
2030	13.57	999	13.57	999	13.57	999	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	13.57	999	13.56	999
2031 to 2063	13.57	999	13.57	999	13.57	999	14.64	997	15.57	995	9.01	1008	8.54	1008	9.16	1007	10.64	1005	14.54	997	13.57	999	13.57	999

Table 6-3. Scenario III - Flow and Head Available for Outback Hydrogeneration Facility												
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Years 2013 – 2018 Water Rights Scenario 3b												
Flow, mgd	13.57	13.57	13.57	14.64	15.57	9.01	8.54	9.16	10.64	14.54	13.57	13.57
Head, feet	999	999	999	997	995	1008	1008	1007	1005	997	999	999
Years 2019 – 2063 Water Rights Scenario 3c												
Flow, mgd	13.57	13.57	13.57	15.64	17.44	9.01	8.54	9.16	11.59	16.26	13.57	13.57
Head, feet	999	999	999	995	990	1008	1008	1007	1003	993	999	999

Note: The flows in Tables 6-1, 6-2, and 6-3 were taken from Chapter 11–Water Rights Considerations.

6.4.1 Energy Generation

The Outback Facility has the optimal high head and flow conditions for a Pelton wheel turbine. Other turbine types were checked briefly but the Pelton turbine is the only turbine that can operate at this high head. Therefore, other turbines were not considered further for this application. The Pelton turbine tentative size and characteristics were determined using software called TURBNPRO. TURBNPRO is a hydraulic turbine sizing and technical data development program. It was created to assist hydraulic engineers in establishing turbine sizes, speeds, setting limitations, dimensions, and performance characteristics for a particular hydroelectric site condition, desired operating parameters and equipment arrangement. Table 6-4 lists the Pelton turbine characteristics for the Outback Facility site. Appendix 6-A provides a typical plan and profile of a Pelton wheel turbine.

Table 6-4. Pelton Turbine Characteristics		
Turbine type	Two Pelton wheels—Alternative 1, each turbine	One Pelton wheel—Alternative 2 , recommended
Turbine size, megawatts (MW)	2.0	3.0
Expected efficiency, percent	89.9	89.9
Minimum flow, cfs	4	5
Flow at peak efficiency, cfs	20.4	28

The 2.0-MW turbine was sized to have the best efficiency point at 20.4 cfs at 1,000 feet of net head. The 3.0-MW turbine was sized to have its peak efficiency at 28 cfs. The turbines were selected to best fit the flows predicted for the life of the project. Flows are based on water rights Scenarios 3b and 3c, as described earlier. Both turbines have a single nozzle. The expected head and flow changes are nominal and the single nozzle should be more than adequate.

The two Pelton wheel arrangement (Alternative 1) has the capacity to meet the desired maximum project capacity. The projected maximum daily flow based on the water rights scenarios for the next 50 years is 26.99 cfs. A single 3.0-MW turbine also meets the design flow criteria and is less expensive.

Two Outback Facility powerhouse alternatives are presented, one with a single selected turbine, and another with two of a smaller turbine, to address the issues of outage time and operational redundancy. Pelton wheel turbines typically have annual maintenance for inspection and repairs lasting 2 to 3 days, rehabilitation every 30 to 40 years lasting 4 to 6 weeks, and any unexpected repairs that could last hours to months. Depending on the City's requirements for power generation at the facility, and the economic benefit of having continuous generation, a standby unit may be desired. Therefore, two alternatives were reviewed for the

Outback Hydrogeneration Facility. Alternative 1 has two Pelton wheel turbines each capable of generating power from the total flow available from Scenarios 3b and 3c and Alternative 2 has one Pelton wheel turbine sized for the same flows.

Table 6-5 lists the annual energy generated for both alternatives at the Outback Facility site for each of the flow scenarios.

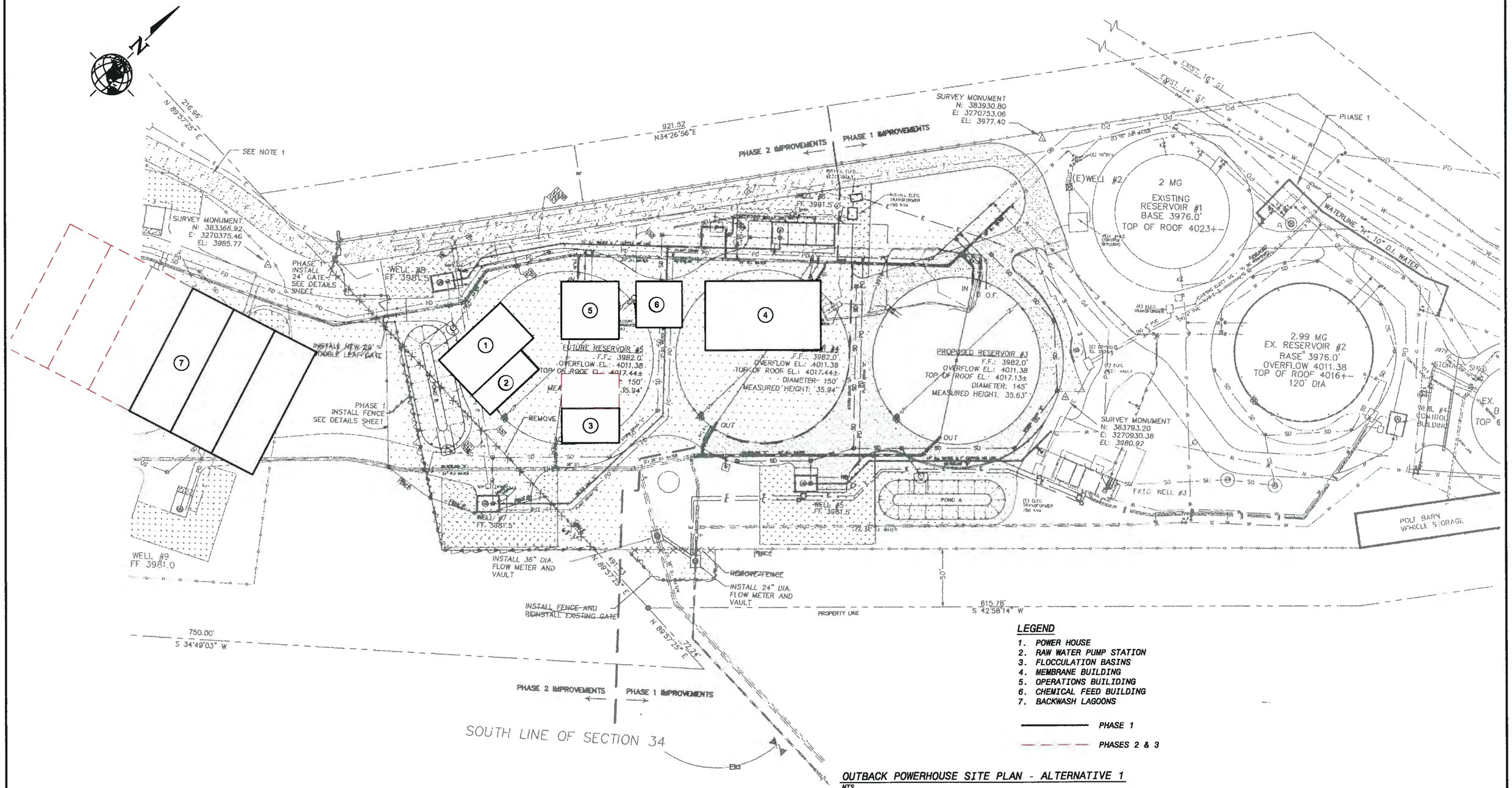
Table 6-5. Outback Powerhouse Annual Energy Generation for Each Alternative and Scenarios I, II, and III

Alternative 1 – Two Pelton wheels		Alternative 2 – One Pelton wheel	
Year	Power, kilowatt hours (kWh)	Year	Power, kWh
Scenario I		Scenario I	
2013 - 2063	11,820,000	2013 - 2063	11,820,000
Scenario II		Scenario II	
2012	4,475,000	2012	4,475,000
2013	9,260,000	2013	9,260,000
2014	9,450,000	2014	9,450,000
2015	9,640,000	2015	9,640,000
2016	9,830,000	2016	9,830,000
2017	10,010,000	2017	10,010,000
2018	10,200,000	2018	10,200,000
2019	10,390,000	2019	10,390,000
2020	10,540,000	2020	10,540,000
2021	10,680,000	2021	10,680,000
2022	10,830,000	2022	10,830,000
2023	10,970,000	2023	10,970,000
2024	11,110,000	2024	11,110,000
2025	11,260,000	2025	11,260,000
2026	11,400,000	2026	11,400,000
2027	11,540,000	2027	11,540,000
2028	11,680,000	2028	11,680,000
2029	11,750,000	2029	11,750,000
2030	11,790,000	2030	11,790,000
2031 - 2063	11,790,000	2031 - 2063	11,790,000
Scenario III		Scenario III	
2013 - 2018	11,820,000	2013 - 2018	11,820,000
2019 - 2063	12,390,000	2019 - 2063	12,390,000

6.4.2 Site Layout

Figure 6-6 shows the site layout of the largest powerhouse footprint (Alternative 1–Two Pelton Wheels). The site plan also shows a preliminary layout with the WTP Alternative 3–Membrane Filtration discussed in Chapter 5. Note that the discharge from the Outback Facility is to atmospheric pressure and will need to be pumped from the raw water pump station to the water treatment. The cost of the pumping facilities is included in the project cost.

The plan layout of both Alternatives 1 and 2 show the typical equipment associated with the facilities. Alternative 1 has two Pelton wheel turbines and is shown in Figure 6-7. Alternative 2 has one Pelton Wheel turbine and is shown in Figure 6-8. Both drawings show the turbine(s) and associated generator, turbine inlet piping and manifolds, energy dissipating valves, mechanical and electrical requirements, and connections to utility power lines.



LEGEND

1. POWER HOUSE
2. RAW WATER PUMP STATION
3. FLOCCULATION BASINS
4. MEMBRANE BUILDING
5. OPERATIONS BUILIDING
6. CHEMICAL FEED BUILDING
7. BACKWASH LAGOONS

PHASE 1

PHASES 2 & 3

OUTBACK POWERHOUSE SITE PLAN - ALTERNATIVE 1

NTS

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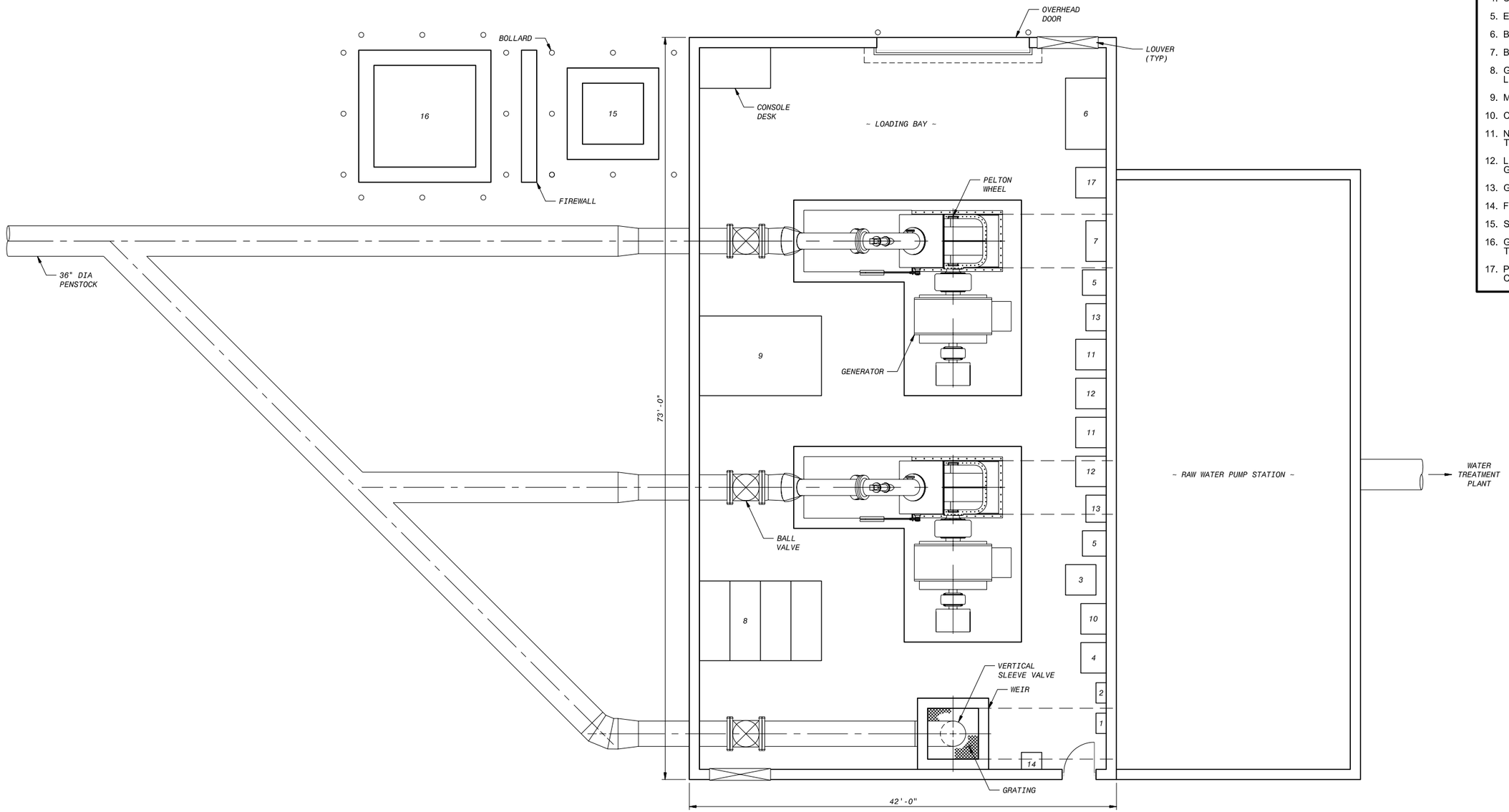
Portland, Oregon

CITY OF BEND

WATER SUPPLY ALTERNATIVES PROJECT

TM5-HYDROGENERATION EVALUATION

Figure 6-6 OUTBACK POWERHOUSE SITE PLAN
(ALTERNATIVE 1 BUILDING SHOWN)



POWERHOUSE EQUIPMENT

1. LIGHTING PANEL
2. POWER PANEL
3. LIGHTING TRANSFORMER
4. UPS CABINET
5. EXCITATION CUBICLE
6. BATTERY SYSTEM
7. BATTERY CHARGER
8. GENERATOR SWITCH GEAR LINEUP
9. MOTOR CONTROL CENTER (MCC)
10. COMMUNICATION CABINET
11. NEUTRAL GROUNDING TRANSFORMER CUBICAL
12. LINE INTERFACE CUBICLE (FOR GENERATION CONNECTION)
13. GOVERNOR CONTROL CUBICLE
14. FIRE ALARM PANEL
15. STATION SERVICE TRANSFORMER
16. GENERATOR STEP-UP TRANSFORMER
17. PACIFICORP OWNED EQUIPMENT CABINET

OUTBACK POWERHOUSE PLAN - ALTERNATIVE 1

3/32" = 1'-0"

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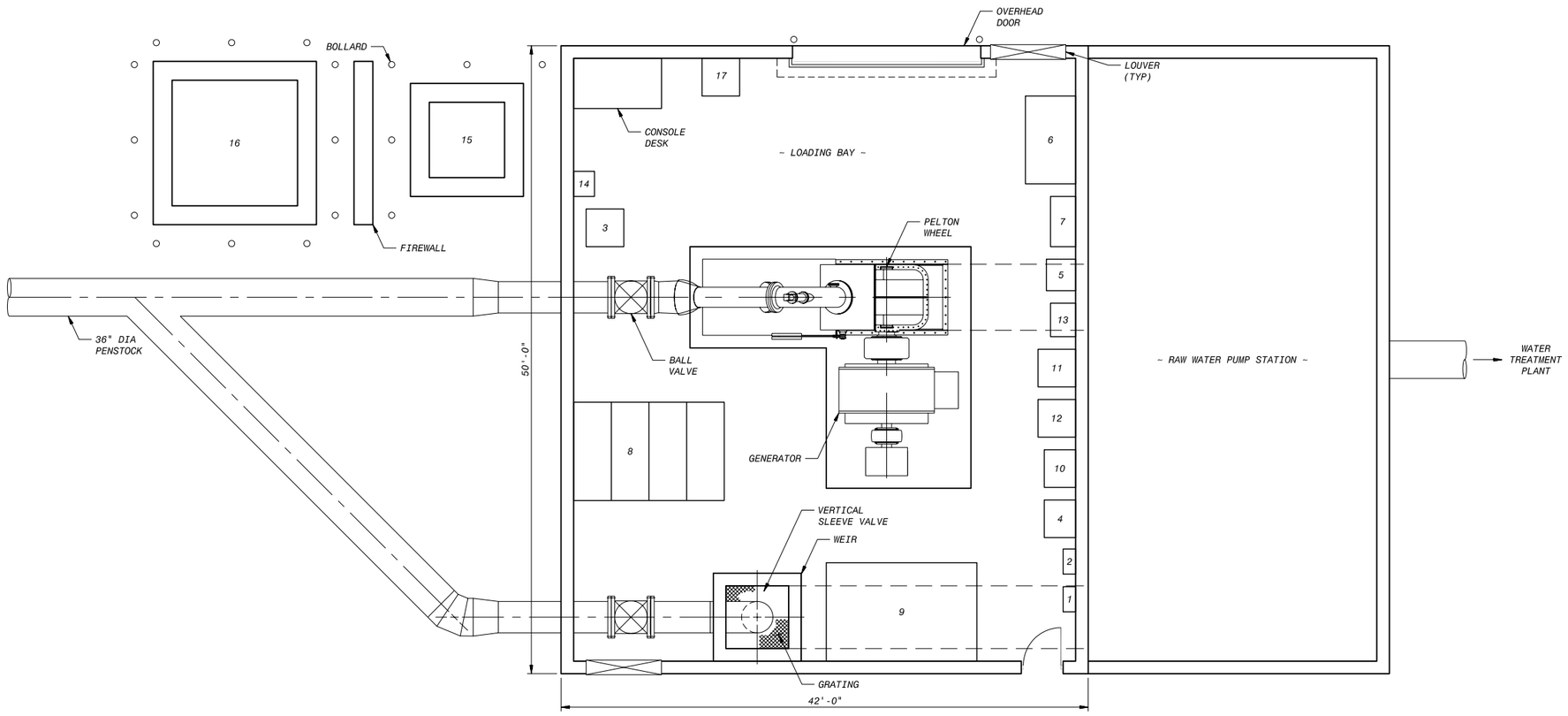
Portland, Oregon

CITY OF BEND
WATER SUPPLY ALTERNATIVES PROJECT
TM5-HYDROGENERATION EVALUATION
Figure 6-7 OUTBACK POWERHOUSE PLAN ALTERNATIVE 1

POWERHOUSE EQUIPMENT

1. LIGHTING PANEL
2. POWER PANEL
3. LIGHTING TRANSFORMER
4. UPS CABINET
5. EXCITATION CUBICLE
6. BATTERY SYSTEM
7. BATTERY CHARGER
8. GENERATOR SWITCH GEAR LINEUP
9. MOTOR CONTROL CENTER (MCC)
10. COMMUNICATION CABINET
11. NEUTRAL GROUNDING TRANSFORMER CUBICAL
12. LINE INTERFACE CUBICLE (FOR GENERATION CONNECTION)
13. GOVERNOR CONTROL CUBICLE
14. FIRE ALARM PANEL
15. STATION SERVICE TRANSFORMER
16. GENERATOR STEP-UP TRANSFORMER
17. PACIFICORP OWNED EQUIPMENT CABINET



OUTBACK POWERHOUSE PLAN - ALTERNATIVE 2

3/32" = 1'-0"

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TM5-HYDROGENERATION EVALUATION

Figure 6-8 OUTBACK POWERHOUSE PLAN ALTERNATIVE 2

As previously discussed, since the Pelton wheel discharges the water to atmospheric conditions, the discharge flow would need to be pumped to the WTP to approximately the Outback Reservoir overflow elevation of 4,011 feet. To gravity feed the discharge to the WTP tanks, the centerline of the turbine would need to be elevated by relocating the facility to higher ground or by raising the centerline elevation of the turbine. Relocating the facility to higher ground (i.e., further upstream on the conduit) will require construction of the powerhouse on forest service land which will negate the ability to obtain a Federal Energy Regulatory Commission (FERC) conduit exemption. Raising the centerline elevation of the turbine will require an elevated powerhouse (approximately 130 feet above grade) to account for hydraulic losses through the WTP. Because of restrictions for a FERC conduit exemption and the additional head required, neither of these options is considered feasible.

6.5 Power Distribution

This section contains a discussion about the power distribution system for the Outback Facility.

6.5.1 Description

The requirements for generation interconnection to PacifiCorp distribution are presented. The proposed generation resource, including a capacity to produce approximately 3 MW of power at the Outback Facility and a total of 0.3 MW (three wells at 0.1 MW each) of power at the ASR Injection Wells Hydrogeneration Facility, is suited to supply power to the PacifiCorp distribution system as a customer-owned/controlled parallel generation project. Technically, it would be feasible to sell energy to another customer using PacifiCorp's electrical system; however, given the scale of this project, such a contractual arrangement would be disproportionately complex.

This study proposes connecting to the PacifiCorp 12.47-kilovolt (kV) distribution system in accordance with the most recent revision of PacifiCorp's *Cogeneration and Parallel Generation Interconnection Guide* and *Small Generator Interconnection Request Application Form*. Any interconnection made with PacifiCorp will be subject to its engineering evaluation. One application may be required at the Outback WTP since both the Outback and ASR Injection Well Hydrogeneration Facilities may be connected to the power distribution at one location. While this study proposes what we believe to be the most reasonable technical solution, there may be constraints or special requirements known only to PacifiCorp.

6.5.2 Plant Facilities

The proposed generation resource, with a capacity to produce approximately 3 MW of power at the Outback Facility and a total of 0.3 MW (three wells at 0.1 MW each) of power at the ASR Injection Wells Hydrogeneration Facility, is suited to supply power to the PacifiCorp distribution system as a customer-owned/controlled parallel generation project. From the load terminals of the generator breaker, insulated power cable will be installed connecting the generator to a unit substation immediately adjacent to and outside the generator building. The unit substation will contain a 3.3-MVA up oil insulated step-up transformer with the utility side 12.47-kV winding connected in a grounded wye configuration. The 12.47-kV high-voltage winding will be connected to a vacuum circuit breaker cubicle, a metering cubicle, and a visible disconnect switch cubicle. The utility's interchange and telemetering instrument transformers would occupy the metering cubicle. The 12.47-kV power output will be conducted via underground PacifiCorp insulated cables to a PacifiCorp riser pole either at the edge of the plant property, or some other convenient location near the adjacent 12.47-kV distribution circuit or to the plant's 12.47-kV distribution circuit.

The most likely extent of the plant-owned (City-owned) equipment will be the 12.47-kV disconnect switch in the unit substation. PacifiCorp will own the insulated cable which will connect to the terminals of the switch and will extend to its overhead distribution circuit. PacifiCorp equipment to be installed within the plant will include the following items:

- PacifiCorp will require the interconnected generator to disconnect from the PacifiCorp circuit if the generator moves outside of acceptable voltage or frequency limits.
- PacifiCorp will require interchange meters and their associated communication circuits. This could be a dial-up telephone circuit.
- PacifiCorp may require a supervisory control and data acquisition (SCADA) remote terminal unit (RTU), for monitoring the status of plant equipment, with associated communication circuits.
- Telemetering transducers and their associated communication circuits, for communication of plant output. This function is required for interconnection, but may be integrated into the SCADA RTU.

The scheme proposed below is believed to be the most cost-effective approach to interconnecting the generator at the WTP.

6.5.3 Utility Facilities

Based on the assumption that there exist no generation sources on the adjacent distribution circuit, the following modifications will be required to PacifiCorp's distribution system:

- PacifiCorp may have to construct a tap from the 12.47-kV line to high side of the visible switchgear cubicle disconnect. This would be at the cost of the generator (City).
- PacifiCorp may have to re-conductor the line serving the WTP. This would be at the cost of the generator (City).
- PacifiCorp may have to alter or add line protection devices or relays. This would be at the cost of the generator (City).

6.5.4 Other Requirements

The facilities would need to comply with the following:

- National Electrical Code
- The National Electrical Safety Code
- Institute of Electrical and Electronics Engineers (IEEE) 1547, Distributed Resources Interconnected with Electric Power Systems
- Power Quality Standard IEEE 519-1992 Harmonic Limits
- Electric Service Requirements Manual for Oregon
- Any other regulations pertaining to a facility of this nature

6.6 Powerhouse Permitting

The City is investigating the feasibility of constructing hydroelectric generation facilities at the Outback Facility, within a new ASR injection well field, and at PRV locations within the distribution system. The following paragraphs discuss the specific federal and state hydroelectric programs and powerhouse construction permitting requirements that could affect the hydrogeneration projects only. Many of these and

other permits are likely required to construct other aspects of the hydrogeneration facilities, including the penstock pipeline and a new intake building. These permits are not discussed in this chapter, but are discussed further in Chapter 10.

The discussion of hydroelectric licensing requirements is based on the following key assumptions:

- The hydroelectric project would have a generating capacity of 3.5 to 4 MW and would utilize the hydroelectric potential at each potential location.
- The potential locations for the hydroelectric project at the Outback Facility, ASR wells, and distribution system sites are not federally owned but owned by the City.
- The location for the hydroelectric project at the Outback Facility, ASR wells, and distribution system sites are not located within the 100-year floodplain of the Tumalo Creek or Bridge Creek.
- Bridge Creek is a navigable waterway.
- There is no discharge to waterways from the hydrogeneration facilities.

6.6.1 Federal Hydroelectric Authorization by the FERC

The Federal Power Act provides FERC with the exclusive authority to license non-federal water power projects on navigable waterways and federal lands. FERC issues licenses for up to 50 years for constructing, operating, and maintaining nonfederal hydropower projects. Development of a hydroelectric facility at the water supply project would require FERC authorization.

Based on the information described above, the project could qualify for a license for a major water power project (5 MW or less; see 18 Code of Federal Regulations [CFR] 4 Subpart G) or a conduit exemption (see 18 CFR 4 Subpart J). These are described below.

FERC License for Major Water Project (1.5 MW to 5 MW) and Minor Water Project (1.5 MW or Less)

A FERC license covers all components, structures, and lands associated with the operation of the hydroelectric facility. FERC licensing regulations are categorized according to certain project-specific criteria, including a facility's generating capacity, and whether a project is not yet constructed or at an existing dam location.

If FERC licensing is pursued for the hydrogeneration project as one application, the project would most likely be considered a major water power project (unit sized between 1.5 MW and 5 MW). If FERC licensing is pursued for the hydrogeneration project as individual applications, the Outback Facility project would most likely be considered as an individual major water project (1.5 MW to 5 MW), and the ASR and Distribution projects would most likely be considered as minor water power project (1.5 MW and less), respectively. Both a major (1.5 MW to 5 MW) or minor (1.5 MW and less) water power project would be subject to the application requirements outlined in 18 CFR 4.61. An application for a major water power project or minor water power project must include the following components (see 18 CFR 4.61):

- Introductory Statement
- Exhibit A. Project Description–describes the technical aspects of the project construction and operation activities
- Exhibit E. Environmental Report–includes a description of environmental resources at the project, and the expected impacts associated with project construction and operation
- Exhibit F. Project Technical Drawings–includes a set of drawings that show the structures and equipment associated with the small conduit hydroelectric facility

- Exhibit G. Project Map–includes a site plan that shows the layout of the principal project features and the project boundary

Consultation with FERC and the state is suggested to determine if these entities would view the Outback Facility, ASR Injection Wells, and Distribution Hydrogeneration Facilities as a single complete project or as separate projects. Such a determination could influence the permitting requirements for the project.

