RECLAMATION

*Managing Water in the West*

# Upper Klamath Basin
# Affordable Power Studies
# Power Cost Benchmark Report

Bureau of Reclamation (Upper Klamath Basin)
Interior Region 10 · California-Great Basin
California*, Nevada*, Oregon*

November 2019

## Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

RECLAMATION
*Managing Water in the West*

# Upper Klamath Basin Affordable Power Studies

# Power Cost Benchmark Report

*prepared for*

**U.S. Department of the Interior**
**Bureau of Reclamation**
**by Kleinschmidt Associates under**
Contract No. 47QRAA18D005P
Task Order 140R2019F0015

*AND*

**Lloyd Reed Consulting**

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# Table of Contents

Page

## List of Tables



## List of Figures

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# Executive Summary

## Purpose and Scope of the Power Cost Benchmark Report

This Power Cost Benchmark ("PCB") Analysis and Report has been prepared by the United States Bureau of Reclamation ("Reclamation") as the Secretary of the Interior's (Secretary's) response to certain provisions outlined in the America's Water Infrastructure Act of 2018 (Pub. L. 115-270, "AWIA") regarding the reduction of power costs to agricultural water users in the Upper Klamath River Basin. Specifically, Section 4308 of the AWIA amended the Klamath Basin Water Supply Enhancement Act of 2000 (Pub. L. 106-498) to address power and water management in the Klamath Basin, including reduction of power costs (Enhancement Act as amended, Section 4(c)). The Enhancement Act as amended will hereafter be referred to as the "Enhancement Act."

In satisfaction of these requirements, this PCB Report is being submitted to the Committee on Energy and Natural Resources of the U.S. Senate and the Committee on Natural Resources of the U.S. House of Representatives (collectively "the Committees"). A separate companion report - referred to as the Affordable Power Measures ("APM") Report - is also being submitted to the Committees as directed by the Enhancement Act.

## The Power Cost Benchmark

Section 4(a)(3) of the Enhancement Act defines the Power Cost Benchmark as follows:

The term 'power cost benchmark' means the average net delivered cost of power of irrigation and drainage at Reclamation projects in the area surrounding the Klamath Project that are similarly situated to the Klamath Project, including Reclamation projects that (A) are located in the Pacific Northwest; and (B) receive project-use power.

Additional information regarding the scope and purpose of the PCB Analysis and Report are contained in Chapter 1.0. Various clarifications of the technical aspects of the PCB are presented in Chapter 7.0.

## Description of the Klamath Project

The Secretary of the Interior authorized development of the Klamath Project on May 15, 1905, under provisions of the Reclamation Act of 1902 (32 Stat. 388). The irrigable lands of the Klamath Project are in south-central Oregon (62 percent) and north-central California (38 percent) and cover lands in Klamath County, Oregon, and Siskiyou and Modoc counties in northern California. The Project provides full-service water and drainage to approximately 210,000 acres of cropland and rangeland located within the Upper Klamath River Basin.

Figure ES-1 displays the project boundaries, irrigation districts, and primary features of the Project.