FERC Conduit Exemption

Hydroelectric projects that meet certain criteria and are expected to result in low environmental impacts can apply for an exemption from the licensing requirements of the Federal Power Act. A conduit exemption includes the components and lands required to operate the hydrogeneration project, but excludes the conduit itself and any associated power transmission line. An exemption is granted to the project in perpetuity (as opposed to a term limit for a license) and generally, has a more abbreviated processing period. The exemption must adopt any conditions imposed by the state and federal fish and wildlife agencies.

A project must meet a number of criteria to qualify for a conduit exemption (see 18 CFR 4.30(b)(2) and 4.30(b)(28)), but those that are of particular importance include the following:

- The project must include the use of a conduit (tunnel, flume, ditch, canal, etc.) whose primary use is for hydroelectric generation. In this case, a conduit is defined as a tunnel, ditch, canal, etc. whose primary use is distribution of water for agricultural, municipal or industrial consumption. The conduit from the intake to Outback WTP would be expected to meet this criterion.
- The project must not include the construction or modification of a dam unless said construction would occur for agricultural, municipal, or industrial consumptive purposes even if hydroelectric generating facilities were not installed. This criterion would be met.
- The project is located entirely on non-federal lands. It is assumed that the lands at the potential hydroelectric locations are non-federal. Therefore, this criterion is met.
- The project has an installed generating capacity of 15 MW or less (40 MW in the case of a municipal water supply project). This criterion is met.
- The project is not an integral part of a dam. This criterion is met.
- The project discharges the water it uses for power generation into one of the following: (a) a conduit; (b) a point of agricultural, municipal, or industrial consumption; or (c) into a natural water body. This criterion is met.

Based on the above information and assumptions, the projects would qualify for an exemption. An application for a small conduit exemption must include the following components (see 18 CFR 4.92):

- Introductory Statement.
- Exhibit A. Project Description–describes the technical aspects of the project construction and operation activities.
- Exhibit E. Environmental Report–includes a description of environmental resources at the project, and the expected impacts associated with project construction and operation.
- Exhibit F. Project Technical Drawings–includes a set of drawings that show the structures and equipment associated with the small conduit hydroelectric facility.
- Exhibit G. Project Map–includes a site plan that shows the layout of the principal project features and the project boundary.

FERC Application Process

The FERC authorization process includes various steps that involve the submittal of preliminary project technical and environmental information to the agencies and the public, and solicitation of comments on the project. The agencies are those with a stake in the project and can include the Oregon Department of Fish and Wildlife (ODFW), National Marine Fisheries Service, Oregon Department of State Lands (ORSL), and others. Formal scoping meetings are held with the agencies to discuss the project, and if necessary, additional studies to characterize environmental conditions at the site or assess project impacts are conducted. Such studies are usually designed in consultation with the agencies. The outcomes of the studies and agency comments are compiled in an application, which is submitted to FERC with copies to the agencies and other stakeholders.

The licensing process for a FERC conduit exemption can be completed in 18 months which includes 6 months for preparation of the application, 6 months for agency review, and 6 months for FERC review and authorization.

For a full FERC license, the licensing process will take 3 to 6 years. The preliminary permit process—comprised of the development of project technical details, performance of environmental studies, pre-filing agency consultations, and development of the appropriate documentation—can be completed in 2 to 4 years, depending on the complexity of the project, number, and extent of studies that are required, etc. FERC authorization generally occurs 1-2 years following submittal of the application, although this may be extended for more complex projects.

6.6.2 Oregon State Hydroelectric Programs

The following paragraphs discuss various state hydroelectric-related programs that could be triggered by the project.

Oregon Water Resources Department (OWRD)

In Oregon, the OWRD regulates water rights through its water rights permitting process. State water rights are not pre-empted by any part of the FERC review process. A separate water right may be needed to produce power, even if the applicant already has a water right for any other use.

Oregon has set up a process that parallels the FERC procedure for issuing water rights. The benefit of having this FERC-state parallel process is that the state has responsibility for managing its water resources. This process also gives the public an opportunity to provide input, makes state agency coordination easier, and Oregon water rights review uses much of the same documentation and studies in its review as are required for FERC.

OWRD has a hydropower application process as part of an existing water right. After an application for a small project is received, OWRD coordinates the necessary agencies to attend a site visit and provide its comments. A variety of agencies must be consulted on water rights applications for hydropower since these applications can involve the areas of water quality, fish and wildlife, plants, cultural resources, land resources/land use, safety, and economics/need for power.

Hydroelectric Applications Review Team (HART)

The state of Oregon has a hydropower review team in place for proposed projects. HART members include representatives of the ODFW, the Oregon Department of Environmental Quality (DEQ), the OWRD, and any other state agency that has the applicable regulatory or advisory responsibility. The function of HART is to develop a unified and consistent state position that would apply during the review process of a hydropower application, subject to public comment. It is likely that the HART review would be used for the proposed project so that the various state agencies could collaborate on their views about regulating this hydropower project.

Oregon Department of Energy (ODE)

Created in 1975, the ODE ensures that the state of Oregon has an adequate supply of reliable and affordable energy and is safe from nuclear contamination by helping Oregonians save energy, develop clean energy resources, promote renewable energy, and clean up nuclear waste.

To encourage investments in energy efficiency and conservation, the ODE offers loans, tax credits, information, and technical expertise to households, businesses, schools, and governments. The office aims to ensure that Oregon's mix of energy resources minimizes harm to the environment and reliably meets the state's needs. To meet this commitment, the office formulates energy policies, advances the development of renewable energy resources, and evaluates whether proposed energy facilities are economically and environmentally sound.

The ODE staffs the Energy Facility Siting Council (EFSC), which is a board of citizens that determines whether energy facilities may be built in Oregon. A small-scale hydropower facility is not included as one of the facilities for which EFSC siting approval is required. Therefore, no authorization from the ODE would be required for this small-scale hydropower project.

Oregon Energy Trust

The Oregon Energy Trust is a nonprofit organization funded by Oregon utility customers to support energy efficiency and renewable energy generation. The Oregon Energy Trust has a mission to change how Oregonians produce and use energy by investing in efficient technologies and renewable resources that save money and protect the environment. The Oregon Energy Trust serves Oregon customers of Portland General Electric (PGE), Pacific Power, NW Natural, and Cascade Natural Gas.

The Oregon Energy Trust is not a permitting authority; however, it offers incentives to assist in development of renewable energy. To be eligible for these incentives, applicants for funding must comply with the following requirements:

- The applicant must be an Oregon customer of PGE or Pacific Power or be willing to deliver power to one of these utilities.
- All systems must generate electricity and must be connected to the local electric utility grid.
- The resource cannot be located in an environmentally protected area.

Considering the above criteria, it appears that the projects would be eligible for funding from the Oregon Energy Trust. Various aspects of this funding will be discussed in Chapters 7, 8, and 9.

6.6.3 Permitting for Construction of the Powerhouse

Other likely local, state, and federal permits required for construction of the power house are briefly summarized and presented here. Many of these and other permits are likely required to construct other aspects of the hydrogeneration facilities, including the penstock pipeline and a new intake building. These permits are not discussed in this chapter, but are discussed further in Chapter 10.

DEQ

The U.S. Environmental Protection Agency (USEPA) delegates authority to DEQ to operate federal environmental programs within the state. There are two DEQ permitting processes that potentially would affect the proposed project: Water Quality Certification and the National Pollutant Discharge Elimination System (NPDES) general stormwater discharge permit. The Water Quality Certification is outlined in Section 401 of the federal Clean Water Act and provides the permit to discharge to waters of the state. For hydroelectric projects the FERC administers the federal licensing program and the DEQ issues the 401 certification.

The NPDES general stormwater discharge permit (1200 C) covers construction activities such as clearing, grading, excavation, and stockpiling that will disturb one or more acres and may discharge to surface water, conveyance systems leading to surface waters of the state. For more information about these DEQ permits please refer to Chapter 10, which goes into further detail.

ODFW

The U.S. Fish and Wildlife Service (USFWS) permits protect endangered or threatened species. ODFW must review the project for potential impacts to fish and wildlife resources. According to the published USFWS list, there are no threatened or endangered species expected within the study area of the project. However, there may be other wildlife or plant species present within the study area that are not listed but are still of concern. If endangered or threatened species are encountered permits will be required with the appropriate permitting programs. Refer to Chapter 10 for additional information.

ODSL

The Oregon removal fill law requires a permit from ODSL for the removal or fill of 50 cubic yards or more of material into waters of the state. The ODSL permit is also required for activities such as stream bank stabilization; wetland fills and excavations; piling projects; water diversions; and other water-related work. Refer to Chapter 10 for additional information.

Oregon Parks and Recreation Department (OPRD)

The OPRD must review the project for potential impacts to archaeological and historic resources.

City of Bend/Deschutes County

For construction, appropriate Deschutes County building permits will need to be pulled by the general contractor including, at a minimum the following: building, mechanical, and electrical. Additionally, any structure would be required to comply with the City's Site Plan Review criterion which addresses issues such as physical appearance, traffic, and noise impacts, etc.

The Outback Facility site itself is outside the City's Urban Growth Boundary. The land is zoned Urban Area Reserve is a residential district and land use permits are issued for most actions. Refer to Chapter 10 for additional information.

6.7 Cost Estimate

The preparation of an opinion of probable construction cost will be presented in Chapter 7. A preliminary budget for each Pelton wheel turbine and generator based on similar projects and vendor budgetary quotes is approximately $1.1 million for each of the two smaller 2.0-MW units and $1.8 million for the single 3.0-MW unit.

6.8 Project Schedule

A preliminary schedule for permitting, design, and construction of the powerhouse is in Appendix 6-B. Time-frames presented are general and based on the preliminary information presented in this report. Durations and scheduling are subject to change in the future as more detailed information about the design and the required permitting is determined. Turbine and generator lead time is approximately 24 to 36 weeks from an approved submittal as stated by the manufacturers we contacted for this study. It is expected that the turbine will be online by October 2012.

6.9 Recommended Alternative

Scenarios I, II, and III each included water right scenarios developed for this project that may occur in the future and will impact power generation during the lifetime of the hydrogeneration facilities. Scenario I assumed that all of the water determined from the Water Right Scenario 3b will be available for generation at Outback Facility, since the ASR Injection Wells Hydrogeneration Facility utilizes the remaining flow. Scenario II assumed that a portion of the Water Right Scenario 3b limited to the water system demand will be available at Outback Facility, since the ASR injection wells are not included. Scenario III is similar to Scenario I except that beginning in the Year 2019, the water rights increased to Water Rights Scenario 3c. Scenario III would produce the largest amount of flow available for generating power at the Outback Facility. It is recommended that Scenarios II and III be carried forward for economic analysis. Scenarios I and III are fairly similar in generation capacity with Scenario III being slightly more optimistic. Scenarios II and III bracket the range of flow scenarios at the Outback Facility.

Two alternatives were reviewed for the layout of the facility: Alternative 1—two turbines, and Alternative 2—one turbine. If the City expects the Outback Facility to serve as a source of revenue with some interruption during downtime, then the second alternative may be preferred. If the City expects the Outback Facility to provide a constant source of revenue without any interruptions during downtime, then the first alternative with two turbines may be preferred. It is expected that the City would best benefit from the reduced capital cost of Alternative 2 as compared to Alternative 1, and that the new WTP would have two electrical feeds and therefore be able to remain in operation during powerhouse outages. However, it is recommended that Alternatives 1 and 2 for a given flow scenario be evaluated economically to compare the value of continuous generation with the cost of an additional turbine.

In summary, the following flow scenarios and plant layouts for the Outback Facility are recommended to be carried forward for economic analysis presented in Chapter 7:

- Alternative 2 (single 3 MW turbine) with Scenario II
- Alternative 2 (single 3 MW turbine) with Scenario III
- Alternative 2 (single 3 MW turbine) with Scenario III
- The same three scenarios with two 2 MW turbines

It is recommended that during predesign the City consider constructing the Outback powerhouse with space for two of the selected turbines. Even if the economic analysis indicates that only one unit should be installed initially, it would facilitate expansion to two units should more water become available or the case for redundancy improve at a future time.

6.10 ASR Injection Wells Hydrogeneration Facility

The following sections present information about the ASR Injection Wells Hydrogeneration Facility.

6.10.1 Water Demand and Projection

The ASR Injection Wells Hydrogeneration Facility is utilized in both Scenario I (Water Right Scenario 3b with full use) and Scenario III (Water Right Scenario 3b with full use from start-up Years 2013 through 2018, and Water Right Scenario 3c from Year 2019 through study end—Year 2063). Scenario II (Water Right Scenario 3b without full use) does not utilize ASR injection wells for generation. All of the scenarios assume the Outback and ASR Injection Well Facilities will be online and have all the required permits by the end of December 2012. The amount of flow available for the ASR Hydrogeneration Facility in Scenarios I and III is the remaining flow from the Outback Facility after the City's water demand has been met. Therefore, the flows available for the ASR Injection Wells Hydrogeneration Facility vary within a year throughout the months, and also vary throughout the years. This is discussed in detail in Section 6.3.1 of this report. Figure 6-3 and Figure 6-5 show the available hydrogeneration flow for the ASR Injection Well Hydrogeneration Facility for Scenarios I and III, respectively.

6.10.2 Generation Site

The ASR Injection Wells Hydrogeneration Facility site was reviewed to determine the flow and head available for hydrogeneration for both Scenarios I and III through years 2013 to 2063. The following assumptions associated with this analysis are outlined below:

- The ASR Injection Wells are considered a beneficial use of water. The beneficial use of all the water through the Outback powerhouse turbine is needed to process the FERC license conduit exemption.
- The aquifer generation option is an addition to the Outback Facility. The injection wells will be located down slope from the Outback facility. Either the water will flow by gravity or by high volume, low head pumps to move water out of the hydro after-bay to the location of the injection wells.
- The static water level in the aquifer is approximately 470 feet below the land surface and the aquifer requires almost no pressure to put water into it. Therefore, there is approximately 470 feet of head to generate power at the bottom of the pipe column in the well that delivers the water to the aquifer. These assumptions are based on Well #7, which was the most recent one drilled on the Outback Facility. Well #7 had a static water level of 470 feet below land surface and produced 2 mgd with 0.8 feet of drawdown. That is with a 16-inch casing.
- The aquifer generation wells will be used for power generation and aquifer recharge only. If a stipulation requires that all the water that is recharged into the aquifer needs to be pumped out during the peak season, other wells besides the injection wells will be used.
- Injection well turbine efficiency remains constant throughout the flow range. This simplification results in an optimistic estimation of hydrogeneration capacity as a pump turbine efficiency is non-linear. However, it is assumed that through careful operation of the clearwell or storage tank downstream of the water treatment plant, water would be provided at a nearly constant rate to the injection well turbines. In this case, pump turbine efficiency would also be constant.
- There is no water flow limit into the groundwater aquifer.

- The maximum flow rate each ASR Injection Well is to be designed for is 2 mgd.

  Note that for later years in the study period, the total annual demand exceeds the annual surface water supply from Bridge Creek. For the purpose of this generation capacity analysis, we assumed no drawdown of the aquifer to meet this demand over the study period. That is, the turbines would not be lowered to generate marginally more power even if the aquifer drawdown was known to exist and quantified.

- The interval basis for calculating hydrogeneration capacity will be monthly. This interval is assumed appropriate for the City water supply system and this feasibility study.
- Life-cycle span of the Outback Facility is 50 years from Years 2013 to 2063.

These assumptions were incorporated to provide the net head and flow used in the hydrogeneration calculations for Scenario I and Scenarios III as listed in Table 6-6. The scenarios result in nearly identical head and flow data for the ASR Injection Wells Hydrogeneration. The only two values that slightly differ between Scenario I and III occur in April in Years 2019 and 2020. The very slightly more conservative Scenario I was chosen for the generation calculations.

Table 6-6. Scenario I and Scenario III—Flow and Head Available for ASR Injection Well Hydrogeneration Facility

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average flow, mgd	Duration, months
Flow, mgd														
2013	5.51	5.89	5.73	3.35	0	0	0	0	0	0	6.05	6.12	5.86	5.6
2014	5.12	5.52	5.35	2.81	0	0	0	0	0	0	5.69	5.76	5.49	5.5
2015	4.73	5.15	4.97	2.27	0	0	0	0	0	0	5.33	5.40	5.11	5.4
2016	4.34	4.78	4.59	1.72	0	0	0	0	0	0	4.96	5.04	4.74	5.4
2017	3.95	4.41	4.21	1.18	0	0	0	0	0	0	4.60	4.68	4.37	5.3
2018	3.56	4.03	3.84	0.63	0	0	0	0	0	0	4.24	4.32	4.00	5.2
2019	3.17	3.66	3.46	Scenario I 0.09 Scenario III 1.09	0	0	0	0	0	0	3.87	3.96	3.63	5
2020	2.78	3.29	3.08	Scenario I 0 Scenario III 0.54	0	0	0	0	0	0	3.51	3.60	3.25	5
2021	2.40	2.92	2.70	0	0	0	0	0	0	0	3.15	3.25	2.88	5
2022	2.01	2.55	2.32	0	0	0	0	0	0	0	2.79	2.89	2.51	4.9
2023	1.62	2.18	1.94	0	0	0	0	0	0	0	2.42	2.53	2.14	4.9
2024	1.23	1.81	1.56	0	0	0	0	0	0	0	2.06	2.17	1.77	4.9
2025	0.84	1.44	1.19	0	0	0	0	0	0	0	1.70	1.81	1.39	4.9
2026	0.45	1.07	0.81	0	0	0	0	0	0	0	1.34	1.45	1.02	4.8
2027	0.06	0.70	0.43	0	0	0	0	0	0	0	0.97	1.09	0.65	4.6
2028	0	0.33	0.05	0	0	0	0	0	0	0	0.61	0.73	0.43	4.1
2029	0	0	0	0	0	0	0	0	0	0	0.25	0.37	0.31	2
2030	0	0	0	0	0	0	0	0	0	0	0	0.010	0	0
2031 - 2063	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Head, feet[1]														
2013 – 2063	470	470	470	470	470	470	470	470	470	470	470	470		

[1] Head is assumed to be the difference between land surface elevation and groundwater elevation. This information based on the most recent well drilled at the Outback site, Outback Well #7.

6.10.3 Energy Generation

The ASR Injection Wells site is not a typical application for turbines. The type of turbine recommended for this application is a vertical submersible pump-turbine. The motor is able to run in both directions; however, the turbine will be optimized for hydropower generation and the pumping ability will not be reviewed. The turbines size and characteristics will be similar to a submersible pump. The pump-turbines size selected was 2 mgd (1,390 gallons per minute [gpm]) with a maximum available flow of approximately 6 mgd, the number of wells required is three. Due to the variation in water quality available, the number of turbines in use will change throughout the years. Table 6-7 lists the vertical submersible turbine characteristics and the estimated annual energy generated for the ASR Injection Wells Hydrogeneration facility site for Scenario I. The two recommended manufacturers for vertical submersible turbines for our application were Ritz from Germany and Indar from Spain. Appendix 6-C provides a typical profile of a vertical submersible pump-turbine.

Table 6-7. Vertical Submersible Turbine Characteristics and Generation for Scenario I

Turbine type	Vertical submersible
Turbine size	92 kilowatts (kW)
Total turbine Capacity (3 turbines)	0.3 MW
Turbine efficiency[1]	75 percent
Generator efficiency[1]	85 percent
Maximum flow each turbine	2 mgd
Annual energy generation[2]	
Year 2013 (3 turbines)	941,000 kWh
Year 2014 (3 turbines)	866,000 kWh
Year 2015 (3 turbines)	791,000 kWh
Year 2016 (3 turbines)	734,000 kWh
Year 2017 (3 turbines)	664,000 kWh
Year 2018 (2 turbines)	596,000 kWh
Year 2019 (2 turbines)	520,000 kWh
Year 2020 (2 turbines)	466,000 kWh
Year 2021 (2 turbines)	413,000 kWh
Year 2022 (2 turbines)	353,000 kWh
Year 2023 (2 turbines)	301,000 kWh
Year 2024 (1 turbine)	249,000 kWh
Year 2025 (1 turbine)	195,000 kWh
Year 2026 (1 turbine)	140,000 kWh
Year 2027 (1 turbine)	86,000 kWh
Year 2028 (1 turbine)	51,000 kWh
Year 2029 (1 turbine)	18,000 kWh
Years 2030 - 2063 (no turbine)	0

[1] Values assumed are based on typical equipment characteristics.

[2] It is assumed that the efficiency remains constant throughout the entire flow range.

The turbine was sized to have the best efficiency point at 2 mgd (3.1 cfs) at 470 feet. The generator is sized to match the turbine output at this best efficiency point. Figure 6-9 shows the annual energy generated throughout the life of the facilities. The figure shows that maximum annual energy generated occurs when the facility is built in Year 2013 with a total of three wells. The annual energy generated then declines to zero at Year 2030 when the water demand consumes the remainder of the water instead of being injected into the groundwater through the facilities.

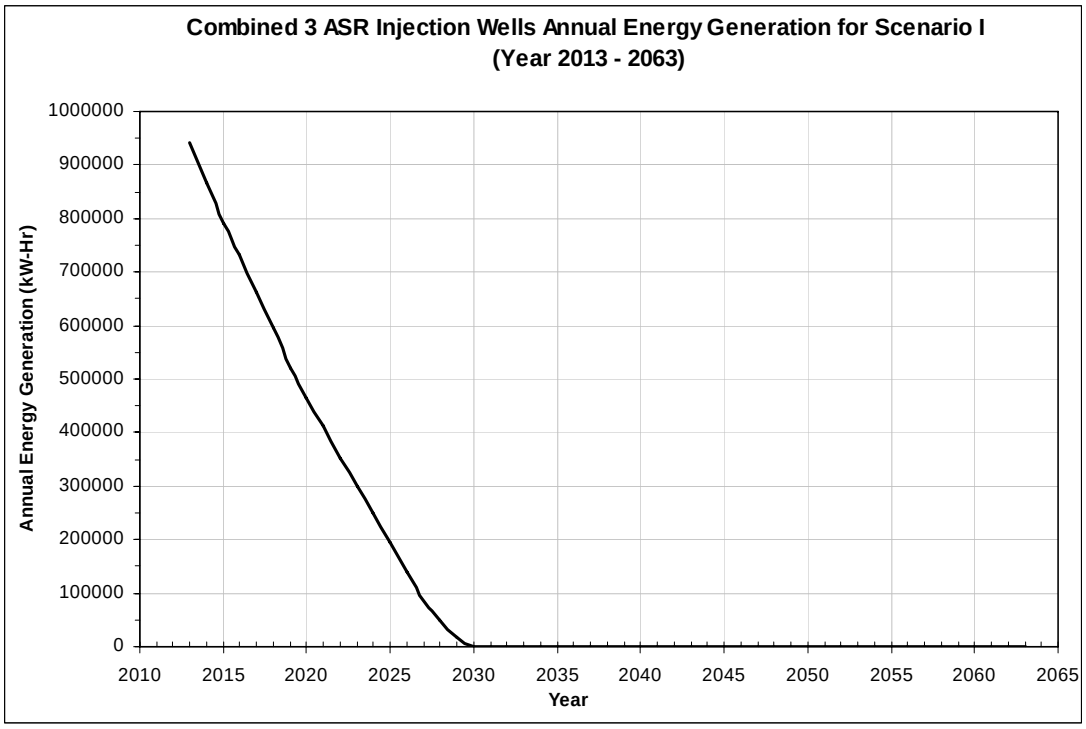


Figure 6-9. Annual Energy Generated at ASR Injection Wells

6.10.4 Site Layout

The wells will be sited near the discharge from the WTP to minimize headloss and be separated from each other so as not to influence each other hydraulically. For the purpose of evaluating the feasibility of ASR Injection Wells for generation, a specific site plan is not needed. Figure 6-10 shows a typical elevation view of an ASR Injection Well Hydrogeneration Facility.

6.11 Power Distribution

This section contains a discussion about the power distribution system for the ASR injection wells.

6.11.1 Description

The requirements for the ASR Injection Well Hydrogeneration Facility interconnection to PacifiCorp distribution are presented in Section 6.5. Both the Outback and the ASR Injection Well Hydrogeneration Facilities are assumed to have a common interconnection with the power distribution system.

6.11.2 Powerhouse Permitting

For the ASR Injection Wells Hydrogeneration Facility permitting requirements, refer to Section 6.6. It is expected that the permitting requirements discussed in Section 6.6 would also apply to the ASR Facility. In addition, an Oregon Injection/Aquifer Storage and Recovery Permit would be required for the ASR Injection Well Hydrogeneration Facility. Consultation with FERC and the state is suggested to determine if these entities would view the Outback, ASR Injection Wells, and Distribution Hydrogeneration Facilities as a single complete project or as separate projects. Such a determination could influence the permitting requirements for the project.

6.11.3 Cost Estimate

The preparation of an opinion of probable construction cost will be presented in Chapter 7. Estimated budget price of one turbine from Indar, a company in Spain is approximately $175,000. This price does not include well development or turbine installation.

6.11.4 Project Schedule

A preliminary schedule for permitting, design and construction of the powerhouse facilities is in Appendix 6-B. Time-frames presented are general and based on the preliminary information presented in this report. Durations and scheduling are subject to change in the future as more detailed information about the design and the required permitting is determined. Turbine lead time is approximately 20 weeks from an approved submittal as stated by the manufacturers we contacted for this study. It is expected that the turbines will be online by October 2012.

6.11.5 Recommended Alternative

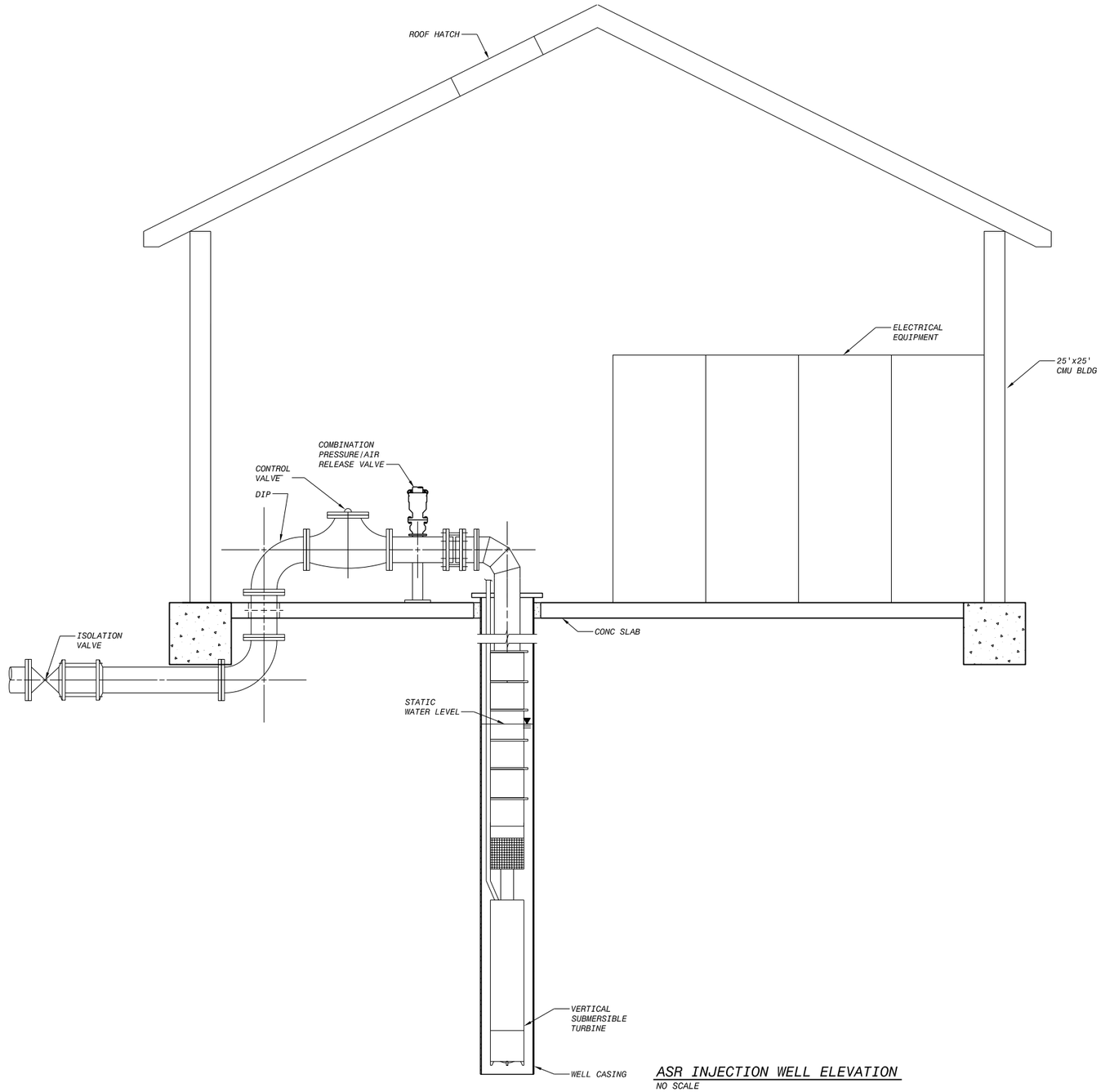
Scenarios I and III have very similar power generation capabilities for the ASR Injection Wells Hydrogeneration Facility. Scenario II would not include power generation via injection wells. The chief benefit of the injection wells is to provide more flow, and thus, more power generation through the Outback Facility. Scenarios I and III were selected for calculation of hydrogeneration capacity and will be evaluated economically as a part of the Outback powerhouse analysis.

6.12 Distribution Hydrogeneration Facility

This section contains a discussion of the PRV Hydrogeneration Facility.

6.12.1 Water Demand and Projections

The City's distribution system model was utilized by Brown and Caldwell to develop the current water demands and pressure at each distribution hydrogeneration facility. This information is listed in Table 6-8. The distribution system hydrogeneration facility locations are assumed to be built and all the required permits obtained by the end of December 2012 and are assumed to generate power from the available flow at each location.



ASR INJECTION WELL ELEVATION
NO SCALE

BLACK & VEATCH Corporation
Portland, Oregon

CITY OF BEND
WATER SUPPLY ALTERNATIVES PROJECT
TM5 - HYDROGENERATION EVALUATION
Figure 6-10 ASR INJECTION WELLS

Table 6-8. Current Flow and Head Available at Each Potential Location

PRV No.	Description	High flow, gpm	Low flow, gpm	Average flow, gpm	Upstream pressure, psi[1]	Setting or downstream pressure, psi
PRV-003	Overturf Feed	488	488	488	60	9
PRV-004	Awbrey Butte Feed	5400	5400	5400	60	9
PRV-031	Summerhill	273	21	96	104	51
PRV-038	Wild Rye and Wild Rye	220	63	169	110	44
PRV-064	Athletic Club	1824	0	906	87	35
PRV-088	Wichita	2125	947	1536	79	51

[1]*psi = pounds per square inch*

Brown and Caldwell received the City's water model in MWH Soft's H20NET. Brown and Caldwell converted the model to MWH Soft's InfoWater V5 (Update #2) for all hydraulic modifications and calibration efforts. The hydrant testing field results were gathered on March 25, 2008 and used for a steady-state calibration. The purpose of steady-state calibration was to verify the pipe connectivity, pipe roughness factors, and the elevations of facilities in the model. After the steady-state calibration was completed, the model was calibrated to execute an extended period simulation (EPS) for a 24-hour period in compliance with USEPA guidelines. The model was calibrated and ready to be used for a 40-day water age analysis by approximately April 18, 2008. The model used to generate the numbers used for the in-town hydrogeneration plant locations is named BendModelH1.mxd.

6.12.2 Generation Site

The distribution hydrogeneration facility sites were reviewed to determine the flow and head available for hydrogeneration through Years 2013 to 2063. The following assumptions associated with this analysis are outlined below.

- Flow and head were calculated by Brown and Caldwell's hydraulic modelers based on data presented in the 2007 Master Plan and projected to 2009. The flows provided are not necessarily the current flow through the PRVs but are optimized flows the PRVs can experience by adjusting other PRVs and well operations.
- The flow from year to year will remain constant, that is, the area served by the existing PRVs is built-out. This is conservative but serves the purpose of establishing initial feasibility.
- The interval basis for calculating hydrogeneration capacity will be monthly. This interval is assumed appropriate for the City's water supply system and this feasibility study.
- Overall efficiency is 77 percent based on a 90 percent efficient generator and an 85 percent efficient turbine.
- Life-cycle span of the Outback Facility is 50 years from Years 2013 to 2063.
- The following flow characteristic is assumed for each site:
  - Overturf and Awbrey Butte flow rate will remain constant throughout each day and through the years.
  - Summerhill, Wild Rye and Wild Rye, Athletic Club, and Wichita have an assumed simplified diurnal curve similar to the curve shown in Figure 6-11. The flow will remain constant throughout each day and through the years. Flows during the day add up to the average flow given in Table 6-9. The turbines are designed to handle a limited flow range. Therefore, when

the flow is greater than the design flow range, the additional flow will bypass the turbine and flow through the parallel PRV. When the flow is below the design flow range, the turbine will not be in operation and all flow will go through the parallel PRV. The diurnal variations at each site were addressed by assuming a constant flow for a set duration. The constant flow optimizes turbine efficiency and generation. This constant operational flow was calculated to provide the quantity of water to meet the average daily demand but in the reduced duration to roughly coincide with the hours of peak usage. This approach yields a best-case generation outcome based on system modeling and ideal operational conditions. It was assumed that the typical hourly variations in demand would be met by nearby PRVs in the distribution system. Based on the typical diurnal curve shown, each site was assumed to run for duration of 16 hours per day.

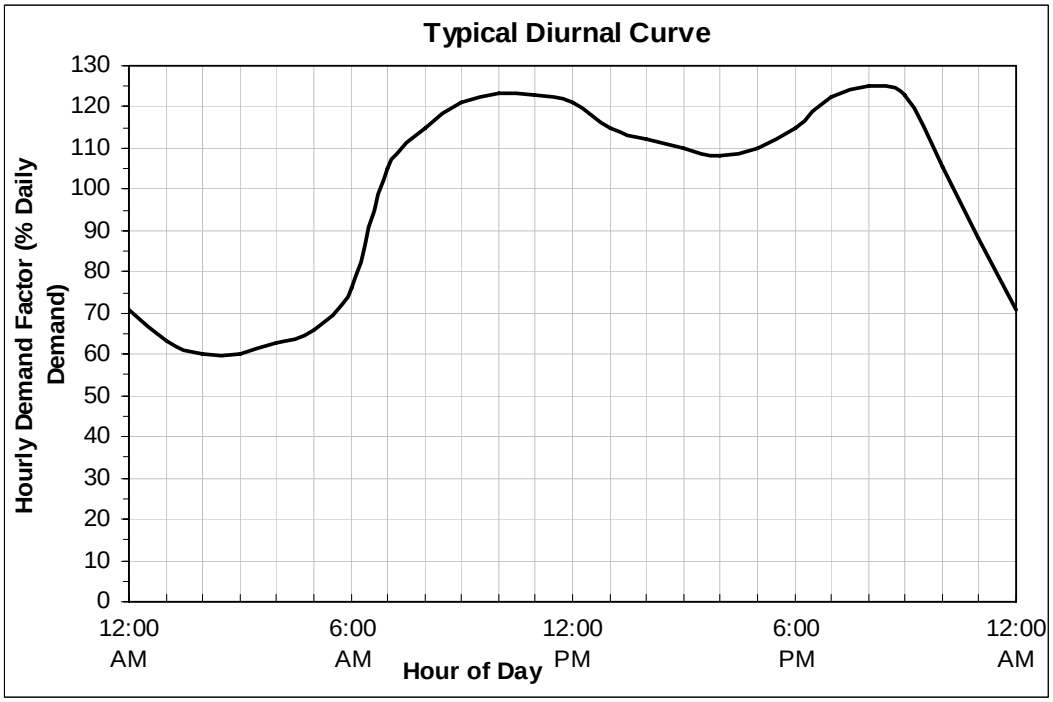


Figure 6-11. Typical Diurnal Curve

These assumptions were incorporated to provide the net head and flow used in the hydrogeneration calculations as listed in Table 6-9. The power provider information was supplied by PacifiCorp. Regardless, interconnection assumptions were based on PacifiCorp's requirements.

Table 6- 9. Flow and Head Available at Each Potential Location

PRV no.	Description	Operational flow, gpm	Head, feet	Power provider
PRV-003	Overturf Feed	488	118	Most likely PacifiCorp
PRV-004	Awbrey Butte Feed	5400	118	Most likely PacifiCorp
PRV-031	Summerhill	96	122	Not determined
PRV-038	Wild Rye and Wild Rye	169	152	Most likely PacifiCorp
PRV-064	Athletic Club	1360	120	Served by PacifiCorp
PRV-088	Wichita	2125	66	Most likely Central Electric Co-op

6.12.3 Energy Generation

The distribution hydrogeneration sites evaluated have various combinations of low and/or high flow and head combinations that may or may not be suitable for hydrogeneration. Table 6-10 lists each type of turbine characteristics and the annual energy generated for each distribution hydrogeneration facility site. Appendix 6-D provides information on the pump turbine, a hydro energy recovery turbine from Cornell.

Table 6-10. Distribution Turbine Characteristics

Description	Overturf feed	Awbrey Butte feed	Summerhill	Wild Rye and Wild Rye	Athletic Club	Wichita
PRV No.	*PRV-003*	*PRV-004*	*PRV-031*	*PRV-038*	*PRV-064*	*PRV-088*
Operational flow, cfs	1.1	12	0.2	0.4	3.0	4.7
Head, feet	118	118	122	152	120	66
Overall efficiency, percent[1]	60	75	60	60	65	72
Power, kW	7	91	1	3	20	19
Operational duration, hours/day	24	24	16	16	16	16
Annual energy generation, kWh	57,000	800,000	12,000	26,000	180,000	170,000
Turbine type	Pump turbine	Pump turbine or Pelton wheel	Pump turbine	Pump turbine	Pump turbine	Pump turbine
Generation potential	Maybe	Potential	Not recommended, flow and power too low. Not cost effective.	Not recommended, flow and power too low. Not cost effective.	Maybe	Maybe

[1] *Efficiencies are based on manufacture information on the recommended available turbine for each site.*

6.12.4 Site Layout

The existing conditions of these sites have not been reviewed for this chapter. For the vault sites, it is assumed that a new PRV paralleling the turbine in a small building will be required as shown in Figure 6-12.

6.13 Power Distribution

6.13.1 Description

The requirements for generation interconnection for each Distribution Hydrogeneration Facility to PacifiCorp distribution are presented. The proposed generation resource is suited to supply power to the PacifiCorp distribution system as a customer-owned/controlled parallel generation project. Technically, it would be feasible to sell energy to another customer using PacifiCorp's electrical system; however, given the scale of this project, such a contractual arrangement would be disproportionately complex. For the purposes of this chapter, it was assumed that similar typical requirements would apply to the CEC distribution system.

This study proposes connecting to the PacifiCorp 12.47-kV distribution system in accordance with the most recent revision of PacifiCorp's *Cogeneration and Parallel Generation Interconnection Guide* and *Small Generator Interconnection Request Application Form*. Any interconnection made with PacifiCorp will be subject to its engineering evaluation. Each site would require a separated application since each site requires a separate connection to the power distribution system. While this study proposes what we believe to be the most reasonable technical solution, there may be constraints or special requirements known only to PacifiCorp or CEC.

6.13.2 Plant Facilities

For the PRV site hydroelectric turbines, it was assumed that each will be less than 100-kW nameplate rating. For planning purposes, the following is assumed:

- A small distribution class transformer will be required at each site to step the generator voltage up to 12.47-kV levels.

6.13.3 Utility Facilities

For the PRV site hydroelectric turbines, it is assumed that each will be less than 100-kW nameplate rating. For planning purposes, the following is assumed:

- PacifiCorp may require a system study and interconnect agreement for each separate PRV location. The extent of this study and agreement may be impacted by the nameplate rating of the generator.
- PacifiCorp will require a visible disconnect between the transformer and PacifiCorp equipment at each site and may have to construct a tap to the high side of the transformer.
- PacifiCorp may require each interconnected generator to disconnect from the PacifiCorp circuit if the generator moves outside of acceptable voltage or frequency limits.
- PacifiCorp will require interchange meters and their associated communication circuits. This could be a dial-up telephone circuit.
- PacifiCorp may have to alter or add line protection devices or relays associated with feeders at each site.

PacifiCorp may require SCADA RTU, telemetering transducers and their associated communication circuits, for communication of generator output.

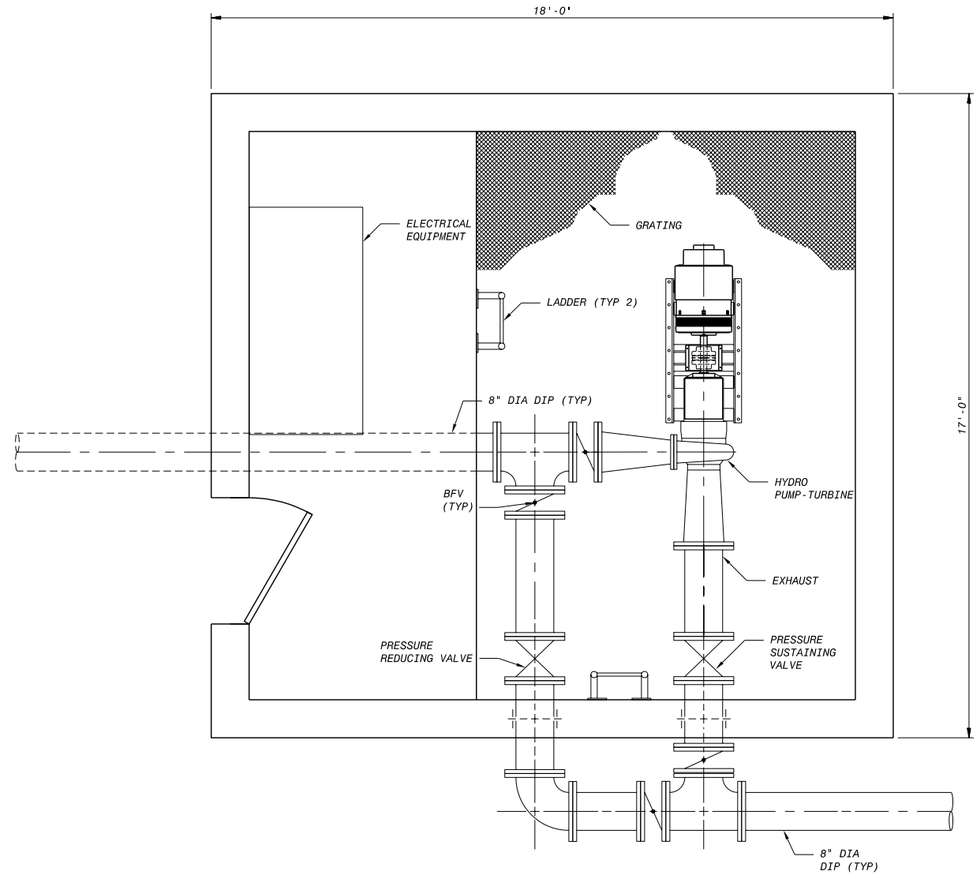
6.13.4 Other Requirements

The facilities would need to comply with the following:

- National Electrical Code
- The National Electrical Safety Code
- IEEE 1547, Distributed Resources Interconnected with Electric Power Systems
- Power Quality Standard IEEE 519-1992 Harmonic Limits
- Electric Service Requirements Manual for Oregon
- Any other regulations pertaining to a facility of this nature

6.14 Powerhouse Permitting

For the Distribution Hydrogeneration Facility permitting requirements, refer to Chapter 10. It is expected that the permitting requirements discussed in Section 4.5 would also apply to this alternative. Consultation with FERC and the state is suggested to determine if these entities would view the Outback, ASR Injection Wells, and Distribution Hydrogeneration Facilities as a single complete project or as separate projects. Such a determination could influence the permitting requirements for the project.



DISTRIBUTION SYSTEM TURBINE PLAN

NO SCALE

BLACK & VEATCH Corporation
Portland, Oregon

CITY OF BEND

WATER SUPPLY ALTERNATIVES PROJECT

TM5-HYDROGENERATION EVALUATION

Figure 6-12 DISTRIBUTION SYSTEM

6.15 Cost Estimate

Estimated budget price of the turbine and generator for each recommended site is listed in Table 6-11. For the Awbrey Butte Feed site, either a pump turbine or a Pelton wheel could be used to generate power, since one considered option would be to place the turbine at the top of the reservoir and allow the after bay to spill into the tank. However, given a constant flow situation, there is no generation benefit for the additional cost of the Pelton Wheel.

Table 6-11. Opinion of Probable Cost

Description	Overturf feed	Awbrey Butte feed	Athletic Club	Wichita
Pump turbine	$55,000	$95,000	$65,000	$68,000
Pelton wheel	N/A	$125,000	N/A	N/A

6.16 Project Schedule

A preliminary schedule for permitting, design, and construction of the powerhouse is in Appendix 6-B. Time-frames presented are general and based on the preliminary information presented in this report. Durations and scheduling are subject to change in the future as more detailed information about the design and the required permitting is determined. Turbine lead time is approximately 16 weeks from an approved submittal as stated by the manufacturers we contacted for this study. It is expected that the turbines will be online by October 2012.

6.17 Recommended Alternative

Based on the potential hydrogeneration the following sites are recommended for economic evaluation:

- Overturf Feed
- Awbrey Feed
- Athletic Club
- Wichita

The Summerhill and Wild Rye and Wild Rye sites were eliminated from further consideration since the power generated is minimal and would not be cost-effective.

Seven other sites were identified which flow could be redirected through for hydrogeneration. Of these, City Operations staff suggested the Wichita site may be the best location to add hydropower. However, this site is likely not served by PacifiCorp. During preliminary design, it is recommended to confirm with PacifiCorp that the sites considered for further evaluation are actually served by PacifiCorp. It is recommended during preliminary design that the flow at each site be measured over a period of time (e.g., 1 year) to determine the actual flow duration curve. This information would then be used to customize a hydrogeneration facility for each site.

It is recommended that during predesign the City investigate further the potential advantage of placing a Pelton wheel turbine over a pump turbine at the Awbrey Butte site. Depending upon size, the Pelton wheel may have a higher efficiency that would justify overtime its greater initial capitol costs.

APPENDIX 6-B

Preliminary Construction Schedule

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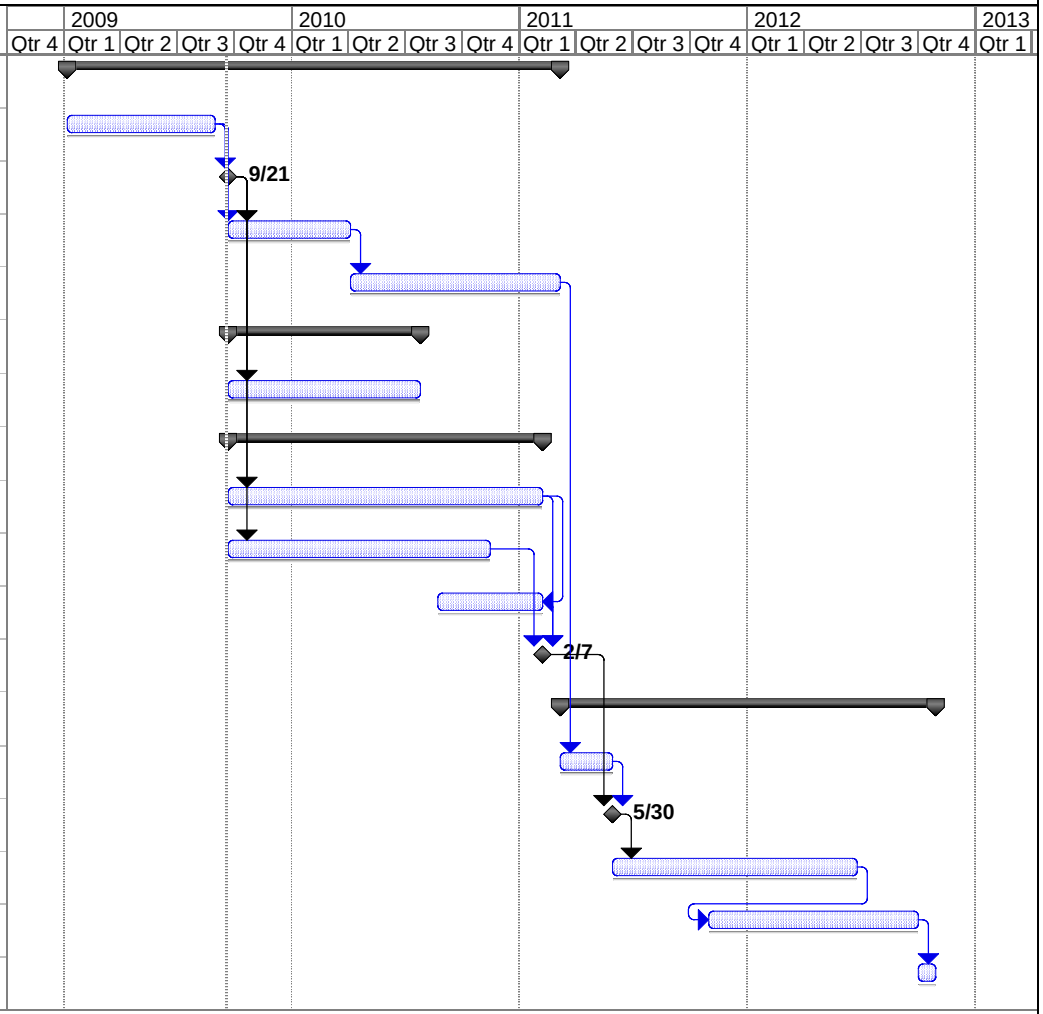
Building a world of difference

Appendix B. Bend Water Supply Project - Hydroelectric Projects Implementation Schedule

Thu 9/17/09

ID	Task Name	Start	Finish	Predecessors
1	**Design**	**Wed 1/7/09**	**Mon 3/7/11**	
2	Feasibility Study	Wed 1/7/09	Tue 9/1/09	
3	Council Approval	Mon 9/21/09	Mon 9/21/09	2FS+15 days
4	Preliminary Design	Tue 9/22/09	Mon 4/5/10	2,3
5	Final Design	Tue 4/6/10	Mon 3/7/11	4
6	**Water Rights**	**Tue 9/22/09**	**Mon 7/26/10**	
7	Confirm Water Right	Tue 9/22/09	Mon 7/26/10	3
8	**Permitting**	**Tue 9/22/09**	**Mon 2/7/11**	
9	FERC Licensing	Tue 9/22/09	Mon 2/7/11	3
10	EA & NEPA	Tue 9/22/09	Mon 11/15/10	3
11	State & County Licensing	Tue 8/24/10	Mon 2/7/11	9FF
12	Permitting Completed	Mon 2/7/11	Mon 2/7/11	9,10,11
13	**Construction**	**Tue 3/8/11**	**Mon 10/29/12**	
14	Bid & Award	Tue 3/8/11	Mon 5/30/11	5
15	Notice-to-Proceed	Mon 5/30/11	Mon 5/30/11	12,14
16	Procurement	Tue 5/31/11	Mon 6/25/12	15
17	Construction	Tue 11/1/11	Mon 10/1/12	16FS-170 days
18	Start-up	Tue 10/2/12	Mon 10/29/12	17



Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External MileTask
Split

Cygnet/164499/E Design Reports and Memoranda/E 1.0 Memoranda and Tech Memos/Hydro Evaluation TM05/Appendix B - Bend WSP Hydro Construction.mpp

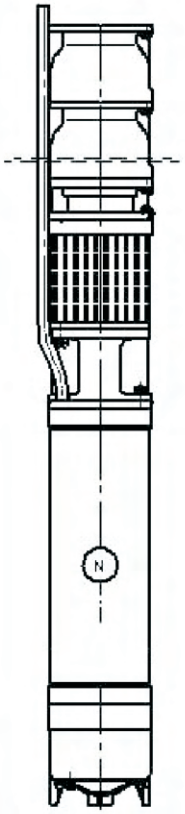
APPENDIX 6-C

Profile of a Vertical Submersible Pump-turbine

Indar

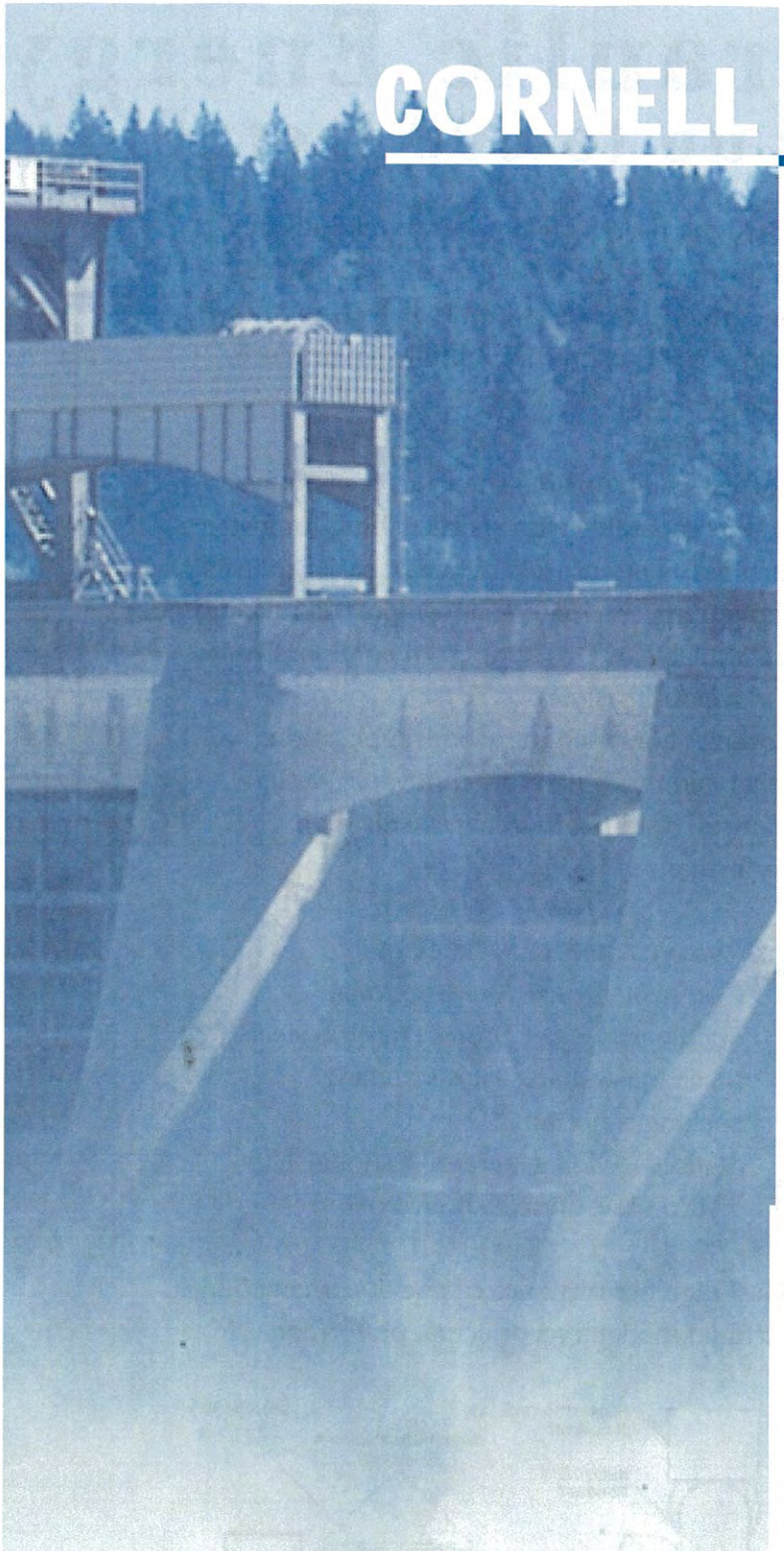
Date: 20/05/2009

UGP-1510/6R | Hz: 60 | r.p.m.: 1750



APPENDIX 6-D

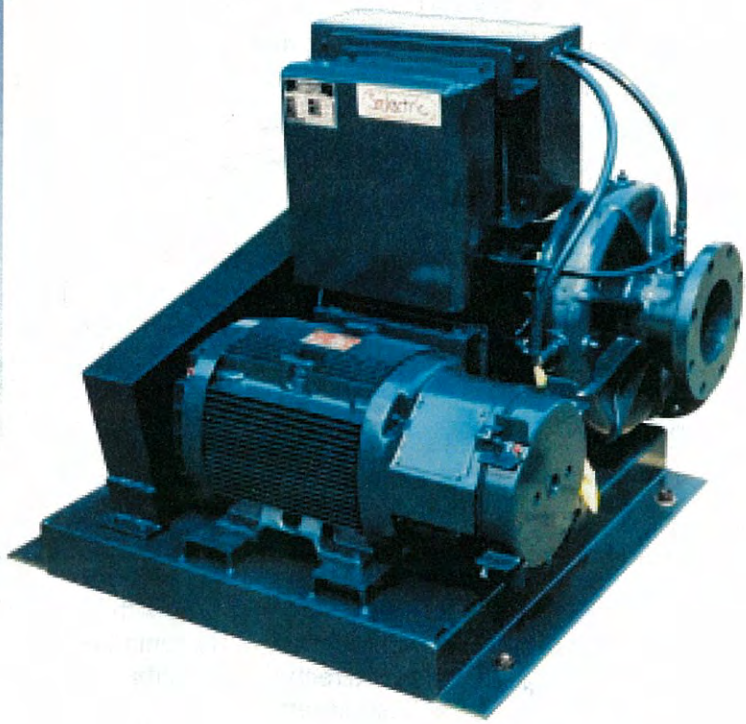
Cornell Hydro Energy Recovery Turbine



CORNELL PUMP COMPANY

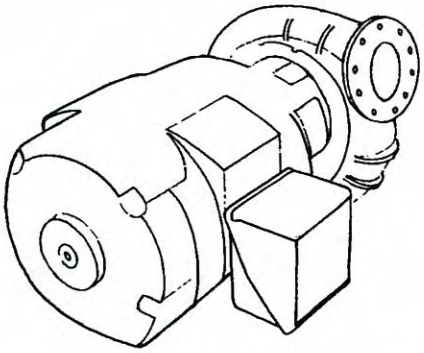
CORNELL®

Hydro & Energy Recovery Turbines 5-400kW



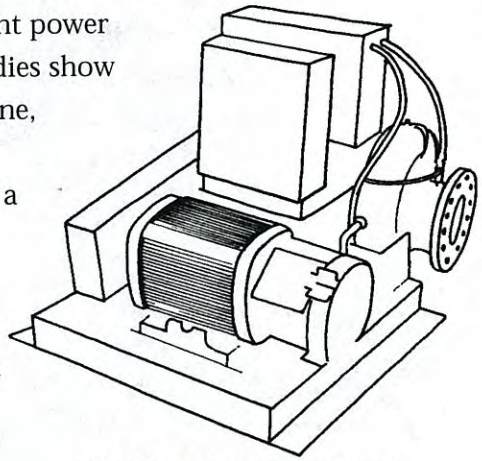
Hydraulic Energy
Heads up to 600 feet; Flow

Industrial plants, municipalities, HVAC installations, and farms are tapping potential hydraulic energy sources to produce electric power as a revenue source, or as a means to reduce overall energy demands.



The simplest of assemblies – no couplings to align – economy of space - close coupled, induction/synchronous generator/turbine assembly – many turbine and generator options available as required.

The key to the system is the use of excess head to drive a turbine. The turbine may be used to drive a pump, a generator, or other power-requiring device. This technology makes it feasible for cities, farmers, resort managers, industrial plants and building managers to consider hydro turbines in their plant power needs. Studies show that a turbine, driven by water from a natural stream or process stream, can generate enough electric power to pay for itself in a short time.



Synchronous generator for stand-alone applications with hydraulic-electric load controller, belt (or direct) drive to turbine, all base assembled.

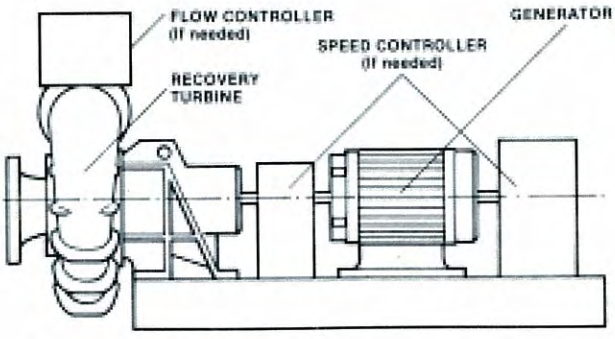
You don't need a raging river to take advantage of the energy savings a Cornell hydro turbine can provide. Heads as low as 55 feet, and flows as low as 90 gallons per minute can produce useable energy.

Cornell's high turbine efficiency is often found to be comparable with specially built imported turbines. They are less complex, easier to install and require less maintenance. Cornell turbines are available in a wide range of configurations and mounting styles.
Cornell's approach to turbine applications has generated many new and innovative design features, resulting in unexpectedly high performance.

STANDARD TURBINE CONSTRUCTION:

- Cast Iron, bronze fitted-optional ductile iron, steel, bronze, tainless steel.
- Mechanical shaft seal is standard, packing is optional.
- Standard ODP generator-optional TEFC.
- Hydro blue, double applied paint.

This high performance can be documented by certified model tests or actual performance tests



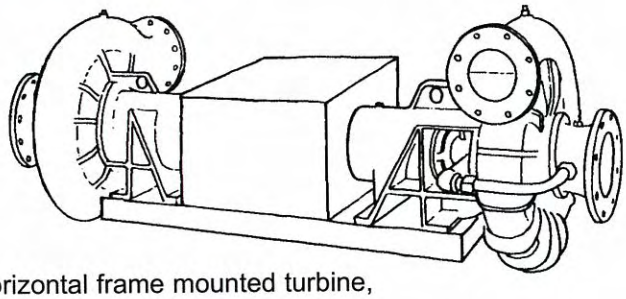
Frame turbine, coupled to a induction generator for applications connected to an existing power grid. Base assembled with optional speed control and safety shut down equipment.

Recovery Turbines
up to 18 cubic feet per second

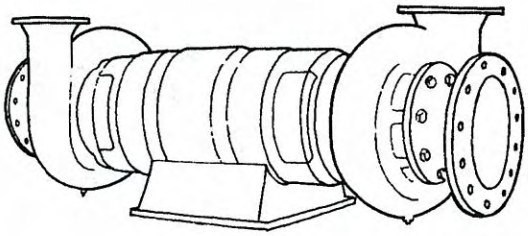
on ordered units, conducted in Cornell's modern hydraulic labs under controlled conditions, by professional engineers.
Let Cornell staff engineers and sales personnel provide specialty application and selections assistance. Whether your needs are demanding – requiring turbines in series or parallel, or utilize a single unit – Cornell will assist in your selection of a hydro turbine energy recovery system that is efficient over a wide range of operation.

Vertical mount, close coupled, turbine with optional integral flywheel* and base elbow. (Also available less flywheel)

* Flywheels are used to prevent excessive surge pressures and to give more stable speed control

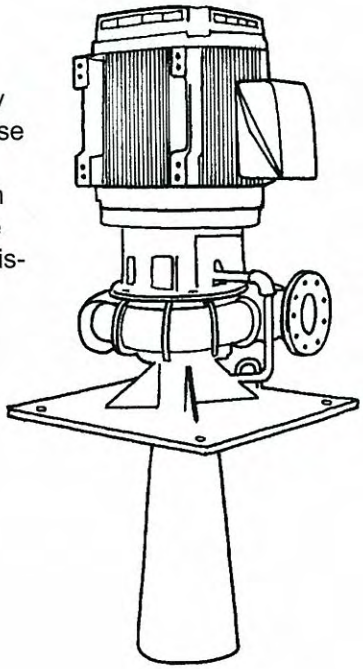


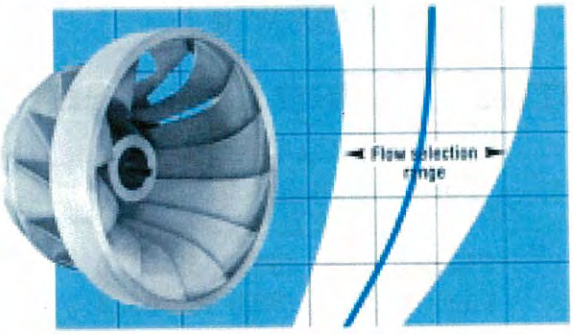
Horizontal frame mounted turbine, direct drive to an energy requiring device. (Turbine driving a pump is shown. A generator maybe substituted for the pump)



An assembly to allow the turbine to reduce a pumping load – common motor, turbine one end, pump other end. Both close coupled with all the features to suit a special installation. Specially suited to HVAC installations.

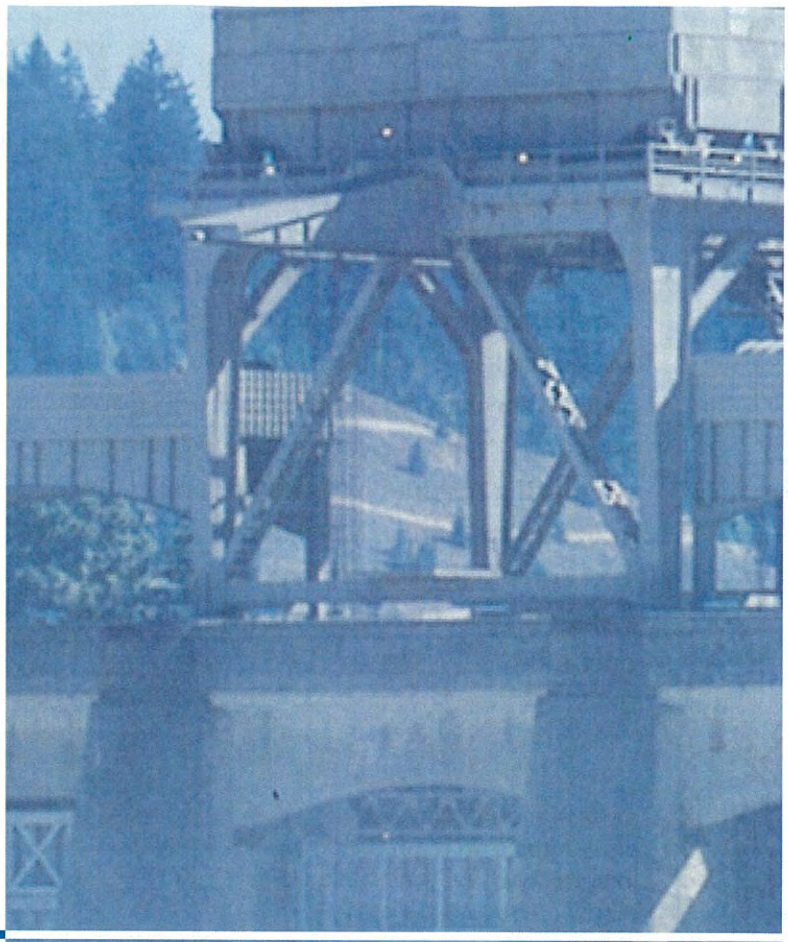
For added space saving or simplicity of manifolding, close coupled, vertical mount with custom draft tub (available less draft tub for discharge manifold mounting).





Special Custom Runners

This stainless steel fabricated runner is custom made to both suit the turbine and available conditions of the job. This simple innovation allows the fixed geometry turbine to be much more broadly applied, with advantages in efficiency and performance characteristics. Many of the larger capacity, double volute, Cornell turbines are available with the custom runner; other use the standard bronze cast runner.



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U.S.A.

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CHAPTER 7
HYDROGENERATION ECONOMIC EVALUATION

Prepared for
City of Bend, Oregon
October 23, 2009
Revised November 19, 2009

Prepared by

Patrick M. Van Duser, Black & Veatch
Carmen Nale, Black & Veatch

Jim Doane, Brown and Caldwell

BLACK & VEATCH
Building a world of difference

BROWN AND CALDWELL

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CHAPTER 7

HYDROGENERATION ECONOMIC EVALUATION

7.0 Introduction

This chapter represents the economic analysis of the hydrogeneration facilities discussed in Chapter 6. These facilities include the Outback Hydrogeneration Facility (Outback Facility), ASR Injection Wells Hydrogeneration Facility, and the Distribution Hydrogeneration Facilities. The economic analyses of the hydropower facilities will be driven by assumptions made regarding project capital costs, operating costs, financing, revenues, tax incentives, renewable energy credits, escalation of costs and revenues, and other parameters. In general, the results of the analysis should be sufficient to indicate general project viability and to differentiate financially between the various possible options.

7.1 Construction Cost Estimate

Hydropower generation is regarded as a mature technology that is unlikely to advance. Turbine efficiency and costs have remained somewhat stable, but construction techniques and costs continue to change. Capital costs are highly dependent upon site characteristics and vary widely. Table 7-1 provides turbine size, annual power generation, and opinion of probable constructed cost in 2009 dollars for the Outback, ASR Injection Wells, and Distribution Hydrogeneration Facilities. Cost estimates were based on Drawings 7-2 through 7-5 provided in Chapter 6 and from contacting turbine generator manufacturers. Annual generation assumptions for each of the hydrogeneration facilities were gathered from Chapter 6. Detailed opinion of probable construction costs for each hydrogeneration facility is in Appendix 7-A.

Table 7-1. Probable Construction Cost Summary

Facility	Turbine size	Calculated annual power generation	Opinion of probable construction cost
Outback Facility			
Alternative 1 – Two Pelton Wheels			
Scenario I	2,000 kilowatts (kW)	11,820,000 kilowatt hours (kWh)	$16,207,000
Scenario II	2,000 kW	9,260,000 kWh, 2013 increasing to 11,790,000 kWh by 2031 and thereafter (2012 is a partial year at 4,475,000 kWh)	
Scenario III	2,000 kW	11,820,000 kWh, 2013 – 2018 12,390,000 kWh, 2019 – 2063	
Alternative 2 – One Pelton Wheel			
Scenario I	3,000 kW	11,820,000 kWh	$13,464,000
Scenario II	3,000 kW	9,260,000 kWh, 2013 increasing to 11,790,000 kWh by 2031 and thereafter (2012 is a partial year at 4,475,000 kWh)	
Scenario III	3,000 kW	11,820,000 kWh, 2013 – 2018 12,390,000 kWh, 2019 – 2063	
ASR Injection Wells Hydrogeneration Facility (three wells)			
Scenarios I and III	92 kW	941,000 kWh, 2013 301,000 kWh, 2023 No Generation, 2031 – 2063	$10,299,000
Scenario II	N/A	N/A	N/A

Table 7-1. Probable Construction Cost Summary			
Facility	Turbine size	Calculated annual power generation	Opinion of probable construction cost
Distribution Hydrogeneration Facilities			
Overturf	7 kW	57,000 kWh	$902,000
Aubrey Butte	91 kW	800,000 kWh	$1,219,000
Athletic Club	20 kW	180,000 kWh	$935,000
Wichita	19 kW	170,000 kWh	$984,000

The annual power generation of the Outback and ASR Injection Well Hydrogeneration Facilities depend on the water rights scenario. Scenario I assumes a Water Right Scenario 3b with full use available to generate power at the Outback Facility and the remaining water through the ASR Injection Wells Hydrogeneration Facility throughout the project life. Scenario II assumes a Water Right Scenario 3b without full use available to generate power at the Outback Facility without any excess water available to generate power from the ASR Injection Wells Hydrogeneration Facility throughout the project life. Scenario III assumes a Water Right Scenario 3b (Years 2012 to 2018) increasing to Scenario 3c (Years 2019 to 2063) with full use available to generate power at the Outback Facility and the remaining water through the ASR Injection Wells Hydrogeneration Facility throughout the project life. Therefore, Scenario III would provide the maximum power generation, followed by Scenario I, and then Scenario II. As more water becomes available, more power can be generated.

The Outback Alternative 1 has two 2-MW turbines versus Alternative 2, which has one 3-MW turbine. The additional turbine, associated piping, electrical equipment, and building increases the powerhouse construction cost approximately an additional $2.7 million.

The ASR Injection Wells Hydrogeneration Facility cost estimate for Scenario I and III do not differ. The only difference between the two was a minor change in flow rate in one month for 2 years. This did not impact the number of wells and associated equipment for either scenario. Scenario II does not utilize the ASR Injection Wells as a source of hydrogenation and relies only on the flow going into the distribution system.

When comparing the Distribution Hydrogeneration Facilities, Aubrey Butte generates the most annual power followed by Athletic Club and Wichita.

7.2 Construction Cost Development

The approximate construction costs developed for each hydrogeneration facility compare the relative initial costs and provide a rough order-of-magnitude estimation for future planning. A summary of opinion of probable construction cost for each hydrogeneration facility is presented in the Appendix 7-A.

The costs presented herein are considered Association of the Advancement of Cost Engineering International (AACE) Class 4 cost estimates. AACE Class 4 opinions of probable cost are considered order-of-magnitude costs and have an accuracy range of minus 30 percent to plus 50 percent. Costs were developed using the following parameters.

7.2.1 General Basis of the Cost Development

- Pricing is in Second Quarter 2009 dollars
- General Requirements 10 percent
- Contractor Markups (Labor, Materials, and Equipment) 8 to 10 percent
- Bonds and Insurance 3.5 percent
- Escalation to Mid-point of Construction (October 2011) 4 percent
- Construction Contingency 30 percent
- Engineering 15 percent

7.2.2 Working Hours

- Skilled Labor Wages and Benefit
  - Source: Published Union Wage Rates collected by R. S. Means *2009 Labor Rates for the Construction Industry*, 36th Annual Edition
  - Payroll costs include workers compensation, FICA, unemployment insurance
  - Assumes 10-hour work day and 40-hour work week. No cost included for premium time or overtime penalty.
- Managements Wages, Benefits, and Payroll Costs (Source: Black & Veatch estimate)

7.2.3 Production Estimates

- Black & Veatch Engineering-Procurement-Construction/Design-Build estimation experience
- Performance based on type of equipment used during cycle times to match equipment, workers, and Construction Sequence Schedule
- Discussions with in-house and experienced Senior Field Estimators and Project Mechanical Engineer

7.2.4 Turbine and Generator Cost

- Vendor quotes for turbine and generator cost. Turbine shutoff valve included for Distribution Hydrogeneration Facilities.
- No hard bids from vendors.
- 1.3 factor on the material costs was used to estimate the installation cost.

7.2.5 Exclusions

The following considerations are excluded from the opinion of construction costs:

- Legal
- Land Acquisition
- Procurement Requirements

- Environmental Mitigation
- Construction Management
- Additional Construction Scope after award of Contract

7.2.6 Assumptions

- All general requirements are assumptions based on Black & Veatch's and Brown and Caldwell's construction estimator's judgment
- No owner-furnished equipment (assumed to simplify costing)
- Construction power furnished by Owner

7.2.7 Possible Cost Risks

- Equipment fuel, lubricants, and wear parts
- Working in limited space and lower productivity due to access constraints

7.3 Generation Interconnect Assumptions and Opinion of Probable Cost

Costs were estimated for interconnection of a new powerhouse to the nearby existing PacifiCorp substation. Interconnection costs were assumed to be similar for each Outback Facility alternative, for each ASR injection well, and distribution site. Assumptions used in this opinion of cost shown in Table 7-2 included the following:

- Profit mark-up applied to costs is 10 percent.
- Construction labor rate is $70 per hour.
- Topographic survey and geotechnical investigation costs are not included.
- No battery required at substation.
- No additional lighting required at substation.
- Generator will be less than 800 feet from PacifiCorp distribution circuit.
- Separate contract and separate meters for energy generation and consumption.
- Outback and ASR Injection Wells Hydrogeneration Facilities share one interconnection point.

Table 7-2. Opinion of Probable Cost of Generation Interconnection	
Outback Facility	
Facility requirements	Installed cost
Equipment and material	$200,000
Sitework	$25,000
Engineering	$55,000
Installation	$150,000
PacifiCorp requirements	
Process interconnection request	$2,000
System impact study	$25,000
Substation engineering	$50,000
Distribution engineering	$30,000
15-kilovolt cable and pole riser	$40,000
Relay modifications to substation	$40,000
Add line potential transformers to feeder bay	$10,000
Construction labor and management	$60,000
Total	$687,000
ASR Injection Hydrogeneration Facility[1]	
Facility requirements	Installed cost
Equipment and material	$5,000
Sitework	$3,000
Engineering	$5,000
Installation	$5,000
Total	$18,000
Distribution Hydrogeneration Facility	
Facility requirements	Installed cost
Equipment and material	$10,000
Sitework	$3,000
Engineering	$5,000
Installation	$10,000
PacifiCorp requirements	
Process interconnection request and study	$2,000
Total	$30,000

Note: Cost includes only additional interconnection costs associated with the addition of the ASR Facility to the Outback Facility. In other words, if the Outback Facility is not built, then additional cost for interconnection of the ASR Facility would be required.

7.4 Summary of Project Development Costs

A summary of expected costs including capital, engineering design, contingencies, permitting, and mid-point of construction costs for each hydrogeneration facility, alternatives, and scenarios are presented below in Table 7-3. The totals included represent an opinion of the probable costs to develop the powerhouse and place it on line generating power. Table 7-3 includes the capital cost only and does not include costs associated with operating or maintaining a powerhouse.

7.5 Additional Considerations

The estimates developed for Alternatives I and II for the Outback Facility do not include the cost of the replacement for the Bridge Creek Intake as discussed in Chapter 3. Consequently, $1.75 million must be added to the costs of the powerhouses and penstock in order to obtain the total cost of the project.

The present worth analysis of costs listed in Table 7-9 for the Outback Facility includes the following total costs of the project:

- The Bridge Creek Intake replacement
- The 36-inch diameter penstock
- The powerhouse including the valves, turbine, and generator
- The Pacific Power & Light interconnection facilities

Similarly, the present worth analysis of revenue for the Outback Facility listed in Table 7-10 includes all identified sources of revenue including the following:

- Oregon's Business Energy Tax Credits (50 percent of the cost of the project up to a credit of $10 million)
- Federal Business Energy Tax (30 percent of the cost of construction)
- Federal Renewable Energy Grants
- Green Tags
- Federal Hydroelectric Production Incentives
- Federal Renewable Electric Production Tax Credits

We have not included potential funds from the Energy Trust of Oregon because it is too early in the process to obtain a commitment on the amount of funding that is available for these projects.

Given the dynamics of the economy, we have included an extraordinary contingency of 6.5 percent in our analysis of Alternative II (the 3-MW turbine alternative) to cover any unexpected volatility in material or labor costs during the course of the project.

Table 7-3 contains probable construction costs for each hydrogenation facility.

Table 7-3. Opinion of Probable Construction Cost Summary

Facility	Turbine size (kW)	Powerhouse construction cost	Inter-connection cost	Contingencies[1]	Engineering[2]	Permitting[3]	Mid-point of construction	Total opinion of probable capital cost
Outback Facility (Scenarios I, II, III)								
Alternative 1–Two 2-MW Pelton Wheels	2,000	$9,020,000	$687,000	$2,913,000	$1,353,000	$818,000	$1,416,000	$16,207,000
Alternative 2–One 3-MW Pelton Wheel	3,000	$7,135,000	$687,000	$2,347,000	$1,173,000	$818,000	$1,304,000	$13,464,000
ASR Injection Wells Hydrogeneration Facility								
Scenarios I and III	92	$5,895,000	$54,000	$1,785,000	$885,000	$780,000	$900,000	$10,299,000
Scenario II	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Distribution Hydrogeneration Facilities								
Overturf	7	$506,000	$30,000	$161,000	$76,000	$51,000	$78,000	$902,000
Aubrey Butte [4]	91	$693,000	$30,000	$217,000	$104,000	$69,000	$106,000	$1,219,000
Athletic Club	20	$525,000	$30,000	$167,000	$79,000	$53,000	$81,000	$935,000
Wichita	19	$554,000	$30,000	$176,000	$84,000	$55,000	$85,000	$984,000

[1] Aubrey Butte turbine cost assumed to be the lower pump-turbine cost instead of the Pelton wheel turbine in cost estimate.

[2] Contingencies are 30 percent of construction cost and interconnection cost.

[3] Engineering is 15 percent of powerhouse construction.

[4] Permitting costs for Outback Facility and ASR Injection Wells Hydrogeneration Facility are based on information provided by Brown and Caldwell. Permitting includes water rights, injection well, Federal Energy Regulatory Commission, and other permits. Distribution facilities permitting costs are assumed to be 10 percent of the powerhouse construction cost.

7.6 Operation and Maintenance (O&M) Assumptions and Costs

The O&M cost consists of mechanical equipment repairs, maintenance, one-quarter full-time-equivalent operator, and associated costs. The O&M costs assumed for each hydrogeneration facility was based on 0.05 percent of the powerhouse construction cost.

7.7 Expected Energy Valuation, Credit, and Tax Benefits

Accurate estimates of the costs associated with the construction and operation of a project over its operating life are essential in determining whether or not the project is viable economically. The level of accuracy of the assumptions made for this analysis is appropriate for the level of detail and timeline associated with these projects. Many of the financial and funding source assumptions were provided by Brown and Caldwell in Chapter 8, and were included where applicable.

7.8 Expected Energy Valuation and Renewable Energy Credit Valuation

The expected energy valuation was based on the assumption that the energy will be sold to the PacifiCorp grid, and not used behind the meter at the City of Bend (City) Water Treatment Plant site.

Renewable energy credits (RECs) are a method for accounting for renewable energy generation. They hold evidence of the production of renewable energy, and provide a methodology which enables renewable energy trade, if there is a market for the credits. The market for RECs in the western U.S. is still evolving, with REC values varying by resource and generation region. The RECs used for the purposes of this analysis include green tags, hydropower production incentive, and federal renewable electric production tax credits.

Cost of energy assumptions and value of RECs are detailed in Table 7-4.

Table 7-4. Cost of Energy Assumptions

Baseline cost of energy (COE) (cents/kWh)[1,2]	6.9 (Year 2013) to 66 (Year 2063)
Value of RECs (cents/kWh)[1]	
Green tags (2.2 cents/kWh inflated 5.7% per year)[1]	1 (Year 2013) to 16 (Year 2063)
Hydropower production incentive (2.2 cents/kWh inflated 5.7% per year for 10 years)[1]	2 (Year 2013) to 2.8 (Year 2023)
Federal renewable electric production tax credit (2.2 cents/kWh per year for 10 years)[1]	1 (Year 2013) to 16 (Year 2063)
COE reference year	2013

[1] *Costs for a given year are listed in that year's dollars.*

[2] *Baseline cost of energy was determined from PacifiCorp's published rates from schedule 37 through Year 2025 then inflated 5.7 percent to the end of the study year.*

7.9 Recognition of Associated Tax Credits, Grants, and Incentives

There are a variety of possible state and federal tax credits, grants, and incentives that possibly could be applicable to the hydrogeneration facilities. These revenue items are discussed further in Chapter 8. Table 7-5 summarizes the state and federal tax credits, grants, and incentives considered in this analysis.

Table 7-5. Tax Credits, Grants, and Incentives

Oregon Business Energy Tax Credit[1]	50 percent construction cost. Up to a $10 million credit per program with a project partner
Federal Business Energy Investment Tax Credit[1]	30 percent of the cost of the project with a project partner
Federal Renewable Energy Grants[1]	$200 per kW for first 2 MW (up to $400,000)

[1] *See Chapter 8.*

To account for the change in the value of money over time, there are assumptions that were required regarding the timing of project construction. For example, construction costs in Year 2009 were escalated to the mid-point of construction (October 2011) at an inflated rate. The annual discount rate is utilized when determining the present worth for each of the alternatives considered by this study. Financial assumptions regarding the discount rate and annual inflated rate are given in Table 7-6.

Table 7-6. Financial Assumptions

Inflated rate, percent [1,2]	4
Annual discount rate, percent [1]	4

[1] *Provided by Brown and Caldwell.*

[2] *For capital costs prior to Year 2013.*

Table 7-7 lists the years from which energy and construction cost assumptions are referenced.

Table 7-7. Study Year Assumptions

Construction cost reference year	2009
Study start year	2013
Length of study, years	50
Study end year	2063

Relevant opinion of probable construction costs for each of the hydrogeneration facilities were presented in Table 7-3. Initial capital cost estimates were gathered for each of the alternatives in Year 2009 dollars, and escalated to the mid-point of construction, as outlined in the paragraphs above. O&M costs were estimated at 0.05 percent of the escalated powerhouse construction costs (in year 2013 dollars). The capital, O&M, and total cost to year 2013 are listed in Table 7-8.

Table 7-8. Probable Opinion of Capital and O&M Cost Summary (Year 2013)

Facility	Turbine size	Capital cost[1]	Annual operation and maintenance costs[2]	Total capital and O&M costs
Outback Facility (Scenarios I, II, and III)				
Alternative 1 – Two 2 MW Pelton Wheels	2 @ 2,000 kW	$16,207,000	$52,800	$16,259,800
Alternative 2 – One 3 MW Pelton Wheel	3,000 kW	$13,464,000	$35,200	$13,499,200
ASR Injection Wells Hydrogeneration Facility				
Scenarios I and III	92 kW	$10,299,000	$34,500	$10,333,500
Scenario II	N/A	N/A	N/A	N/A
Distribution Hydrogeneration Facilities				
Overturf	7 kW	$902,000	$3,000	$905,000
Aubrey Butte	91 kW	$1,219,000	$4,100	$1,223,100
Athletic Club	20 kW	$935,000	$3,100	$938,100
Wichita	19 kW	$984,000	$3,200	$987,200

[1] Powerhouse Capital cost escalated to 2013.

[2] Annual O&M costs escalated to 2013 dollars (Initial value: 0.05 percent of 2009 construction cost).

7.10 Financial Analyses

The present worth of each hydrogeneration facility was calculated to determine the expected economic benefit associated with it. Revenue streams were compared to relevant costs to determine whether the hydrogeneration facility will expect a financial gain or loss over the life of the facility.

A simple payback period was calculated by determining the year when the total present worth revenue cost was equal to the total present worth capital and O&M costs. Simple payback determines the number of years required to recover the initial capital investment of a project plus the cumulative O&M costs to the payback year, given a stated revenue stream. For the purposes of this analysis, the initial capital investment and initial revenue starts in the initial study start year. The results of the present worth and payback period analyses for each of the hydrogeneration facilities are provided in Table 7-9. The detailed present worth analysis for each hydrogeneration facility is provided in Appendices 7-B through 7-E.

Note that flow Scenarios I and III include ASR injection wells to maximize the flow through the Outback turbine and to show beneficial use of the full water right. The ASR injection wells alone show a net loss and would not be constructed without the Outback powerhouse. The present worth analysis for the ASR injection wells is provided for information only and their loss net loss is included in the combined Outback powerhouse and ASR injection wells facility.

Table 7-9. 50-Year Present Worth Analysis

Facility	Turbine size, kW	Calculated annual power generation	Present worth all revenue streams	Present worth capital and O&M costs	Gain/(loss)	Simple payback period, from study start year, years
Outback Facility						
Alternative 1 – Two 2 MW Pelton Wheels						
Scenario I	2 @ 2,000	11,820,000 kWh	$65,752,000	$27,530,000	$38,222,000	29
Scenario II	2 @ 2,000	9,260,000 kWh in 2013, increasing to 11,790,000 kWh by 2031 and thereafter (2012 is a partial year at 4,475,000 kWh)	$62,967,000	$27,530,000	$35,437,000	30
Scenario III	2 @ 2,000	11,820,000 kWh, 2013 – 2018 12,390,000 kWh, 2019 – 2063	$68,427,000	$27,530,000	$40,897,000	28
Alternative 2 – One 3 MW Pelton Wheel						
Scenario I	3,000	11,460,000 kWh	$65,752,000	$25,329,000	$40,423,000	28
Scenario II	3,000	9,260,000 kWh in 2013, increasing to 11,790,000 kWh by 2031 and thereafter (2012 is a partial year at 4,475,000 kWh)	$62,967,000	$25,329,000	$37,638,000	29
Scenario III	3,000	11,460,000 kWh, 2013 – 2018 12,020,000 kWh, 2019 – 2063	$68,427,000	$25,329,000	$43,098,000	27
ASR Injection Wells Hydrogeneration Facility						
Scenarios I and III	92	941,000 kWh, 2013 301,000 kWh, 2023 No Generation, 2031 – 2063	$9,668,000	$11,074,000	($1,407,000)	N/A
Scenario II	N/A	N/A	N/A	N/A	N/A	N/A
Distribution Hydrogeneration Facilities						
Overturf	7	57,000 kWh	$769,000	$969,000	($200,000)	N/A
Aubrey Butte	91	800,000 kWh	$4,345,000	$1,310,000	$3,034,000	6
Athletic Club	20	180,000 kWh	$1,349,000	$1,004,000	$345,000	31
Wichita	19	170,000 kWh	$1,331,000	$1,057,000	$274,000	34

Notes:

1. Outback Facility includes ASR injection wells for Scenarios I and III.

2. The net loss for ASR Injection Well Hydrogeneration Facility is incorporated in the Outback Facility Scenarios I and III present worth analysis.

7.11 Summary of Economic Evaluation and Recommendations

Based on these results, all of the project alternatives and scenarios for the Outback Facility appear to be very attractive from a financial perspective. The ASR Injection Wells Hydrogeneration Facility was incorporated into the Outback Facility for Scenarios I and III since both scenarios require the beneficial use of the water being injected into the wells. Outback Alternative 2 with one 3 MW Pelton wheel provides the more gain and a slightly quicker payback when compared to Alternative 1. The Outback Alternative 2, Scenario III produces the most income.

When comparing the results of the Outback Facility for Scenario II (water used for generation flows only to the distribution system) with Scenarios II and III (surplus water is used for Aquifer Storage), it is evident that inclusion of down-well hydrogeneration reduces the payback period by 1 or 2 years. That is, the additional flow through the Outback turbine combined with well generation revenue justifies the cost of well installation. When comparing the results of Scenarios I and III, the additional water rights in Scenario III (Water Rights scenario 3c) results in a net benefit of about $2.7 million over the life of the project. The Outback Facility with single 3MW Pelton wheel turbine combined with the ASR injection wells is feasible financially given the parameters of this study and is recommended to be carried forward into predesign. Scenario II, water used for generation flows only to the distribution system is quite attractive economically returning $37.6 million dollars more than its cost to build and operate over 50 years.

Based on the results of this economic evaluation, the Aubrey Butte, Athletic Club, and Wichita sites are feasible. Aubrey Butte is the most attractive distribution hydrogeneration site by far with a short payback period of 6 years. The Aubrey Butte site is recommended to be carried forward into predesign.

The only distribution hydrogeneration facility that appears unfeasible at this point is Overturf. Per Chapter 6, the generation for the Wichita and Athletic Club sites are based on a best case flow scenario. It is recommended that the distribution system hydraulic model and City operations staff coordinate to establish an implementable system operation plan for maximizing the constant flow point for the Wichita and Athletic Club turbines. The Overturf, Athletic Club and Wichita distribution system sites may be more attractive or may be less attractive as the economic assumptions are revised; the feasibility of these three sites are sensitive to changes in assumptions.

The financial assumptions and incentive programs presented herein are preliminary and based on the best information available at this time. It is recommended that further evaluation of the revenues be conducted as these incentive programs are finalized and the present worth analysis is updated.

We recommend that the project proceed using a single 3-MW Pelton Turbine/Generator at the Outback Facility.

APPENDIX 7-A

Estimate of Probable Construction Cost

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B&V Project 164499.0800

Feasibility Study

City of Bend
Bend, Oregon

Hydrogeneration Feasibility Study
New Powerhouse Building (WTP Pelton Turbine)

OPINION OF
PROBABLE CONSTRUCTION COST
June 2009

OUTBACK SITE - ALTERNATIVE 1 TWO TURBINES SUMMARY

General Requirements, Bonds, and Insurance (13.5%)	$1,073,000
Sitework	$741,000
Turbine Generator Package (materials and install)	$2,860,000
Outback Powerhouse Building	$844,000
After-bay and Raw Water Pump Station	$1,200,000
Piping, valves, fittings	$712,000
Instrumentation (7%)	$445,000
Electrical (18%)	$1,145,000
Turbine and Powerhouse Construction Cost Subtotal	**$9,020,000**
Interconnect Fee	**$687,000**
Contingencies (30% of construction cost & interconnection Fee)	**$2,913,000**
Engineering (15% of construction cost)	**$1,353,000**
Permitting (Water Rights and Hydro License)	**$818,000**
Subtotal Probable Project Cost	**$14,791,000**
Mid-Point of Construction (October 2011)	**$1,416,000**
Rate = 4.0%	
Time = 2.3 years	
TOTAL PROBABLE PROJECT COST	**$16,207,000**

Outback Site---Cost for a single 3 MW Turbine

General Requirements, Bonds, and Insurance	963,000.00
Sitework	492,000.00
Turbine Generator Package	1,938,000.00
Outback Powerhouse Building	697,000.00
After-bay and Raw Water Pump Station	1,200,000.00
Piping, valves, fittings,	418,000.00
Instrumentation	400,000.00
Electrical	1,027,000.00
Turbine and Powerhouse Construction Cost Subtotal	**7,135,000.00**
Interconnection fee	**687,000.00**
Contingencies	**2,347,000.00**
Engineering	**1,173,000.00**
Permitting	**818,000.00**
Subtotal	**12,160,000.00**
Mid-Point of Construction Cost	**1,304,000.00**
Total Probable Project Cost	**13,464,000.00**

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Feasibility Study

City of Bend
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Hydrogeneration Feasibility Study
New Powerhouse Building (ASR Vertical Submersible Turbine)

OPINION OF
PROBABLE CONSTRUCTION COST
June 2009

ASR INJECTION WELLS SUMMARY

General Requirements, Bonds, and Insurance (13.5%)	$233,700
Sitework	$167,200
ASR Well Powerhouse Building	$1,024,600
Piping, valves, fittings	$193,000
Instrumentation (7%)	$97,000
Electrical (18%)	$249,300
Turbine and Powerhouse Construction Cost Subtotal each well	**$1,965,000**
Interconnect Fee each well	**$18,000**
Contingencies (30% of construction cost & interconnection Fee) each well	**$595,000**
Engineering (15% of construction cost) each well	**$295,000**
Permitting each well	**$260,000**
Subtotal Probable Project Cost each ASR Injection Well	**$3,133,000**
Mid-Point of Construction (October 2011) each well	**$300,000**
Rate = 4.0%	
Time = 2.3 years	
Subtotal Probable Project Cost each ASR Injection Well	**$3,433,000**
TOTAL PROBABLE PROJECT COST (Total 3 ASR Injection Wells)	**$10,299,000**

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Feasibility Study

City of Bend
Bend, Oregon

Hydrogeneration Feasibility Study
New Powerhouse Building (Distribution System Turbines)

OPINION OF
PROBABLE CONSTRUCTION COST
June 2009

OVERTURF - DISTRIBUTION SYSTEM SUMMARY

Overturf General Requirements, Bonds, and Insurance (13.5%)	$60,100
Sitework	$37,000
Turbine Generator Package (materials and install)	$71,500
Distribution Powerhouse Building	$182,400
Piping, valves, fittings	$65,500
Instrumentation (7%)	$25,000
Electrical (18%)	$64,200
Turbine and Powerhouse Construction Cost Subtotal	**$506,000**
Interconnect Fee	**$30,000**
Contingencies (30% of construction cost & interconnection fee)	**$161,000**
Engineering (15% of construction cost)	**$76,000**
Permitting (10% of construction cost)	**$51,000**
Subtotal Probable Project Cost	**$824,000**
Mid-Point of Construction (October 2011) Rate = 4.0% Time = 2.3 years	**$78,000**
TOTAL PROBABLE PROJECT COST	**$902,000**

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Hydrogeneration Feasibility Study
New Powerhouse Building (Distribution System Turbines)

OPINION OF
PROBABLE CONSTRUCTION COST
June 2009

AWBREY BUTTE - DISTRIBUTION SYSTEM SUMMARY

Awbrey Butte Feed General Requirements, Bonds, and Insurance (13.5%)	$82,400
Sitework	$37,000
Turbine Generator Package (materials and install)	$123,500
Distribution Powerhouse Building	$182,400
Piping, valves, fittings	$145,100
Instrumentation (7%)	$34,200
Electrical (18%)	$87,900
Turbine and Powerhouse Construction Cost Subtotal	**$693,000**
Interconnect Fee	**$30,000**
Contingencies (30% of construction cost & interconnection fee)	**$217,000**
Engineering (15% of construction cost)	**$104,000**
Permitting (10% of construction cost)	**$69,000**
Subtotal Probable Project Cost	**$1,113,000**
Mid-Point of Construction (October 2011)	**$106,000**
Rate = 4.0%	
Time = 2.3 years	
TOTAL PROBABLE PROJECT COST	**$1,219,000**

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Feasibility Study

City of Bend
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Hydrogeneration Feasibility Study
New Powerhouse Building (Distribution System Turbines)

OPINION OF
PROBABLE CONSTRUCTION COST
June 2009

ATHLETIC CLUB - DISTRIBUTION SYSTEM SUMMARY

Athletic Club General Requirements, Bonds, and Insurance (13.5%)	$62,300
Sitework	$37,000
Turbine Generator Package (materials and install)	$84,500
Distribution Powerhouse Building	$182,400
Piping, valves, fittings	$65,500
Instrumentation (7%)	$25,900
Electrical (18%)	$66,500
Turbine and Powerhouse Construction Cost Subtotal	**$525,000**
Interconnect Fee	**$30,000**
Contingencies (30% of construction cost & interconnection fee)	**$167,000**
Engineering (15% of construction cost)	**$79,000**
Permitting (10% of construction cost)	**$53,000**
Subtotal Probable Project Cost	**$854,000**
Mid-Point of Construction (October 2011)	**$81,000**
Rate = 4.0%	
Time = 2.3 years	
TOTAL PROBABLE PROJECT COST	**$935,000**

4800 Meadows Road, Suite 200, Lake Oswego, Oregon 97035, (503) 699-7556

B&V Project 164499.0800

Feasibility Study

City of Bend
Bend, Oregon

Hydrogeneration Feasibility Study
New Powerhouse Building (Distribution System Turbines)

OPINION OF
PROBABLE CONSTRUCTION COST
June 2009

WICHITA - DISTRIBUTION SYSTEM SUMMARY

Wichita General Requirements, Bonds, and Insurance (13.5%)	$66,000
Sitework	$37,000
Turbine Generator Package (materials and install)	$88,400
Distribution Powerhouse Building	$182,400
Piping, valves, fittings	$82,400
Instrumentation (7%)	$27,400
Electrical (18%)	$70,300
Turbine and Powerhouse Construction Cost Subtotal	**$554,000**
Interconnect Fee	**$30,000**
Contingencies (30% of construction cost & interconnection fee)	**$176,000**
Engineering (15% of construction cost)	**$84,000**
Permitting (10% of construction cost)	**$55,000**
Subtotal Probable Project Cost	**$899,000**
Mid-Point of Construction (October 2011)	**$85,000**
Rate = 4.0%	
Time = 2.3 years	
TOTAL PROBABLE PROJECT COST	**$984,000**

APPENDIX 7-B

Present Worth Analysis for Outback Alternative 1 Scenarios I, II and III

Outback Alternative 1																						
Scenario I																						
Two Pelton turbines at the Outback Site																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth	**Total**	Outback	ASR																			
Present Worth of Revenues	**$ 77,421,766**	$ 67,754,210	$9,667,557																			
Present Worth of Costs	**$ 54,087,395**	$ 43,013,174	$11,074,221																			
Gain / (Loss)	**$ 23,334,371**	$ 24,741,036	($1,406,665)																			
Capital Costs	$ 41,827,000																					
Turbine and Powerhouse Construction Cost	$ 9,020,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761																					
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	0.156	
Annual Energy Production (MWh)	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	
Total Electricity Sales Revenues	$ 1,288,380	$ 1,312,020	$ 1,347,480	$ 1,394,760	$ 1,430,220	$ 1,465,680	$ 1,501,140	$ 1,548,420	$ 1,583,880	$ 1,595,700	$ 1,158,360	$ 1,170,180	$ 1,182,000	$ 1,252,920	$ 1,323,840	$ 1,394,760	$ 1,477,500	$ 1,560,240	$ 1,642,980	$ 1,749,360	$ 1,843,920	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit (50% construction cost up to $10 million/program)	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000																	
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700																					
Total Revenue	$ 8,271,080	$ 3,312,020	$ 3,347,480	$ 3,394,760	$ 3,430,220	$ 1,465,680	$ 1,501,140	$ 1,548,420	$ 1,583,880	$ 1,595,700	$ 1,158,360	$ 1,170,180	$ 1,182,000	$ 1,252,920	$ 1,323,840	$ 1,394,760	$ 1,477,500	$ 1,560,240	$ 1,642,980	$ 1,749,360	$ 1,843,920	
Total Costs																						
Capital Cost Expenditures	$ 41,827,000																					
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$ 41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	0.4564	
Present Worth Total Revenues	$ 8,271,080	$ 3,184,635	$ 3,094,933	$ 3,017,929	$ 2,932,166	$ 1,204,682	$ 1,186,373	$ 1,176,672	$ 1,157,326	$ 1,121,118	$ 782,547	$ 760,127	$ 738,274	$ 752,471	$ 764,485	$ 774,461	$ 788,849	$ 800,985	$ 811,021	$ 830,320	$ 841,541	
Present Worth Capital Cost Expenditures	$ 41,827,000																					
Present Worth O&M Expenditures	$ 52,761	$ 50,731	$ 48,780	$ 46,904	$ 45,100	$ 43,365	$ 41,697	$ 40,094	$ 38,552	$ 37,069	$ 35,643	$ 34,272	$ 32,954	$ 31,687	$ 30,468	$ 29,296	$ 28,169	$ 27,086	$ 26,044	$ 25,042	$ 24,079	
Present Worth Total Cost	$ 41,879,761	$ 50,731	$ 48,780	$ 46,904	$ 45,100	$ 43,365	$ 41,697	$ 40,094	$ 38,552	$ 37,069	$ 35,643	$ 34,272	$ 32,954	$ 31,687	$ 30,468	$ 29,296	$ 28,169	$ 27,086	$ 26,044	$ 25,042	$ 24,079	
Outback Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Outback and ASR Hydrogeneration Facilities Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Outback Alternative 1																						
Scenario I																						
Two Pelton turbines at the Outback Site																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth	**Total**																					
Present Worth of Revenues	**$ 77,421,766**																					
Present Worth of Costs	**$ 54,087,395**																					
Gain / (Loss)	**$ 23,334,371**																					
Capital Costs	$ 41,827,000																					
Turbine and Powerhouse Construction Cost	$ 9,020,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761																					
Period Number	0	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Year	2013	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	0.473	
Annual Energy Production (MWh)	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	
Total Electricity Sales Revenues	$ 1,288,380	$ 1,950,300	$ 2,056,680	$ 2,174,880	$ 2,304,900	$ 2,434,920	$ 2,564,940	$ 2,718,600	$ 2,872,260	$ 3,037,740	$ 3,215,040	$ 3,392,340	$ 3,581,460	$ 3,782,400	$ 4,006,980	$ 4,231,560	$ 4,479,780	$ 4,728,000	$ 4,999,860	$ 5,283,540	$ 5,590,860	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit (50% construction cost up to $10 million/program)	$ 2,000,000																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700																					
Total Revenue	$ 8,271,080	$ 1,950,300	$ 2,056,680	$ 2,174,880	$ 2,304,900	$ 2,434,920	$ 2,564,940	$ 2,718,600	$ 2,872,260	$ 3,037,740	$ 3,215,040	$ 3,392,340	$ 3,581,460	$ 3,782,400	$ 4,006,980	$ 4,231,560	$ 4,479,780	$ 4,728,000	$ 4,999,860	$ 5,283,540	$ 5,590,860	
Total Costs																						
Capital Cost Expenditures	$ 41,827,000																					
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$ 41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	0.2083	
Present Worth Total Revenues	$ 8,271,080	$ 855,857	$ 867,827	$ 882,406	$ 899,191	$ 913,379	$ 925,146	$ 942,856	$ 957,834	$ 974,056	$ 991,257	$ 1,005,694	$ 1,020,924	$ 1,036,734	$ 1,056,048	$ 1,072,343	$ 1,091,582	$ 1,107,755	$ 1,126,396	$ 1,144,524	$ 1,164,515	
Present Worth Capital Cost Expenditures	$ 41,827,000																					
Present Worth O&M Expenditures	$ 52,761	$ 23,153	$ 22,263	$ 21,406	$ 20,583	$ 19,791	$ 19,030	$ 18,298	$ 17,594	$ 16,918	$ 16,267	$ 15,641	$ 15,040	$ 14,461	$ 13,905	$ 13,370	$ 12,856	$ 12,362	$ 11,886	$ 11,429	$ 10,989	
Present Worth Total Cost	$ 41,879,761	$ 23,153	$ 22,263	$ 21,406	$ 20,583	$ 19,791	$ 19,030	$ 18,298	$ 17,594	$ 16,918	$ 16,267	$ 15,641	$ 15,040	$ 14,461	$ 13,905	$ 13,370	$ 12,856	$ 12,362	$ 11,886	$ 11,429	$ 10,989	
Outback Payback Period	no	no	no	no	no	no	no	no	no	29	30	31	32	33	34	35	36	37	38	39	40	
Outback and ASR Hydrogeneration Facilities Payback Period	no	no	no	no	no	no	no	no	no	no	30	31	32	33	34	35	36	37	38	39	40	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Outback Alternative 1												
Scenario I												
Two Pelton turbines at the Outback Site												
Present Worth Analysis Worksheet - Conceptual and Comparative												
Total 50-year Present Worth	**Total**											
Present Worth of Revenues	**$ 77,421,766**											
Present Worth of Costs	**$ 54,087,395**											
Gain / (Loss)	**$ 23,334,371**											
Capital Costs	$ 41,827,000											
Turbine and Powerhouse Construction Cost	$ 9,020,000											
Operation and Maintenance Costs												
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761											
Period Number	0	41	42	43	44	45	46	47	48	49	50	
Year	2013	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues												
Electrical Sales Revenue												
Cost of Energy ($/KWh)[1,2]	0.109	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	11,820	
Total Electricity Sales Revenues	$ 1,288,380	$ 5,898,180	$ 6,240,960	$ 6,583,740	$ 6,973,800	$ 7,363,860	$ 7,789,380	$ 8,226,720	$ 8,699,520	$ 9,195,960	$ 9,716,040	
Tax Credits, Grants, Incentives												
Oregon Business Energy Tax Credit (50% construction cost up to $10 million/program)	$ 2,000,000											
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000											
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000											
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700											
Total Revenue	$ 8,271,080	$ 5,898,180	$ 6,240,960	$ 6,583,740	$ 6,973,800	$ 7,363,860	$ 7,789,380	$ 8,226,720	$ 8,699,520	$ 9,195,960	$ 9,716,040	
Total Costs												
Capital Cost Expenditures	$ 41,827,000											
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$ 41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis												
Present Worth Factor	1.0000	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 8,271,080	$ 1,181,275	$ 1,201,852	$ 1,219,099	$ 1,241,660	$ 1,260,681	$ 1,282,240	$ 1,302,146	$ 1,324,021	$ 1,345,747	$ 1,367,169	
Present Worth Capital Cost Expenditures	$ 41,827,000											
Present Worth O&M Expenditures	$ 52,761	$ 10,567	$ 10,160	$ 9,770	$ 9,394	$ 9,033	$ 8,685	$ 8,351	$ 8,030	$ 7,721	$ 7,424	
Present Worth Total Cost	$ 41,879,761	$ 10,567	$ 10,160	$ 9,770	$ 9,394	$ 9,033	$ 8,685	$ 8,351	$ 8,030	$ 7,721	$ 7,424	
Outback Payback Period	no	41	42	43	44	45	46	47	48	49	50	
Outback and ASR Hydrogeneration Facilities Payback Period	no	41	42	43	44	45	46	47	48	49	50	
Notes:												
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009												
2. Values based on Jim Doanes email 6-10-2010												

Outback Alternative 1																						
Scenario II																						
Two Pelton turbines at the Outback Site																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$65,602,289																					
Present Worth of Costs	$43,013,174																					
Gain / (Loss)	$22,589,115																					
Capital Costs	$41,827,000																					
Turbine and Powerhouse Construction Cost	$ 9,020,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761																					
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	0.156	
Annual Energy Production (MWh)	9,260	9,450	9,640	9,830	10,010	10,200	10,390	10,540	10,680	10,830	10,970	11,110	11,260	11,400	11,540	10,680	11,750	11,790	11,790	11,790	11,790	
Total Electricity Sales Revenues	$ 1,009,340	$1,048,950	$1,098,960	$1,159,940	$1,211,210	$1,264,800	$1,319,530	$1,380,740	$1,431,120	$1,462,050	$1,075,060	$1,099,890	$1,126,000	$1,208,400	$1,292,480	$1,260,240	$1,468,750	$1,556,280	$1,638,810	$1,744,920	$1,839,240	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000																	
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700																					
Total Revenue	$ 7,992,040	$3,048,950	$3,098,960	$3,159,940	$3,211,210	$1,264,800	$1,319,530	$1,380,740	$1,431,120	$1,462,050	$1,075,060	$1,099,890	$1,126,000	$1,208,400	$1,292,480	$1,260,240	$1,468,750	$1,556,280	$1,638,810	$1,744,920	$1,839,240	
Total Costs																						
Capital Cost Expenditures	$41,827,000																					
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	0.4564	
Present Worth Total Revenues	$ 7,992,040	$2,931,683	$2,865,163	$2,809,175	$2,744,956	$1,039,573	$1,042,844	$1,049,249	$1,045,705	$1,027,217	$ 726,272	$ 714,468	$ 703,296	$ 725,734	$ 746,375	$ 699,767	$ 784,178	$ 798,953	$ 808,963	$ 828,213	$ 839,405	
Present Worth Capital Cost Expenditures	$41,827,000																					
Present Worth O&M Expenditures	$ 52,761	$ 50,731	$ 48,780	$ 46,904	$ 45,100	$ 43,365	$ 41,697	$ 40,094	$ 38,552	$ 37,069	$ 35,643	$ 34,272	$ 32,954	$ 31,687	$ 30,468	$ 29,296	$ 28,169	$ 27,086	$ 26,044	$ 25,042	$ 24,079	
Present Worth Total Cost	$41,879,761	$ 50,731	$ 48,780	$ 46,904	$ 45,100	$ 43,365	$ 41,697	$ 40,094	$ 38,552	$ 37,069	$ 35,643	$ 34,272	$ 32,954	$ 31,687	$ 30,468	$ 29,296	$ 28,169	$ 27,086	$ 26,044	$ 25,042	$ 24,079	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Outback Alternative 1																						
Scenario II																						
Two Pelton turbines at the Outback Site																						
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Present Worth of Revenues	$65,602,289																					
Present Worth of Costs	$43,013,174																					
Gain / (Loss)	$22,589,115																					
Capital Costs	$41,827,000																					
Turbine and Powerhouse Construction Cost	$ 9,020,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761																					
Period Number	0	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Year	2013	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	0.473	
Annual Energy Production (MWh)	9,260	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	
Total Electricity Sales Revenues	$ 1,009,340	$1,945,350	$2,051,460	$2,169,360	$2,299,050	$2,428,740	$2,558,430	$2,711,700	$2,864,970	$3,030,030	$3,206,880	$3,383,730	$3,572,370	$3,772,800	$3,996,810	$4,220,820	$4,468,410	$4,716,000	$4,987,170	$5,270,130	$5,576,670	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700																					
Total Revenue	$ 7,992,040	$1,945,350	$2,051,460	$2,169,360	$2,299,050	$2,428,740	$2,558,430	$2,711,700	$2,864,970	$3,030,030	$3,206,880	$3,383,730	$3,572,370	$3,772,800	$3,996,810	$4,220,820	$4,468,410	$4,716,000	$4,987,170	$5,270,130	$5,576,670	
Total Costs																						
Capital Cost Expenditures	$41,827,000																					
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	0.2083	
Present Worth Total Revenues	$ 7,992,040	$ 853,685	$ 865,625	$ 880,166	$ 896,909	$ 911,061	$ 922,798	$ 940,462	$ 955,403	$ 971,583	$ 988,741	$1,003,141	$1,018,332	$1,034,102	$1,053,368	$1,069,621	$1,088,812	$1,104,944	$1,123,537	$1,141,619	$1,161,559	
Present Worth Capital Cost Expenditures	$41,827,000																					
Present Worth O&M Expenditures	$ 52,761	$ 23,153	$ 22,263	$ 21,406	$ 20,583	$ 19,791	$ 19,030	$ 18,298	$ 17,594	$ 16,918	$ 16,267	$ 15,641	$ 15,040	$ 14,461	$ 13,905	$ 13,370	$ 12,856	$ 12,362	$ 11,886	$ 11,429	$ 10,989	
Present Worth Total Cost	$41,879,761	$ 23,153	$ 22,263	$ 21,406	$ 20,583	$ 19,791	$ 19,030	$ 18,298	$ 17,594	$ 16,918	$ 16,267	$ 15,641	$ 15,040	$ 14,461	$ 13,905	$ 13,370	$ 12,856	$ 12,362	$ 11,886	$ 11,429	$ 10,989	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	31	32	33	34	35	36	37	38	39	40	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Outback Alternative 1												
Scenario II												
Two Pelton turbines at the Outback Site												
Present Worth Analysis Worksheet - Conceptual and Comparative												
Total 50-year Present Worth												
Present Worth of Revenues	$65,602,289											
Present Worth of Costs	$43,013,174											
Gain / (Loss)	$22,589,115											
Capital Costs	$41,827,000											
Turbine and Powerhouse Construction Cost	$ 9,020,000											
Operation and Maintenance Costs												
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761											
Period Number	0	41	42	43	44	45	46	47	48	49	50	
Year	2013	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues												
Electrical Sales Revenue												
Cost of Energy ($/KWh)[1,2]	0.109	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	9,260	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	11,790	
Total Electricity Sales Revenues	$ 1,009,340	$5,883,210	$6,225,120	$6,567,030	$6,956,100	$7,345,170	$7,769,610	$8,205,840	$8,677,440	$9,172,620	$9,691,380	
Tax Credits, Grants, Incentives												
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000											
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000											
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000											
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700											
Total Revenue	$ 7,992,040	$5,883,210	$6,225,120	$6,567,030	$6,956,100	$7,345,170	$7,769,610	$8,205,840	$8,677,440	$9,172,620	$9,691,380	
Total Costs												
Capital Cost Expenditures	$41,827,000											
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis												
Present Worth Factor	1.0000	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 7,992,040	$1,178,277	$1,198,802	$1,216,005	$1,238,508	$1,257,481	$1,278,985	$1,298,841	$1,320,661	$1,342,331	$1,363,699	
Present Worth Capital Cost Expenditures	$41,827,000											
Present Worth O&M Expenditures	$ 52,761	$ 10,567	$ 10,160	$ 9,770	$ 9,394	$ 9,033	$ 8,685	$ 8,351	$ 8,030	$ 7,721	$ 7,424	
Present Worth Total Cost	$41,879,761	$ 10,567	$ 10,160	$ 9,770	$ 9,394	$ 9,033	$ 8,685	$ 8,351	$ 8,030	$ 7,721	$ 7,424	
Payback Period	no	41	42	43	44	45	46	47	48	49	50	
Notes:												
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009												
2. Values based on Jim Doanes email 6-10-2010												

Outback Alternative 1																					
Scenario III																					
Two Pelton turbines at the Outback Site																					
Present Worth Analysis Worksheet - Conceptual and Comparative																					
Total 50-year Present Worth	**Total**	Outback	ASR																		
Present Worth of Revenues	**$79,700,487**	$70,032,930	$9,667,557																		
Present Worth of Costs	**$54,087,395**	$43,013,174	$11,074,221																		
Gain / (Loss)	**$25,613,091**	$27,019,756	($1,406,665)																		
Capital Costs	$41,827,000																				
Turbine and Powerhouse Construction Cost	$ 9,020,000																				
Operation and Maintenance Costs																					
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761																				
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
Total Revenues																					
Electrical Sales Revenue																					
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	
Annual Energy Production (MWh)	11,820	11,820	11,820	11,820	11,820	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	
Total Electricity Sales Revenues	$ 1,288,380	$ 1,312,020	$ 1,347,480	$1,394,760	$1,430,220	$1,536,360	$1,573,530	$1,623,090	$1,660,260	$1,672,650	$1,214,220	$1,226,610	$1,239,000	$1,313,340	$1,387,680	$1,462,020	$1,548,750	$1,635,480	$1,722,210	$1,833,720	
Tax Credits, Grants, Incentives																					
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000	$ 2,000,000	$ 2,000,000	$2,000,000	$2,000,000																
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																				
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																				
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700																				
Total Revenue	$ 8,271,080	$ 3,312,020	$ 3,347,480	$3,394,760	$3,430,220	$1,536,360	$1,573,530	$1,623,090	$1,660,260	$1,672,650	$1,214,220	$1,226,610	$1,239,000	$1,313,340	$1,387,680	$1,462,020	$1,548,750	$1,635,480	$1,722,210	$1,833,720	
Total Costs																					
Capital Cost Expenditures	$41,827,000																				
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis																					
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	
Present Worth Total Revenues	$ 8,271,080	$ 3,184,635	$ 3,094,933	$3,017,929	$2,932,166	$1,262,776	$1,243,584	$1,233,415	$1,213,136	$1,175,182	$ 820,284	$ 796,782	$ 773,876	$ 788,758	$ 801,351	$ 811,808	$ 826,890	$ 839,612	$ 850,131	$ 870,361	
Present Worth Capital Cost Expenditures	$41,827,000																				
Present Worth O&M Expenditures	$ 52,761	$ 50,731	$ 48,780	$ 46,904	$ 45,100	$ 43,365	$ 41,697	$ 40,094	$ 38,552	$ 37,069	$ 35,643	$ 34,272	$ 32,954	$ 31,687	$ 30,468	$ 29,296	$ 28,169	$ 27,086	$ 26,044	$ 25,042	
Present Worth Total Cost	$41,879,761	$ 50,731	$ 48,780	$ 46,904	$ 45,100	$ 43,365	$ 41,697	$ 40,094	$ 38,552	$ 37,069	$ 35,643	$ 34,272	$ 32,954	$ 31,687	$ 30,468	$ 29,296	$ 28,169	$ 27,086	$ 26,044	$ 25,042	
Outback Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Outback and ASR Hydrogeneration Facilities Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Notes:																					
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																					
2. Values based on Jim Doanes email 6-10-2010																					

Outback Alternative 1																						
Scenario III																						
Two Pelton turbines at the Outback Site																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth	**Total**																					
Present Worth of Revenues	**$79,700,487**																					
Present Worth of Costs	**$54,087,395**																					
Gain / (Loss)	**$25,613,091**																					
Capital Costs	$41,827,000																					
Turbine and Powerhouse Construction Cost	$ 9,020,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761																					
Period Number	0	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
Year	2013	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.156	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	
Annual Energy Production (MWh)	11,820	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	
Total Electricity Sales Revenues	$ 1,288,380	$1,932,840	$2,044,350	$2,155,860	$2,279,760	$2,416,050	$2,552,340	$2,688,630	$2,849,700	$3,010,770	$3,184,230	$3,370,080	$3,555,930	$3,754,170	$3,964,800	$4,200,210	$4,435,620	$4,695,810	$4,956,000	$5,240,970	$5,538,330	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700																					
Total Revenue	$ 8,271,080	$1,932,840	$2,044,350	$2,155,860	$2,279,760	$2,416,050	$2,552,340	$2,688,630	$2,849,700	$3,010,770	$3,184,230	$3,370,080	$3,555,930	$3,754,170	$3,964,800	$4,200,210	$4,435,620	$4,695,810	$4,956,000	$5,240,970	$5,538,330	
Total Costs																						
Capital Cost Expenditures	$41,827,000																					
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4564	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	
Present Worth Total Revenues	$ 8,271,080	$ 882,123	$ 897,129	$ 909,677	$ 924,959	$ 942,553	$ 957,426	$ 969,760	$ 988,323	$1,004,024	$1,021,028	$1,039,059	$1,054,192	$1,070,156	$1,086,729	$1,106,974	$1,124,055	$1,144,222	$1,161,175	$1,180,714	$1,199,716	
Present Worth Capital Cost Expenditures	$41,827,000																					
Present Worth O&M Expenditures	$ 52,761	$ 24,079	$ 23,153	$ 22,263	$ 21,406	$ 20,583	$ 19,791	$ 19,030	$ 18,298	$ 17,594	$ 16,918	$ 16,267	$ 15,641	$ 15,040	$ 14,461	$ 13,905	$ 13,370	$ 12,856	$ 12,362	$ 11,886	$ 11,429	
Present Worth Total Cost	$41,879,761	$ 24,079	$ 23,153	$ 22,263	$ 21,406	$ 20,583	$ 19,791	$ 19,030	$ 18,298	$ 17,594	$ 16,918	$ 16,267	$ 15,641	$ 15,040	$ 14,461	$ 13,905	$ 13,370	$ 12,856	$ 12,362	$ 11,886	$ 11,429	
Outback Payback Period	no	no	no	no	no	no	no	no	no	28	29	30	31	32	33	34	35	36	37	38	39	
Outback and ASR Hydrogeneration Facilities Payback Period	no	no	no	no	no	no	no	no	no	no	29	30	31	32	33	34	35	36	37	38	39	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Outback Alternative 1													
Scenario III													
Two Pelton turbines at the Outback Site													
Present Worth Analysis Worksheet - Conceptual and Comparative													
Total 50-year Present Worth	**Total**												
Present Worth of Revenues	**$79,700,487**												
Present Worth of Costs	**$54,087,395**												
Gain / (Loss)	**$25,613,091**												
Capital Costs	$41,827,000												
Turbine and Powerhouse Construction Cost	$ 9,020,000												
Operation and Maintenance Costs													
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 52,761												
Period Number	0	40	41	42	43	44	45	46	47	48	49	50	
Year	2013	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues													
Electrical Sales Revenue													
Cost of Energy ($/KWh)[1,2]	0.109	0.473	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	11,820	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	12,390	
Total Electricity Sales Revenues	$ 1,288,380	$5,860,470	$6,182,610	$6,541,920	$6,901,230	$7,310,100	$7,718,970	$8,165,010	$8,623,440	$9,119,040	$9,639,420	$10,184,580	
Tax Credits, Grants, Incentives													
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000												
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000												
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000												
Energy Trust of Oregon (10% Capital Cost)2	$ 4,182,700												
Total Revenue	$ 8,271,080	$5,860,470	$6,182,610	$6,541,920	$6,901,230	$7,310,100	$7,718,970	$8,165,010	$8,623,440	$9,119,040	$9,639,420	$10,184,580	
Total Costs													
Capital Cost Expenditures	$41,827,000												
O&M Expenditures	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Total Cost	$41,879,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	$ 52,761	
Present Worth Analysis													
Present Worth Factor	1.0000	0.2083	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 8,271,080	$1,220,672	$1,238,240	$1,259,810	$1,277,888	$1,301,537	$1,321,475	$1,344,074	$1,364,940	$1,387,870	$1,410,644	$ 1,433,099	
Present Worth Capital Cost Expenditures	$41,827,000												
Present Worth O&M Expenditures	$ 52,761	$ 10,989	$ 10,567	$ 10,160	$ 9,770	$ 9,394	$ 9,033	$ 8,685	$ 8,351	$ 8,030	$ 7,721	$ 7,424	
Present Worth Total Cost	$41,879,761	$ 10,989	$ 10,567	$ 10,160	$ 9,770	$ 9,394	$ 9,033	$ 8,685	$ 8,351	$ 8,030	$ 7,721	$ 7,424	
Outback Payback Period	no	40	41	42	43	44	45	46	47	48	49	50	
Outback and ASR Hydrogeneration Facilities Payback Period	no	40	41	42	43	44	45	46	47	48	49	50	
Notes:													
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009													
2. Values based on Jim Doanes email 6-10-2010													

APPENDIX 7-C

Present worth Analysis for Outback Alternative 2 Scenarios I, II and III

Outback Alternative 2																				
Scenario I																				
One Pelton turbines at the Outback Site																				
Present Worth Analysis Worksheet - Conceptual and Comparative																				
Total 50-year Present Worth	**Total**	Outback	ASR																	
Present Worth of Revenues	**$75,312,768**	$65,645,211	$9,667,557																	
Present Worth of Costs	**$48,899,960**	$37,825,739	$11,074,221																	
Gain / (Loss)	**$26,412,808**	$27,819,472	($1,406,665)																	
Capital Costs	$37,035,000																			
Turbine and Powerhouse Construction Cost	$ 6,013,000																			
Operation and Maintenance Costs																				
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172																			
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Revenues																				
Electrical Sales Revenue																				
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148
Annual Energy Production (MWh)	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460
Total Electricity Sales Revenues	$ 1,249,140	$ 1,272,060	$ 1,306,440	$1,352,280	$1,386,660	$1,421,040	$1,455,420	$1,501,260	$1,535,640	$1,547,100	$1,123,080	$1,134,540	$1,146,000	$1,214,760	$1,283,520	$1,352,280	$1,432,500	$1,512,720	$1,592,940	$1,696,080
Tax Credits, Grants, Incentives																				
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000	$ 2,000,000	$ 2,000,000	$2,000,000	$2,000,000															
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																			
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																			
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500																			
Total Revenue	$ 7,752,640	$ 3,272,060	$ 3,306,440	$3,352,280	$3,386,660	$1,421,040	$1,455,420	$1,501,260	$1,535,640	$1,547,100	$1,123,080	$1,134,540	$1,146,000	$1,214,760	$1,283,520	$1,352,280	$1,432,500	$1,512,720	$1,592,940	$1,696,080
Total Costs																				
Capital Cost Expenditures	$37,035,000																			
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172
Present Worth Analysis																				
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746
Present Worth Total Revenues	$ 7,752,640	$ 3,146,212	$ 3,056,990	$2,980,165	$2,894,931	$1,167,991	$1,150,240	$1,140,834	$1,122,077	$1,086,972	$ 758,713	$ 736,976	$ 715,788	$ 729,553	$ 741,201	$ 750,873	$ 764,823	$ 776,590	$ 786,320	$ 805,032
Present Worth Capital Cost Expenditures	$37,035,000																			
Present Worth O&M Expenditures	$ 35,172	$ 33,819	$ 32,518	$ 31,268	$ 30,065	$ 28,909	$ 27,797	$ 26,728	$ 25,700	$ 24,711	$ 23,761	$ 22,847	$ 21,968	$ 21,123	$ 20,311	$ 19,530	$ 18,779	$ 18,056	$ 17,362	$ 16,694
Present Worth Total Cost	$37,070,172	$ 33,819	$ 32,518	$ 31,268	$ 30,065	$ 28,909	$ 27,797	$ 26,728	$ 25,700	$ 24,711	$ 23,761	$ 22,847	$ 21,968	$ 21,123	$ 20,311	$ 19,530	$ 18,779	$ 18,056	$ 17,362	$ 16,694
Outback Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Outback and ASR Hydrogeneration Facilities Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Notes:																				
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																				
2. Values based on Jim Doanes email 6-10-2010																				

Outback Alternative 2																						
Scenario I																						
One Pelton turbines at the Outback Site																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth	**Total**																					
Present Worth of Revenues	**$75,312,768**																					
Present Worth of Costs	**$48,899,960**																					
Gain / (Loss)	**$26,412,808**																					
Capital Costs	$37,035,000																					
Turbine and Powerhouse Construction Cost	$ 6,013,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172																					
Period Number	0	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
Year	2013	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.156	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	
Annual Energy Production (MWh)	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	
Total Electricity Sales Revenues	$ 1,249,140	$1,787,760	$1,890,900	$1,994,040	$2,108,640	$2,234,700	$2,360,760	$2,486,820	$2,635,800	$2,784,780	$2,945,220	$3,117,120	$3,289,020	$3,472,380	$3,667,200	$3,884,940	$4,102,680	$4,343,340	$4,584,000	$4,847,580	$5,122,620	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500																					
Total Revenue	$ 7,752,640	$1,787,760	$1,890,900	$1,994,040	$2,108,640	$2,234,700	$2,360,760	$2,486,820	$2,635,800	$2,784,780	$2,945,220	$3,117,120	$3,289,020	$3,472,380	$3,667,200	$3,884,940	$4,102,680	$4,343,340	$4,584,000	$4,847,580	$5,122,620	
Total Costs																						
Capital Cost Expenditures	$37,035,000																					
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4564	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	
Present Worth Total Revenues	$ 7,752,640	$ 815,910	$ 829,790	$ 841,396	$ 855,531	$ 871,804	$ 885,561	$ 896,969	$ 914,139	$ 928,661	$ 944,389	$ 961,066	$ 975,064	$ 989,829	$1,005,158	$1,023,884	$1,039,683	$1,058,336	$1,074,017	$1,092,089	$1,109,665	
Present Worth Capital Cost Expenditures	$37,035,000																					
Present Worth O&M Expenditures	$ 35,172	$ 16,052	$ 15,435	$ 14,841	$ 14,270	$ 13,721	$ 13,194	$ 12,686	$ 12,198	$ 11,729	$ 11,278	$ 10,844	$ 10,427	$ 10,026	$ 9,640	$ 9,270	$ 8,913	$ 8,570	$ 8,241	$ 7,924	$ 7,619	
Present Worth Total Cost	$37,070,172	$ 16,052	$ 15,435	$ 14,841	$ 14,270	$ 13,721	$ 13,194	$ 12,686	$ 12,198	$ 11,729	$ 11,278	$ 10,844	$ 10,427	$ 10,026	$ 9,640	$ 9,270	$ 8,913	$ 8,570	$ 8,241	$ 7,924	$ 7,619	
Outback Payback Period	no	no	no	no	no	no	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
Outback and ASR Hydrogeneration Facilities Payback Period	no	no	no	no	no	no	no	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Outback Alternative 2													
Scenario I													
One Pelton turbines at the Outback Site													
Present Worth Analysis Worksheet - Conceptual and Comparative													
Total 50-year Present Worth	**Total**												
Present Worth of Revenues	**$75,312,768**												
Present Worth of Costs	**$48,899,960**												
Gain / (Loss)	**$26,412,808**												
Capital Costs	$37,035,000												
Turbine and Powerhouse Construction Cost	$ 6,013,000												
Operation and Maintenance Costs													
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172												
Period Number	0	40	41	42	43	44	45	46	47	48	49	50	
Year	2013	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues													
Electrical Sales Revenue													
Cost of Energy ($/KWh)[1,2]	0.109	0.473	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	11,460	
Total Electricity Sales Revenues	$ 1,249,140	$5,420,580	$5,718,540	$6,050,880	$6,383,220	$6,761,400	$7,139,580	$7,552,140	$7,976,160	$8,434,560	$8,915,880	$9,420,120	
Tax Credits, Grants, Incentives													
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000												
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000												
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000												
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500												
Total Revenue	$ 7,752,640	$5,420,580	$5,718,540	$6,050,880	$6,383,220	$6,761,400	$7,139,580	$7,552,140	$7,976,160	$8,434,560	$8,915,880	$9,420,120	
Total Costs													
Capital Cost Expenditures	$37,035,000												
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Present Worth Analysis													
Present Worth Factor	1.0000	0.2083	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 7,752,640	$1,129,047	$1,145,297	$1,165,248	$1,181,969	$1,203,843	$1,222,285	$1,243,187	$1,262,487	$1,283,696	$1,304,760	$1,325,530	
Present Worth Capital Cost Expenditures	$37,035,000												
Present Worth O&M Expenditures	$ 35,172	$ 7,326	$ 7,044	$ 6,773	$ 6,513	$ 6,262	$ 6,021	$ 5,790	$ 5,567	$ 5,353	$ 5,147	$ 4,949	
Present Worth Total Cost	$37,070,172	$ 7,326	$ 7,044	$ 6,773	$ 6,513	$ 6,262	$ 6,021	$ 5,790	$ 5,567	$ 5,353	$ 5,147	$ 4,949	
Outback Payback Period	no	40	41	42	43	44	45	46	47	48	49	50	
Outback and ASR Hydrogeneration Facilities Payback Period	no	40	41	42	43	44	45	46	47	48	49	50	
Notes:													
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009													
2. Values based on Jim Doanes email 6-10-2010													

Outback Alternative 2																						
Scenario II																						
One Pelton turbines at the Outback Site																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$63,608,444																					
Present Worth of Costs	$37,825,739																					
Gain / (Loss)	$25,782,705																					
Capital Costs	$37,035,000																					
Turbine and Powerhouse Construction Cost	$ 6,013,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172																					
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	0.156	
Annual Energy Production (MWh)	8,990	9,172	9,355	9,536	9,718	9,899	10,080	10,227	10,367	10,506	10,646	10,785	10,924	11,063	11,201	10,367	11,397	11,442	11,443	11,443	11,443	
Total Electricity Sales Revenues	$ 979,904	$1,018,138	$1,066,419	$1,125,290	$1,175,854	$1,227,462	$1,280,108	$1,339,673	$1,389,126	$1,418,370	$1,043,309	$1,067,744	$1,092,430	$1,172,679	$1,254,559	$1,223,260	$1,424,624	$1,510,332	$1,590,529	$1,693,513	$1,785,055	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000																	
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500																					
Total Revenue	$ 7,483,404	$3,018,138	$3,066,419	$3,125,290	$3,175,854	$1,227,462	$1,280,108	$1,339,673	$1,389,126	$1,418,370	$1,043,309	$1,067,744	$1,092,430	$1,172,679	$1,254,559	$1,223,260	$1,424,624	$1,510,332	$1,590,529	$1,693,513	$1,785,055	
Total Costs																						
Capital Cost Expenditures	$37,035,000																					
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	0.4564	
Present Worth Total Revenues	$ 7,483,404	$2,902,056	$2,835,077	$2,778,371	$2,714,733	$1,008,884	$1,011,688	$1,018,042	$1,015,020	$ 996,528	$ 704,822	$ 693,586	$ 682,328	$ 704,280	$ 724,477	$ 679,233	$ 760,618	$ 775,364	$ 785,130	$ 803,813	$ 814,676	
Present Worth Capital Cost Expenditures	$37,035,000																					
Present Worth O&M Expenditures	$ 35,172	$ 33,819	$ 32,518	$ 31,268	$ 30,065	$ 28,909	$ 27,797	$ 26,728	$ 25,700	$ 24,711	$ 23,761	$ 22,847	$ 21,968	$ 21,123	$ 20,311	$ 19,530	$ 18,779	$ 18,056	$ 17,362	$ 16,694	$ 16,052	
Present Worth Total Cost	$37,070,172	$ 33,819	$ 32,518	$ 31,268	$ 30,065	$ 28,909	$ 27,797	$ 26,728	$ 25,700	$ 24,711	$ 23,761	$ 22,847	$ 21,968	$ 21,123	$ 20,311	$ 19,530	$ 18,779	$ 18,056	$ 17,362	$ 16,694	$ 16,052	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Outback Alternative 2																						
Scenario II																						
One Pelton turbines at the Outback Site																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$63,608,444																					
Present Worth of Costs	$37,825,739																					
Gain / (Loss)	$25,782,705																					
Capital Costs	$37,035,000																					
Turbine and Powerhouse Construction Cost	$ 6,013,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172																					
Period Number	0	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Year	2013	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	0.473	
Annual Energy Production (MWh)	8,990	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	
Total Electricity Sales Revenues	$ 979,904	$1,888,039	$1,991,022	$2,105,449	$2,231,318	$2,357,187	$2,483,057	$2,631,811	$2,780,566	$2,940,763	$3,112,403	$3,284,043	$3,467,125	$3,661,650	$3,879,061	$4,096,471	$4,336,767	$4,577,063	$4,840,244	$5,114,868	$5,412,377	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500																					
Total Revenue	$ 7,483,404	$1,888,039	$1,991,022	$2,105,449	$2,231,318	$2,357,187	$2,483,057	$2,631,811	$2,780,566	$2,940,763	$3,112,403	$3,284,043	$3,467,125	$3,661,650	$3,879,061	$4,096,471	$4,336,767	$4,577,063	$4,840,244	$5,114,868	$5,412,377	
Total Costs																						
Capital Cost Expenditures	$37,035,000																					
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	0.2083	
Present Worth Total Revenues	$ 7,483,404	$ 828,535	$ 840,123	$ 854,236	$ 870,485	$ 884,221	$ 895,612	$ 912,756	$ 927,256	$ 942,960	$ 959,612	$ 973,588	$ 988,332	$1,003,637	$1,022,335	$1,038,109	$1,056,735	$1,072,391	$1,090,437	$1,107,986	$1,127,339	
Present Worth Capital Cost Expenditures	$37,035,000																					
Present Worth O&M Expenditures	$ 35,172	$ 15,435	$ 14,841	$ 14,270	$ 13,721	$ 13,194	$ 12,686	$ 12,198	$ 11,729	$ 11,278	$ 10,844	$ 10,427	$ 10,026	$ 9,640	$ 9,270	$ 8,913	$ 8,570	$ 8,241	$ 7,924	$ 7,619	$ 7,326	
Present Worth Total Cost	$37,070,172	$ 15,435	$ 14,841	$ 14,270	$ 13,721	$ 13,194	$ 12,686	$ 12,198	$ 11,729	$ 11,278	$ 10,844	$ 10,427	$ 10,026	$ 9,640	$ 9,270	$ 8,913	$ 8,570	$ 8,241	$ 7,924	$ 7,619	$ 7,326	
Payback Period	no	no	no	no	no	no	no	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Outback Alternative 2												
Scenario II												
One Pelton turbines at the Outback Site												
Present Worth Analysis Worksheet - Conceptual and Comparative												
Total 50-year Present Worth												
Present Worth of Revenues	$63,608,444											
Present Worth of Costs	$37,825,739											
Gain / (Loss)	$25,782,705											
Capital Costs	$37,035,000											
Turbine and Powerhouse Construction Cost	$ 6,013,000											
Operation and Maintenance Costs												
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172											
Period Number	0	41	42	43	44	45	46	47	48	49	50	
Year	2013	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues												
Electrical Sales Revenue												
Cost of Energy ($/KWh)[1,2]	0.109	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	8,990	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	11,443	
Total Electricity Sales Revenues	$ 979,904	$5,709,886	$6,041,723	$6,373,560	$6,751,168	$7,128,776	$7,540,711	$7,964,090	$8,421,796	$8,902,388	$9,405,865	
Tax Credits, Grants, Incentives												
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000											
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000											
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000											
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500											
Total Revenue	$ 7,483,404	$5,709,886	$6,041,723	$6,373,560	$6,751,168	$7,128,776	$7,540,711	$7,964,090	$8,421,796	$8,902,388	$9,405,865	
Total Costs												
Capital Cost Expenditures	$37,035,000											
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Present Worth Analysis												
Present Worth Factor	1.0000	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 7,483,404	$1,143,564	$1,163,484	$1,180,181	$1,202,021	$1,220,435	$1,241,306	$1,260,576	$1,281,753	$1,302,785	$1,323,524	
Present Worth Capital Cost Expenditures	$37,035,000											
Present Worth O&M Expenditures	$ 35,172	$ 7,044	$ 6,773	$ 6,513	$ 6,262	$ 6,021	$ 5,790	$ 5,567	$ 5,353	$ 5,147	$ 4,949	
Present Worth Total Cost	$37,070,172	$ 7,044	$ 6,773	$ 6,513	$ 6,262	$ 6,021	$ 5,790	$ 5,567	$ 5,353	$ 5,147	$ 4,949	
Payback Period	no	41	42	43	44	45	46	47	48	49	50	
Notes:												
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009												
2. Values based on Jim Doanes email 6-10-2010												

Outback Alternative 2																				
Scenario III																				
One Pelton turbines at the Outback Site																				
Present Worth Analysis Worksheet - Conceptual and Comparative																				
Total 50-year Present Worth	**Total**	Outback	ASR																	
Present Worth of Revenues	**$77,551,511**	$67,883,954	$9,667,557																	
Present Worth of Costs	**$48,899,960**	$37,825,739	$11,074,221																	
Gain / (Loss)	**$28,651,551**	$30,058,215	($1,406,665)																	
Capital Costs	$37,035,000																			
Turbine and Powerhouse Construction Cost	$ 6,013,000																			
Operation and Maintenance Costs																				
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172																			
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Revenues																				
Electrical Sales Revenue																				
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148
Annual Energy Production (MWh)	11,460	11,460	11,460	11,460	11,460	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020
Total Electricity Sales Revenues	$ 1,249,140	$ 1,272,060	$ 1,306,440	$1,352,280	$1,386,660	$1,490,480	$1,526,540	$1,574,620	$1,610,680	$1,622,700	$1,177,960	$1,189,980	$1,202,000	$1,274,120	$1,346,240	$1,418,360	$1,502,500	$1,586,640	$1,670,780	$1,778,960
Tax Credits, Grants, Incentives																				
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000	$ 2,000,000	$ 2,000,000	$2,000,000	$2,000,000															
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																			
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																			
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500																			
Total Revenue	$ 7,752,640	$ 3,272,060	$ 3,306,440	$3,352,280	$3,386,660	$1,490,480	$1,526,540	$1,574,620	$1,610,680	$1,622,700	$1,177,960	$1,189,980	$1,202,000	$1,274,120	$1,346,240	$1,418,360	$1,502,500	$1,586,640	$1,670,780	$1,778,960
Total Costs																				
Capital Cost Expenditures	$37,035,000																			
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172
Present Worth Analysis																				
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746
Present Worth Total Revenues	$ 7,752,640	$ 3,146,212	$ 3,056,990	$2,980,165	$2,894,931	$1,225,066	$1,206,447	$1,196,582	$1,176,908	$1,140,087	$ 795,788	$ 772,988	$ 750,766	$ 765,203	$ 777,420	$ 787,565	$ 802,197	$ 814,539	$ 824,744	$ 844,370
Present Worth Capital Cost Expenditures	$37,035,000																			
Present Worth O&M Expenditures	$ 35,172	$ 33,819	$ 32,518	$ 31,268	$ 30,065	$ 28,909	$ 27,797	$ 26,728	$ 25,700	$ 24,711	$ 23,761	$ 22,847	$ 21,968	$ 21,123	$ 20,311	$ 19,530	$ 18,779	$ 18,056	$ 17,362	$ 16,694
Present Worth Total Cost	$37,070,172	$ 33,819	$ 32,518	$ 31,268	$ 30,065	$ 28,909	$ 27,797	$ 26,728	$ 25,700	$ 24,711	$ 23,761	$ 22,847	$ 21,968	$ 21,123	$ 20,311	$ 19,530	$ 18,779	$ 18,056	$ 17,362	$ 16,694
Outback Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Outback and ASR Hydrogeneration Facilities Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Notes:																				
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																				
2. Values based on Jim Doanes email 6-10-2010																				

Outback Alternative 2																					
Scenario III																					
One Pelton turbines at the Outback Site																					
Present Worth Analysis Worksheet - Conceptual and Comparative																					
Total 50-year Present Worth	**Total**																				
Present Worth of Revenues	**$77,551,511**																				
Present Worth of Costs	**$48,899,960**																				
Gain / (Loss)	**$28,651,551**																				
Capital Costs	$37,035,000																				
Turbine and Powerhouse Construction Cost	$ 6,013,000																				
Operation and Maintenance Costs																					
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172																				
Period Number	0	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Year	2013	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052
Total Revenues																					
Electrical Sales Revenue																					
Cost of Energy ($/KWh)[1,2]	0.109	0.156	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447
Annual Energy Production (MWh)	11,460	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020
Total Electricity Sales Revenues	$ 1,249,140	$1,875,120	$1,983,300	$2,091,480	$2,211,680	$2,343,900	$2,476,120	$2,608,340	$2,764,600	$2,920,860	$3,089,140	$3,269,440	$3,449,740	$3,642,060	$3,846,400	$4,074,780	$4,303,160	$4,555,580	$4,808,000	$5,084,460	$5,372,940
Tax Credits, Grants, Incentives																					
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000																				
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000																				
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000																				
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500																				
Total Revenue	$ 7,752,640	$1,875,120	$1,983,300	$2,091,480	$2,211,680	$2,343,900	$2,476,120	$2,608,340	$2,764,600	$2,920,860	$3,089,140	$3,269,440	$3,449,740	$3,642,060	$3,846,400	$4,074,780	$4,303,160	$4,555,580	$4,808,000	$5,084,460	$5,372,940
Total Costs																					
Capital Cost Expenditures	$37,035,000																				
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172
Present Worth Analysis																					
Present Worth Factor	1.0000	0.4564	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166
Present Worth Total Revenues	$ 7,752,640	$ 855,780	$ 870,339	$ 882,511	$ 897,337	$ 914,406	$ 928,834	$ 940,800	$ 958,809	$ 974,041	$ 990,537	$1,008,029	$1,022,711	$1,038,198	$1,054,276	$1,073,917	$1,090,487	$1,110,052	$1,126,499	$1,145,455	$1,163,890
Present Worth Capital Cost Expenditures	$37,035,000																				
Present Worth O&M Expenditures	$ 35,172	$ 16,052	$ 15,435	$ 14,841	$ 14,270	$ 13,721	$ 13,194	$ 12,686	$ 12,198	$ 11,729	$ 11,278	$ 10,844	$ 10,427	$ 10,026	$ 9,640	$ 9,270	$ 8,913	$ 8,570	$ 8,241	$ 7,924	$ 7,619
Present Worth Total Cost	$37,070,172	$ 16,052	$ 15,435	$ 14,841	$ 14,270	$ 13,721	$ 13,194	$ 12,686	$ 12,198	$ 11,729	$ 11,278	$ 10,844	$ 10,427	$ 10,026	$ 9,640	$ 9,270	$ 8,913	$ 8,570	$ 8,241	$ 7,924	$ 7,619
Outback Payback Period	no	no	no	no	no	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Outback and ASR Hydrogeneration Facilities Payback Period	no	no	no	no	no	no	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Notes:																					
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																					
2. Values based on Jim Doanes email 6-10-2010																					

Outback Alternative 2													
Scenario III													
One Pelton turbines at the Outback Site													
Present Worth Analysis Worksheet - Conceptual and Comparative													
Total 50-year Present Worth	**Total**												
Present Worth of Revenues	**$77,551,511**												
Present Worth of Costs	**$48,899,960**												
Gain / (Loss)	**$28,651,551**												
Capital Costs	$37,035,000												
Turbine and Powerhouse Construction Cost	$ 6,013,000												
Operation and Maintenance Costs													
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 35,172												
Period Number	0	40	41	42	43	44	45	46	47	48	49	50	
Year	2013	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues													
Electrical Sales Revenue													
Cost of Energy ($/KWh)[1,2]	0.109	0.473	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	11,460	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	12,020	
Total Electricity Sales Revenues	$ 1,249,140	$5,685,460	$5,997,980	$6,346,560	$6,695,140	$7,091,800	$7,488,460	$7,921,180	$8,365,920	$8,846,720	$9,351,560	$9,880,440	
Tax Credits, Grants, Incentives													
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 2,000,000												
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 400,000												
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 400,000												
Energy Trust of Oregon (10% Capital Cost)2	$ 3,703,500												
Total Revenue	$ 7,752,640	$5,685,460	$5,997,980	$6,346,560	$6,695,140	$7,091,800	$7,488,460	$7,921,180	$8,365,920	$8,846,720	$9,351,560	$9,880,440	
Total Costs													
Capital Cost Expenditures	$37,035,000												
O&M Expenditures	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Total Cost	$37,070,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	$ 35,172	
Present Worth Analysis													
Present Worth Factor	1.0000	0.2083	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 7,752,640	$1,184,219	$1,201,263	$1,222,188	$1,239,727	$1,262,669	$1,282,012	$1,303,936	$1,324,179	$1,346,424	$1,368,518	$1,390,303	
Present Worth Capital Cost Expenditures	$37,035,000												
Present Worth O&M Expenditures	$ 35,172	$ 7,326	$ 7,044	$ 6,773	$ 6,513	$ 6,262	$ 6,021	$ 5,790	$ 5,567	$ 5,353	$ 5,147	$ 4,949	
Present Worth Total Cost	$37,070,172	$ 7,326	$ 7,044	$ 6,773	$ 6,513	$ 6,262	$ 6,021	$ 5,790	$ 5,567	$ 5,353	$ 5,147	$ 4,949	
Outback Payback Period	no	40	41	42	43	44	45	46	47	48	49	50	
Outback and ASR Hydrogeneration Facilities Payback Period	no	40	41	42	43	44	45	46	47	48	49	50	
Notes:													
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009													
2. Values based on Jim Doanes email 6-10-2010													

APPENDIX 7-D

Present Worth Analysis for ASR Injection Wells Scenarios I, II and III

ASR Injection Wells Hydrogeneration Facility

Scenarios I & III

Vertical Submersible Turbine at ASR Wells

Present Worth Analysis Worksheet - Conceptual and Comparative

This spreadsheet is to provide some detailed information on the ASR costs, revenues only. The present worth analysis is included in the Outback Hydrogeneration Facility Alternative 1 and 2 for Scenarios I and III. This is not a stand alone present worth analysis.

Total 50-year Present Worth																					
Present Worth of Revenues	$9,667,557																				
Present Worth of Costs	$11,074,221																				
Gain / (Loss)	($1,406,665)																				
Capital Costs	$ 10,299,000																				
Turbine and Powerhouse Construction Cost	$ 5,895,000																				
Operation and Maintenance Costs																					
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 34,482																				
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Total Revenues																					
Electrical Sales Revenue																					
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	0.156
Annual Energy Production (MWh)	941	866	791	734	664	596	520	466	413	353	301	249	195	140	86	51	18	0	0	0	0
Total Electricity Sales Revenues	$ 102,569	$ 96,106	$ 90,201	$ 86,606	$ 80,359	$ 73,957	$ 66,096	$ 61,041	$ 55,330	$ 47,610	$ 29,467	$ 24,621	$ 19,530	$ 14,881	$ 9,602	$ 5,965	$ 2,222	$ -	$ -	$ -	$ -
Tax Credits, Grants, Incentives																					
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 1,029,900	$ 1,029,900	$ 1,029,900	$ 1,029,900	$ 1,029,900																
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 55,200																				
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 3,089,700																				
Energy Trust of Oregon (10% Capital Cost)2	$ 1,029,900																				
Total Revenue	$ 5,307,269	$ 1,126,006	$ 1,120,101	$ 1,116,506	$ 1,110,259	$ 73,957	$ 66,096	$ 61,041	$ 55,330	$ 47,610	$ 29,467	$ 24,621	$ 19,530	$ 14,881	$ 9,602	$ 5,965	$ 2,222	$ -	$ -	$ -	$ -
Total Costs																					
Capital Cost Expenditures	$ 10,299,000																				
O&M Expenditures	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482
Total Cost	$ 10,333,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482
Present Worth Analysis																					
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	0.4564
Present Worth Total Revenues	$ 5,307,269	$ 1,082,698	$ 1,035,597	$ 992,570	$ 949,054	$ 60,787	$ 52,237	$ 46,386	$ 40,429	$ 33,450	$ 19,907	$ 15,993	$ 12,198	$ 8,937	$ 5,545	$ 3,312	$ 1,186	$ -	$ -	$ -	$ -
Present Worth Capital Cost Expenditures	$ 10,299,000																				
Present Worth O&M Expenditures	$ 34,482	$ 33,155	$ 31,880	$ 30,654	$ 29,475	$ 28,341	$ 27,251	$ 26,203	$ 25,195	$ 24,226	$ 23,295	$ 22,399	$ 21,537	$ 20,709	$ 19,912	$ 19,146	$ 18,410	$ 17,702	$ 17,021	$ 16,366	$ 15,737
Present Worth Total Cost	$ 10,333,482	$ 33,155	$ 31,880	$ 30,654	$ 29,475	$ 28,341	$ 27,251	$ 26,203	$ 25,195	$ 24,226	$ 23,295	$ 22,399	$ 21,537	$ 20,709	$ 19,912	$ 19,146	$ 18,410	$ 17,702	$ 17,021	$ 16,366	$ 15,737
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no

Notes:

1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009
2. Values based on Jim Doanes email 6-10-2010

ASR Injection Wells Hydrogeneration Facility

Scenarios I & III

Vertical Submersible Turbine at ASR Wells

Present Worth Analysis Worksheet - Conceptual and Comparative

This spreadsheet is to provide some detailed information on the ASR costs, revenues only. The present worth analysis is included in the Outback Hydrogeneration Facility Alternative 1 and 2 for Scenarios I and III. This is not a stand alone present worth analysis.

Total 50-year Present Worth																						
Present Worth of Revenues	$9,667,557																					
Present Worth of Costs	$11,074,221																					
Gain / (Loss)	($1,406,665)																					
Capital Costs	$ 10,299,000																					
Turbine and Powerhouse Construction Cost	$ 5,895,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 34,482																					
Period Number	0	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Year	2013	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	0.473	
Annual Energy Production (MWh)	941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Electricity Sales Revenues	$ 102,569	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 1,029,900																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 55,200																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 3,089,700																					
Energy Trust of Oregon (10% Capital Cost)2	$ 1,029,900																					
Total Revenue	$ 5,307,269	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Total Costs																						
Capital Cost Expenditures	$ 10,299,000																					
O&M Expenditures	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	
Total Cost	$ 10,333,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	0.2083	
Present Worth Total Revenues	$ 5,307,269	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Present Worth Capital Cost Expenditures	$ 10,299,000																					
Present Worth O&M Expenditures	$ 34,482	$ 15,132	$ 14,550	$ 13,990	$ 13,452	$ 12,935	$ 12,437	$ 11,959	$ 11,499	$ 11,057	$ 10,631	$ 10,222	$ 9,829	$ 9,451	$ 9,088	$ 8,738	$ 8,402	$ 8,079	$ 7,768	$ 7,469	$ 7,182	
Present Worth Total Cost	$ 10,333,482	$ 15,132	$ 14,550	$ 13,990	$ 13,452	$ 12,935	$ 12,437	$ 11,959	$ 11,499	$ 11,057	$ 10,631	$ 10,222	$ 9,829	$ 9,451	$ 9,088	$ 8,738	$ 8,402	$ 8,079	$ 7,768	$ 7,469	$ 7,182	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	

Notes:

1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009
2. Values based on Jim Doanes email 6-10-2010

ASR Injection Wells Hydrogeneration Facility

Scenarios I & III

Vertical Submersible Turbine at ASR Wells

Present Worth Analysis Worksheet - Conceptual and Comparative

This spreadsheet is to provide some detailed information on the ASR costs, revenues only. The present worth analysis is included in the Outback Hydrogeneration Facility Alternative 1 and 2 for Scenarios I and III. This is not a stand alone present worth analysis.

Total 50-year Present Worth											
Present Worth of Revenues	$9,667,557										
Present Worth of Costs	$11,074,221										
Gain / (Loss)	($1,406,665)										
Capital Costs	$ 10,299,000										
Turbine and Powerhouse Construction Cost	$ 5,895,000										
Operation and Maintenance Costs											
O&M Costs (Start year, @ 0.05% of Construction Cost)	$ 34,482										
Period Number	0	41	42	43	44	45	46	47	48	49	50
Year	2013	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063
Total Revenues											
Electrical Sales Revenue											
Cost of Energy ($/KWh)[1,2]	0.109	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822
Annual Energy Production (MWh)	941	0	0	0	0	0	0	0	0	0	0
Total Electricity Sales Revenues	$ 102,569	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Credits, Grants, Incentives											
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 1,029,900										
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 55,200										
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 3,089,700										
Energy Trust of Oregon (10% Capital Cost)2	$ 1,029,900										
Total Revenue	$ 5,307,269	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Costs											
Capital Cost Expenditures	$ 10,299,000										
O&M Expenditures	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482
Total Cost	$ 10,333,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482	$ 34,482
Present Worth Analysis											
Present Worth Factor	1.0000	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407
Present Worth Total Revenues	$ 5,307,269	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Present Worth Capital Cost Expenditures	$ 10,299,000										
Present Worth O&M Expenditures	$ 34,482	$ 6,906	$ 6,640	$ 6,385	$ 6,139	$ 5,903	$ 5,676	$ 5,458	$ 5,248	$ 5,046	$ 4,852
Present Worth Total Cost	$ 10,333,482	$ 6,906	$ 6,640	$ 6,385	$ 6,139	$ 5,903	$ 5,676	$ 5,458	$ 5,248	$ 5,046	$ 4,852
Payback Period	no	no	no	no	no	no	no	no	no	no	no

Notes:

1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009
2. Values based on Jim Doanes email 6-10-2010

APPENDIX 7-E

Present Worth Analysis for Distribution

Distribution Overturf																						
Pump-Turbines at Distribution System PRVs																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$768,668																					
Present Worth of Costs	$968,541																					
Gain / (Loss)	($199,873)																					
Capital Costs	$902,000																					
Turbine and Powerhouse Construction Cost	$506,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$2,960																					
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	0.156	
Annual Energy Production (MWh)	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	
Total Electricity Sales Revenues	$ 6,213	$ 6,327	$ 6,498	$ 6,726	$ 6,897	$ 7,068	$ 7,239	$ 7,467	$ 7,638	$ 7,695	$ 5,586	$ 5,643	$ 5,700	$ 6,042	$ 6,384	$ 6,726	$ 7,125	$ 7,524	$ 7,923	$ 8,436	$ 8,892	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 90,200	$ 90,200	$ 90,200	$ 90,200	$ 90,200																	
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 1,400																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 1,400																					
Energy Trust of Oregon (10% Capital Cost)2	$ 90,200																					
Total Revenue	$ 189,413	$ 96,527	$ 96,698	$ 96,926	$ 97,097	$ 7,068	$ 7,239	$ 7,467	$ 7,638	$ 7,695	$ 5,586	$ 5,643	$ 5,700	$ 6,042	$ 6,384	$ 6,726	$ 7,125	$ 7,524	$ 7,923	$ 8,436	$ 8,892	
Total Costs																						
Capital Cost Expenditures	$ 902,000																					
O&M Expenditures	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	
Total Cost	$ 904,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	0.4564	
Present Worth Total Revenues	$ 189,413	$ 92,814	$ 89,403	$ 86,167	$ 82,999	$ 5,809	$ 5,721	$ 5,674	$ 5,581	$ 5,406	$ 3,774	$ 3,666	$ 3,560	$ 3,629	$ 3,687	$ 3,735	$ 3,804	$ 3,863	$ 3,911	$ 4,004	$ 4,058	
Present Worth Capital Cost Expenditures	$ 902,000																					
Present Worth O&M Expenditures	$ 2,960	$ 2,846	$ 2,736	$ 2,631	$ 2,530	$ 2,433	$ 2,339	$ 2,249	$ 2,163	$ 2,079	$ 1,999	$ 1,923	$ 1,849	$ 1,778	$ 1,709	$ 1,643	$ 1,580	$ 1,519	$ 1,461	$ 1,405	$ 1,351	
Present Worth Total Cost	$ 904,960	$ 2,846	$ 2,736	$ 2,631	$ 2,530	$ 2,433	$ 2,339	$ 2,249	$ 2,163	$ 2,079	$ 1,999	$ 1,923	$ 1,849	$ 1,778	$ 1,709	$ 1,643	$ 1,580	$ 1,519	$ 1,461	$ 1,405	$ 1,351	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Distribution Overturf																						
Pump-Turbines at Distribution System PRVs																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$768,668																					
Present Worth of Costs	$968,541																					
Gain / (Loss)	($199,873)																					
Capital Costs	$902,000																					
Turbine and Powerhouse Construction Cost	$506,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$2,960																					
Period Number	0	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Year	2013	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	0.473	
Annual Energy Production (MWh)	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	
Total Electricity Sales Revenues	$ 6,213	$ 9,405	$ 9,918	$ 10,488	$ 11,115	$ 11,742	$ 12,369	$ 13,110	$ 13,851	$ 14,649	$ 15,504	$ 16,359	$ 17,271	$ 18,240	$ 19,323	$ 20,406	$ 21,603	$ 22,800	$ 24,111	$ 25,479	$ 26,961	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 90,200																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 1,400																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 1,400																					
Energy Trust of Oregon (10% Capital Cost)2	$ 90,200																					
Total Revenue	$ 189,413	$ 9,405	$ 9,918	$ 10,488	$ 11,115	$ 11,742	$ 12,369	$ 13,110	$ 13,851	$ 14,649	$ 15,504	$ 16,359	$ 17,271	$ 18,240	$ 19,323	$ 20,406	$ 21,603	$ 22,800	$ 24,111	$ 25,479	$ 26,961	
Total Costs																						
Capital Cost Expenditures	$ 902,000																					
O&M Expenditures	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	
Total Cost	$ 904,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	0.2083	
Present Worth Total Revenues	$ 189,413	$ 4,127	$ 4,185	$ 4,255	$ 4,336	$ 4,405	$ 4,461	$ 4,547	$ 4,619	$ 4,697	$ 4,780	$ 4,850	$ 4,923	$ 4,999	$ 5,093	$ 5,171	$ 5,264	$ 5,342	$ 5,432	$ 5,519	$ 5,616	
Present Worth Capital Cost Expenditures	$ 902,000																					
Present Worth O&M Expenditures	$ 2,960	$ 1,299	$ 1,249	$ 1,201	$ 1,155	$ 1,110	$ 1,068	$ 1,026	$ 987	$ 949	$ 913	$ 877	$ 844	$ 811	$ 780	$ 750	$ 721	$ 693	$ 667	$ 641	$ 616	
Present Worth Total Cost	$ 904,960	$ 1,299	$ 1,249	$ 1,201	$ 1,155	$ 1,110	$ 1,068	$ 1,026	$ 987	$ 949	$ 913	$ 877	$ 844	$ 811	$ 780	$ 750	$ 721	$ 693	$ 667	$ 641	$ 616	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Distribution Overturf												
Pump-Turbines at Distribution System PRVs												
Present Worth Analysis Worksheet - Conceptual and Comparative												
Total 50-year Present Worth												
Present Worth of Revenues	$768,668											
Present Worth of Costs	$968,541											
Gain / (Loss)	($199,873)											
Capital Costs	$902,000											
Turbine and Powerhouse Construction Cost	$506,000											
Operation and Maintenance Costs												
O&M Costs (Start year, @ 0.05% of Construction Cost)	$2,960											
Period Number	0	41	42	43	44	45	46	47	48	49	50	
Year	2013	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues												
Electrical Sales Revenue												
Cost of Energy ($/KWh)[1,2]	0.109	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	57	57	57	57	57	57	57	57	57	57	57	
Total Electricity Sales Revenues	$ 6,213	$ 28,443	$ 30,096	$ 31,749	$ 33,630	$ 35,511	$ 37,563	$ 39,672	$ 41,952	$ 44,346	$ 46,854	
Tax Credits, Grants, Incentives												
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 90,200											
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 1,400											
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 1,400											
Energy Trust of Oregon (10% Capital Cost)2	$ 90,200											
Total Revenue	$ 189,413	$ 28,443	$ 30,096	$ 31,749	$ 33,630	$ 35,511	$ 37,563	$ 39,672	$ 41,952	$ 44,346	$ 46,854	
Total Costs												
Capital Cost Expenditures	$ 902,000											
O&M Expenditures	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	
Total Cost	$ 904,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	$ 2,960	
Present Worth Analysis												
Present Worth Factor	1.0000	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 189,413	$ 5,697	$ 5,796	$ 5,879	$ 5,988	$ 6,079	$ 6,183	$ 6,279	$ 6,385	$ 6,490	$ 6,593	
Present Worth Capital Cost Expenditures	$ 902,000											
Present Worth O&M Expenditures	$ 2,960	$ 593	$ 570	$ 548	$ 527	$ 507	$ 487	$ 468	$ 450	$ 433	$ 416	
Present Worth Total Cost	$ 904,960	$ 593	$ 570	$ 548	$ 527	$ 507	$ 487	$ 468	$ 450	$ 433	$ 416	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	
Notes:												
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009												
2. Values based on Jim Doanes email 6-10-2010												

Distribution Awbrey Butte																						
Pump-Turbines at Distribution System PRVs																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$4,344,459																					
Present Worth of Costs	$1,310,133																					
Gain / (Loss)	$3,034,326																					
Capital Costs	$1,219,000																					
Turbine and Powerhouse Construction Cost	$693,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$4,054																					
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	0.156	
Annual Energy Production (MWh)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	
Total Electricity Sales Revenues	$ 87,200	$ 88,800	$ 91,200	$ 94,400	$ 96,800	$ 99,200	$ 101,600	$ 104,800	$ 107,200	$ 108,000	$ 78,400	$ 79,200	$ 80,000	$ 84,800	$ 89,600	$ 94,400	$ 100,000	$ 105,600	$ 111,200	$ 118,400	$ 124,800	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 121,900	$ 121,900	$ 121,900	$ 121,900	$ 121,900																	
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 18,200																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 18,200																					
Energy Trust of Oregon (10% Capital Cost)2	$ 121,900																					
Total Revenue	$ 367,400	$ 210,700	$ 213,100	$ 216,300	$ 218,700	$ 99,200	$ 101,600	$ 104,800	$ 107,200	$ 108,000	$ 78,400	$ 79,200	$ 80,000	$ 84,800	$ 89,600	$ 94,400	$ 100,000	$ 105,600	$ 111,200	$ 118,400	$ 124,800	
Total Costs																						
Capital Cost Expenditures	$ 1,219,000																					
O&M Expenditures	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	
Total Cost	$ 1,223,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	0.4564	
Present Worth Total Revenues	$ 367,400	$ 202,596	$ 197,023	$ 192,290	$ 186,946	$ 81,535	$ 80,296	$ 79,639	$ 78,330	$ 75,879	$ 52,964	$ 51,447	$ 49,968	$ 50,929	$ 51,742	$ 52,417	$ 53,391	$ 54,212	$ 54,891	$ 56,198	$ 56,957	
Present Worth Capital Cost Expenditures	$ 1,219,000																					
Present Worth O&M Expenditures	$ 4,054	$ 3,898	$ 3,748	$ 3,604	$ 3,465	$ 3,332	$ 3,204	$ 3,080	$ 2,962	$ 2,848	$ 2,738	$ 2,633	$ 2,532	$ 2,434	$ 2,341	$ 2,251	$ 2,164	$ 2,081	$ 2,001	$ 1,924	$ 1,850	
Present Worth Total Cost	$ 1,223,054	$ 3,898	$ 3,748	$ 3,604	$ 3,465	$ 3,332	$ 3,204	$ 3,080	$ 2,962	$ 2,848	$ 2,738	$ 2,633	$ 2,532	$ 2,434	$ 2,341	$ 2,251	$ 2,164	$ 2,081	$ 2,001	$ 1,924	$ 1,850	
Payback Period	no	no	no	no	no	no	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Distribution Awbrey Butte																						
Pump-Turbines at Distribution System PRVs																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$4,344,459																					
Present Worth of Costs	$1,310,133																					
Gain / (Loss)	$3,034,326																					
Capital Costs	$1,219,000																					
Turbine and Powerhouse Construction Cost	$693,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$4,054																					
Period Number	0	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Year	2013	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	0.473	
Annual Energy Production (MWh)	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	
Total Electricity Sales Revenues	$ 87,200	$ 132,000	$ 139,200	$ 147,200	$ 156,000	$ 164,800	$ 173,600	$ 184,000	$ 194,400	$ 205,600	$ 217,600	$ 229,600	$ 242,400	$ 256,000	$ 271,200	$ 286,400	$ 303,200	$ 320,000	$ 338,400	$ 357,600	$ 378,400	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 121,900																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 18,200																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 18,200																					
Energy Trust of Oregon (10% Capital Cost)2	$ 121,900																					
Total Revenue	$ 367,400	$ 132,000	$ 139,200	$ 147,200	$ 156,000	$ 164,800	$ 173,600	$ 184,000	$ 194,400	$ 205,600	$ 217,600	$ 229,600	$ 242,400	$ 256,000	$ 271,200	$ 286,400	$ 303,200	$ 320,000	$ 338,400	$ 357,600	$ 378,400	
Total Costs																						
Capital Cost Expenditures	$ 1,219,000																					
O&M Expenditures	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	
Total Cost	$ 1,223,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	0.2083	
Present Worth Total Revenues	$ 367,400	$ 57,926	$ 58,736	$ 59,723	$ 60,859	$ 61,819	$ 62,616	$ 63,814	$ 64,828	$ 65,926	$ 67,090	$ 68,067	$ 69,098	$ 70,168	$ 71,475	$ 72,578	$ 73,880	$ 74,975	$ 76,237	$ 77,464	$ 78,817	
Present Worth Capital Cost Expenditures	$ 1,219,000																					
Present Worth O&M Expenditures	$ 4,054	$ 1,779	$ 1,710	$ 1,645	$ 1,581	$ 1,521	$ 1,462	$ 1,406	$ 1,352	$ 1,300	$ 1,250	$ 1,202	$ 1,155	$ 1,111	$ 1,068	$ 1,027	$ 988	$ 950	$ 913	$ 878	$ 844	
Present Worth Total Cost	$ 1,223,054	$ 1,779	$ 1,710	$ 1,645	$ 1,581	$ 1,521	$ 1,462	$ 1,406	$ 1,352	$ 1,300	$ 1,250	$ 1,202	$ 1,155	$ 1,111	$ 1,068	$ 1,027	$ 988	$ 950	$ 913	$ 878	$ 844	
Payback Period	no	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Distribution Awbrey Butte												
Pump-Turbines at Distribution System PRVs												
Present Worth Analysis Worksheet - Conceptual and Comparative												
Total 50-year Present Worth												
Present Worth of Revenues	$4,344,459											
Present Worth of Costs	$1,310,133											
Gain / (Loss)	$3,034,326											
Capital Costs	$1,219,000											
Turbine and Powerhouse Construction Cost	$693,000											
Operation and Maintenance Costs												
O&M Costs (Start year, @ 0.05% of Construction Cost)	$4,054											
Period Number	0	41	42	43	44	45	46	47	48	49	50	
Year	2013	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues												
Electrical Sales Revenue												
Cost of Energy ($/KWh)[1,2]	0.109	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	800	800	800	800	800	800	800	800	800	800	800	
Total Electricity Sales Revenues	$ 87,200	$ 399,200	$ 422,400	$ 445,600	$ 472,000	$ 498,400	$ 527,200	$ 556,800	$ 588,800	$ 622,400	$ 657,600	
Tax Credits, Grants, Incentives												
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 121,900											
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 18,200											
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 18,200											
Energy Trust of Oregon (10% Capital Cost)2	$ 121,900											
Total Revenue	$ 367,400	$ 399,200	$ 422,400	$ 445,600	$ 472,000	$ 498,400	$ 527,200	$ 556,800	$ 588,800	$ 622,400	$ 657,600	
Total Costs												
Capital Cost Expenditures	$ 1,219,000											
O&M Expenditures	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	
Total Cost	$ 1,223,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	$ 4,054	
Present Worth Analysis												
Present Worth Factor	1.0000	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 367,400	$ 79,951	$ 81,344	$ 82,511	$ 84,038	$ 85,325	$ 86,784	$ 88,132	$ 89,612	$ 91,083	$ 92,533	
Present Worth Capital Cost Expenditures	$ 1,219,000											
Present Worth O&M Expenditures	$ 4,054	$ 812	$ 781	$ 751	$ 722	$ 694	$ 667	$ 642	$ 617	$ 593	$ 570	
Present Worth Total Cost	$ 1,223,054	$ 812	$ 781	$ 751	$ 722	$ 694	$ 667	$ 642	$ 617	$ 593	$ 570	
Payback Period	no	41	42	43	44	45	46	47	48	49	50	
Notes:												
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009												
2. Values based on Jim Doanes email 6-10-2010												

Distribution Athletic Club																					
Pump-Turbines at Distribution System PRVs																					
Present Worth Analysis Worksheet - Conceptual and Comparative																					
Total 50-year Present Worth																					
Present Worth of Revenues	$1,349,294																				
Present Worth of Costs	$1,004,040																				
Gain / (Loss)	$345,254																				
Capital Costs	$935,000																				
Turbine and Powerhouse Construction Cost	$525,000																				
Operation and Maintenance Costs																					
O&M Costs (Start year, @ 0.05% of Construction Cost)	$3,071																				
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Total Revenues																					
Electrical Sales Revenue																					
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	0.156
Annual Energy Production (MWh)	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
Total Electricity Sales Revenues	$ 19,620	$ 19,980	$ 20,520	$ 21,240	$ 21,780	$ 22,320	$ 22,860	$ 23,580	$ 24,120	$ 24,300	$ 17,640	$ 17,820	$ 18,000	$ 19,080	$ 20,160	$ 21,240	$ 22,500	$ 23,760	$ 25,020	$ 26,640	$ 28,080
Tax Credits, Grants, Incentives																					
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 93,500	$ 93,500	$ 93,500	$ 93,500	$ 93,500																
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 4,000																				
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 4,000																				
Energy Trust of Oregon (10% Capital Cost)2	$ 93,500																				
Total Revenue	$ 214,620	$ 113,480	$ 114,020	$ 114,740	$ 115,280	$ 22,320	$ 22,860	$ 23,580	$ 24,120	$ 24,300	$ 17,640	$ 17,820	$ 18,000	$ 19,080	$ 20,160	$ 21,240	$ 22,500	$ 23,760	$ 25,020	$ 26,640	$ 28,080
Total Costs																					
Capital Cost Expenditures	$ 935,000																				
O&M Expenditures	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071
Total Cost	$ 938,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071
Present Worth Analysis																					
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	0.4564
Present Worth Total Revenues	$ 214,620	$ 109,115	$ 105,418	$ 102,003	$ 98,542	$ 18,345	$ 18,067	$ 17,919	$ 17,624	$ 17,073	$ 11,917	$ 11,576	$ 11,243	$ 11,459	$ 11,642	$ 11,794	$ 12,013	$ 12,198	$ 12,351	$ 12,644	$ 12,815
Present Worth Capital Cost Expenditures	$ 935,000																				
Present Worth O&M Expenditures	$ 3,071	$ 2,953	$ 2,839	$ 2,730	$ 2,625	$ 2,524	$ 2,427	$ 2,334	$ 2,244	$ 2,158	$ 2,075	$ 1,995	$ 1,918	$ 1,844	$ 1,773	$ 1,705	$ 1,640	$ 1,577	$ 1,516	$ 1,458	$ 1,402
Present Worth Total Cost	$ 938,071	$ 2,953	$ 2,839	$ 2,730	$ 2,625	$ 2,524	$ 2,427	$ 2,334	$ 2,244	$ 2,158	$ 2,075	$ 1,995	$ 1,918	$ 1,844	$ 1,773	$ 1,705	$ 1,640	$ 1,577	$ 1,516	$ 1,458	$ 1,402
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Notes:																					
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																					
2. Values based on Jim Doanes email 6-10-2010																					

Distribution Athletic Club																						
Pump-Turbines at Distribution System PRVs																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$1,349,294																					
Present Worth of Costs	$1,004,040																					
Gain / (Loss)	$345,254																					
Capital Costs	$935,000																					
Turbine and Powerhouse Construction Cost	$525,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$3,071																					
Period Number	0	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Year	2013	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	0.473	
Annual Energy Production (MWh)	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	
Total Electricity Sales Revenues	$ 19,620	$ 29,700	$ 31,320	$ 33,120	$ 35,100	$ 37,080	$ 39,060	$ 41,400	$ 43,740	$ 46,260	$ 48,960	$ 51,660	$ 54,540	$ 57,600	$ 61,020	$ 64,440	$ 68,220	$ 72,000	$ 76,140	$ 80,460	$ 85,140	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 93,500																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 4,000																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 4,000																					
Energy Trust of Oregon (10% Capital Cost)2	$ 93,500																					
Total Revenue	$ 214,620	$ 29,700	$ 31,320	$ 33,120	$ 35,100	$ 37,080	$ 39,060	$ 41,400	$ 43,740	$ 46,260	$ 48,960	$ 51,660	$ 54,540	$ 57,600	$ 61,020	$ 64,440	$ 68,220	$ 72,000	$ 76,140	$ 80,460	$ 85,140	
Total Costs																						
Capital Cost Expenditures	$ 935,000																					
O&M Expenditures	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	
Total Cost	$ 938,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	0.2083	
Present Worth Total Revenues	$ 214,620	$ 13,033	$ 13,216	$ 13,438	$ 13,693	$ 13,909	$ 14,089	$ 14,358	$ 14,586	$ 14,833	$ 15,095	$ 15,315	$ 15,547	$ 15,788	$ 16,082	$ 16,330	$ 16,623	$ 16,869	$ 17,153	$ 17,429	$ 17,734	
Present Worth Capital Cost Expenditures	$ 935,000																					
Present Worth O&M Expenditures	$ 3,071	$ 1,348	$ 1,296	$ 1,246	$ 1,198	$ 1,152	$ 1,108	$ 1,065	$ 1,024	$ 985	$ 947	$ 910	$ 875	$ 842	$ 809	$ 778	$ 748	$ 719	$ 692	$ 665	$ 640	
Present Worth Total Cost	$ 938,071	$ 1,348	$ 1,296	$ 1,246	$ 1,198	$ 1,152	$ 1,108	$ 1,065	$ 1,024	$ 985	$ 947	$ 910	$ 875	$ 842	$ 809	$ 778	$ 748	$ 719	$ 692	$ 665	$ 640	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	31	32	33	34	35	36	37	38	39	40	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Distribution Athletic Club												
Pump-Turbines at Distribution System PRVs												
Present Worth Analysis Worksheet - Conceptual and Comparative												
Total 50-year Present Worth												
Present Worth of Revenues	$1,349,294											
Present Worth of Costs	$1,004,040											
Gain / (Loss)	$345,254											
Capital Costs	$935,000											
Turbine and Powerhouse Construction Cost	$525,000											
Operation and Maintenance Costs												
O&M Costs (Start year, @ 0.05% of Construction Cost)	$3,071											
Period Number	0	41	42	43	44	45	46	47	48	49	50	
Year	2013	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	
Total Revenues												
Electrical Sales Revenue												
Cost of Energy ($/KWh)[1,2]	0.109	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822	
Annual Energy Production (MWh)	180	180	180	180	180	180	180	180	180	180	180	
Total Electricity Sales Revenues	$ 19,620	$ 89,820	$ 95,040	$ 100,260	$ 106,200	$ 112,140	$ 118,620	$ 125,280	$ 132,480	$ 140,040	$ 147,960	
Tax Credits, Grants, Incentives												
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 93,500											
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 4,000											
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 4,000											
Energy Trust of Oregon (10% Capital Cost)2	$ 93,500											
Total Revenue	$ 214,620	$ 89,820	$ 95,040	$ 100,260	$ 106,200	$ 112,140	$ 118,620	$ 125,280	$ 132,480	$ 140,040	$ 147,960	
Total Costs												
Capital Cost Expenditures	$ 935,000											
O&M Expenditures	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	
Total Cost	$ 938,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	$ 3,071	
Present Worth Analysis												
Present Worth Factor	1.0000	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407	
Present Worth Total Revenues	$ 214,620	$ 17,989	$ 18,302	$ 18,565	$ 18,909	$ 19,198	$ 19,526	$ 19,830	$ 20,163	$ 20,494	$ 20,820	
Present Worth Capital Cost Expenditures	$ 935,000											
Present Worth O&M Expenditures	$ 3,071	$ 615	$ 591	$ 569	$ 547	$ 526	$ 506	$ 486	$ 467	$ 449	$ 432	
Present Worth Total Cost	$ 938,071	$ 615	$ 591	$ 569	$ 547	$ 526	$ 506	$ 486	$ 467	$ 449	$ 432	
Payback Period	no	41	42	43	44	45	46	47	48	49	50	
Notes:												
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009												
2. Values based on Jim Doanes email 6-10-2010												

Distribution Wichita																					
Pump-Turbines at Distribution System PRVs																					
Present Worth Analysis Worksheet - Conceptual and Comparative																					
Total 50-year Present Worth																					
Present Worth of Revenues	$1,331,209																				
Present Worth of Costs	$1,056,854																				
Gain / (Loss)	$274,355																				
Capital Costs	$984,000																				
Turbine and Powerhouse Construction Cost	$554,000																				
Operation and Maintenance Costs																					
O&M Costs (Start year, @ 0.05% of Construction Cost)	$3,241																				
Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Total Revenues																					
Electrical Sales Revenue																					
Cost of Energy ($/KWh)[1,2]	0.109	0.111	0.114	0.118	0.121	0.124	0.127	0.131	0.134	0.135	0.098	0.099	0.100	0.106	0.112	0.118	0.125	0.132	0.139	0.148	0.156
Annual Energy Production (MWh)	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Total Electricity Sales Revenues	$ 18,530	$ 18,870	$ 19,380	$ 20,060	$ 20,570	$ 21,080	$ 21,590	$ 22,270	$ 22,780	$ 22,950	$ 16,660	$ 16,830	$ 17,000	$ 18,020	$ 19,040	$ 20,060	$ 21,250	$ 22,440	$ 23,630	$ 25,160	$ 26,520
Tax Credits, Grants, Incentives																					
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 98,400	$ 98,400	$ 98,400	$ 98,400	$ 98,400																
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 3,800																				
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 3,800																				
Energy Trust of Oregon (10% Capital Cost)2	$ 98,400																				
Total Revenue	$ 222,930	$ 117,270	$ 117,780	$ 118,460	$ 118,970	$ 21,080	$ 21,590	$ 22,270	$ 22,780	$ 22,950	$ 16,660	$ 16,830	$ 17,000	$ 18,020	$ 19,040	$ 20,060	$ 21,250	$ 22,440	$ 23,630	$ 25,160	$ 26,520
Total Costs																					
Capital Cost Expenditures	$ 984,000																				
O&M Expenditures	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241
Total Cost	$ 987,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241
Present Worth Analysis																					
Present Worth Factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936	0.4746	0.4564
Present Worth Total Revenues	$ 222,930	$ 112,760	$ 108,894	$ 105,311	$ 101,696	$ 17,326	$ 17,063	$ 16,923	$ 16,645	$ 16,124	$ 11,255	$ 10,932	$ 10,618	$ 10,822	$ 10,995	$ 11,139	$ 11,346	$ 11,520	$ 11,664	$ 11,942	$ 12,103
Present Worth Capital Cost Expenditures	$ 984,000																				
Present Worth O&M Expenditures	$ 3,241	$ 3,116	$ 2,996	$ 2,881	$ 2,770	$ 2,663	$ 2,561	$ 2,463	$ 2,368	$ 2,277	$ 2,189	$ 2,105	$ 2,024	$ 1,946	$ 1,871	$ 1,799	$ 1,730	$ 1,664	$ 1,600	$ 1,538	$ 1,479
Present Worth Total Cost	$ 987,241	$ 3,116	$ 2,996	$ 2,881	$ 2,770	$ 2,663	$ 2,561	$ 2,463	$ 2,368	$ 2,277	$ 2,189	$ 2,105	$ 2,024	$ 1,946	$ 1,871	$ 1,799	$ 1,730	$ 1,664	$ 1,600	$ 1,538	$ 1,479
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Notes:																					
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																					
2. Values based on Jim Doanes email 6-10-2010																					

Distribution Wichita																						
Pump-Turbines at Distribution System PRVs																						
Present Worth Analysis Worksheet - Conceptual and Comparative																						
Total 50-year Present Worth																						
Present Worth of Revenues	$1,331,209																					
Present Worth of Costs	$1,056,854																					
Gain / (Loss)	$274,355																					
Capital Costs	$984,000																					
Turbine and Powerhouse Construction Cost	$554,000																					
Operation and Maintenance Costs																						
O&M Costs (Start year, @ 0.05% of Construction Cost)	$3,241																					
Period Number	0	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Year	2013	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	
Total Revenues																						
Electrical Sales Revenue																						
Cost of Energy ($/KWh)[1,2]	0.109	0.165	0.174	0.184	0.195	0.206	0.217	0.230	0.243	0.257	0.272	0.287	0.303	0.320	0.339	0.358	0.379	0.400	0.423	0.447	0.473	
Annual Energy Production (MWh)	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	
Total Electricity Sales Revenues	$ 18,530	$ 28,050	$ 29,580	$ 31,280	$ 33,150	$ 35,020	$ 36,890	$ 39,100	$ 41,310	$ 43,690	$ 46,240	$ 48,790	$ 51,510	$ 54,400	$ 57,630	$ 60,860	$ 64,430	$ 68,000	$ 71,910	$ 75,990	$ 80,410	
Tax Credits, Grants, Incentives																						
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 98,400																					
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 3,800																					
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 3,800																					
Energy Trust of Oregon (10% Capital Cost)2	$ 98,400																					
Total Revenue	$ 222,930	$ 28,050	$ 29,580	$ 31,280	$ 33,150	$ 35,020	$ 36,890	$ 39,100	$ 41,310	$ 43,690	$ 46,240	$ 48,790	$ 51,510	$ 54,400	$ 57,630	$ 60,860	$ 64,430	$ 68,000	$ 71,910	$ 75,990	$ 80,410	
Total Costs																						
Capital Cost Expenditures	$ 984,000																					
O&M Expenditures	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	
Total Cost	$ 987,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	
Present Worth Analysis																						
Present Worth Factor	1.0000	0.4388	0.4220	0.4057	0.3901	0.3751	0.3607	0.3468	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437	0.2343	0.2253	0.2166	0.2083	
Present Worth Total Revenues	$ 222,930	$ 12,309	$ 12,481	$ 12,691	$ 12,933	$ 13,137	$ 13,306	$ 13,561	$ 13,776	$ 14,009	$ 14,257	$ 14,464	$ 14,683	$ 14,911	$ 15,189	$ 15,423	$ 15,700	$ 15,932	$ 16,200	$ 16,461	$ 16,749	
Present Worth Capital Cost Expenditures	$ 984,000																					
Present Worth O&M Expenditures	$ 3,241	$ 1,422	$ 1,367	$ 1,315	$ 1,264	$ 1,216	$ 1,169	$ 1,124	$ 1,081	$ 1,039	$ 999	$ 961	$ 924	$ 888	$ 854	$ 821	$ 790	$ 759	$ 730	$ 702	$ 675	
Present Worth Total Cost	$ 987,241	$ 1,422	$ 1,367	$ 1,315	$ 1,264	$ 1,216	$ 1,169	$ 1,124	$ 1,081	$ 1,039	$ 999	$ 961	$ 924	$ 888	$ 854	$ 821	$ 790	$ 759	$ 730	$ 702	$ 675	
Payback Period	no	no	no	no	no	no	no	no	no	no	no	no	no	no	34	35	36	37	38	39	40	
Notes:																						
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009																						
2. Values based on Jim Doanes email 6-10-2010																						

Distribution Wichita											
Pump-Turbines at Distribution System PRVs											
Present Worth Analysis Worksheet - Conceptual and Comparative											
Total 50-year Present Worth											
Present Worth of Revenues	$1,331,209										
Present Worth of Costs	$1,056,854										
Gain / (Loss)	$274,355										
Capital Costs	$984,000										
Turbine and Powerhouse Construction Cost	$554,000										
Operation and Maintenance Costs											
O&M Costs (Start year, @ 0.05% of Construction Cost)	$3,241										
Period Number	0	41	42	43	44	45	46	47	48	49	50
Year	2013	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063
Total Revenues											
Electrical Sales Revenue											
Cost of Energy ($/KWh)[1,2]	0.109	0.499	0.528	0.557	0.590	0.623	0.659	0.696	0.736	0.778	0.822
Annual Energy Production (MWh)	170	170	170	170	170	170	170	170	170	170	170
Total Electricity Sales Revenues	$ 18,530	$ 84,830	$ 89,760	$ 94,690	$ 100,300	$ 105,910	$ 112,030	$ 118,320	$ 125,120	$ 132,260	$ 139,740
Tax Credits, Grants, Incentives											
Oregon Business Energy Tax Credit 2 (50% construction cost up to $10 million/program)	$ 98,400										
Federal Business Energy Investment Tax Credit ($200/kW for 1st 2MW)2	$ 3,800										
Federal Renewable Energy Grants ($200/kW for 1st 2MW)2	$ 3,800										
Energy Trust of Oregon (10% Capital Cost)2	$ 98,400										
Total Revenue	$ 222,930	$ 84,830	$ 89,760	$ 94,690	$ 100,300	$ 105,910	$ 112,030	$ 118,320	$ 125,120	$ 132,260	$ 139,740
Total Costs											
Capital Cost Expenditures	$ 984,000										
O&M Expenditures	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241
Total Cost	$ 987,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241	$ 3,241
Present Worth Analysis											
Present Worth Factor	1.0000	0.2003	0.1926	0.1852	0.1780	0.1712	0.1646	0.1583	0.1522	0.1463	0.1407
Present Worth Total Revenues	$ 222,930	$ 16,990	$ 17,286	$ 17,534	$ 17,858	$ 18,132	$ 18,442	$ 18,728	$ 19,043	$ 19,355	$ 19,663
Present Worth Capital Cost Expenditures	$ 984,000										
Present Worth O&M Expenditures	$ 3,241	$ 649	$ 624	$ 600	$ 577	$ 555	$ 533	$ 513	$ 493	$ 474	$ 456
Present Worth Total Cost	$ 987,241	$ 649	$ 624	$ 600	$ 577	$ 555	$ 533	$ 513	$ 493	$ 474	$ 456
Payback Period	no	41	42	43	44	45	46	47	48	49	50
Notes:											
1. Values based on Jim Doanes "Value of Power Production 061009.xls" spreadsheet emailed 6-10-2009											
2. Values based on Jim Doanes email 6-10-2010											