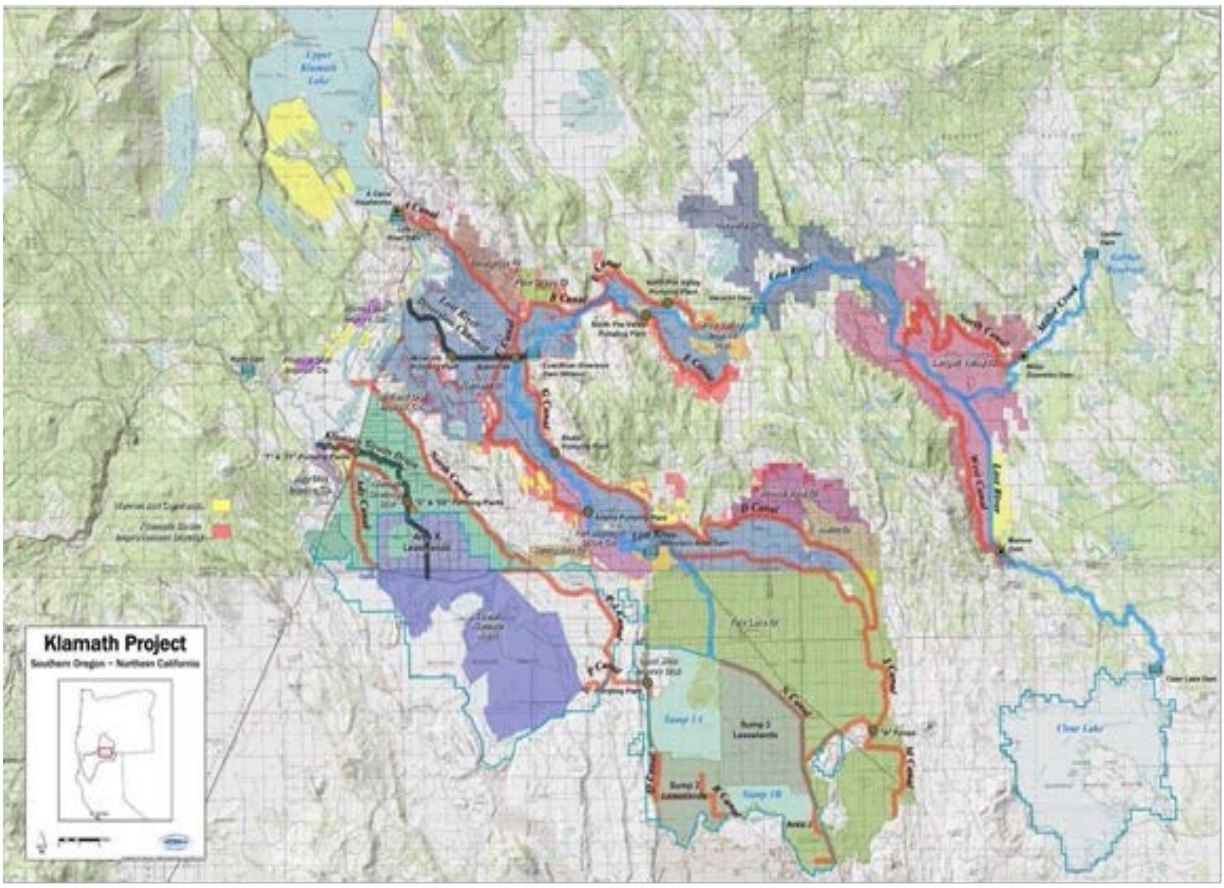


Figure ES-1. Map of the Klamath Project showing primary Project features

In addition to irrigation customers that are served by the Project, there are a significant number of additional water users irrigating lands that are located within the larger Upper Klamath Basin. These so-called “Off-Project areas” include irrigated lands in Oregon within the watersheds of the Lost, Sprague, Williamson, and Wood rivers. There are water uses located in the Off-Project areas that are considered to be “covered users” under the Enhancement Act (Section 4(a)(1)). Therefore, this PCB Analysis incorporates power cost information for irrigation and/or drainage customers that are located both within the Klamath Project’s boundaries and the covered users that are located in the Upper Klamath Basin Off-Project areas.

Additional general information regarding the Klamath Irrigation Project is contained in Chapter 2.0.

## Historical Power Costs for Irrigation and Drainage use in the Upper Klamath Basin

At the time of the Klamath Project’s development, Reclamation filed for all unappropriated water in the Klamath Basin along with the right to appropriate water for power development at several locations. Reclamation recognized that in order to irrigate the land it was necessary to access inexpensive power for both drainage and pumping purposes.  Although Reclamation had the

authority and intent to develop and provide power to the Klamath Project irrigators at the time of the Project's development, inadequate funding prevented it from doing so.

In 1917 the California Oregon Power Company ("COPCO"), now PacifiCorp, approached Reclamation and proposed building a dam on Upper Klamath Lake to provide better water regulation for COPCO's planned hydropower facilities to be developed on the Klamath River. Later that same year Reclamation entered into a 50-year contract with COPCO for the construction and operation of Link River Dam that also included provisions for COPCO to provide power at discounted rates to the Klamath Project beneficiaries. Reclamation's contract with COPCO protected irrigation rights and provided the Klamath Project water users with power rates locked in at 1917 levels; this agreement therefore allowed Reclamation to provide the Klamath Project with affordable power for Basin irrigators as was its original intent.

The original COPCO/Reclamation contract was amended in 1956, featuring essentially the same power rates for an additional 50-year period, and this agreement became a provision of PacifiCorp's Klamath Hydroelectric Project FERC operating license. Later in 1956, a separate COPCO contract provided Off-Project agricultural power users located in the Upper Klamath Basin with reduced power rates similar to those of the On-Project users.

At the expiration of PacifiCorp's FERC license in 2006, the Oregon and California Public Utility Commissions ("PUCs") allowed PacifiCorp to phase in full tariff power rates to agricultural customers in the Basin over a period of several years. PacifiCorp's 1956 FERC license expiration and the PUCs' rulings ended nearly 90 years of reduced or at-cost power rates for the Klamath On-Project and Off-Project irrigators.

## Current Power Costs for Irrigation and Drainage use in the Upper Klamath Basin

The termination of the 1956 PacifiCorp power supply agreements by the Oregon and California PUCs resulted in an increase in power rates for agricultural water users in the Klamath Basin from 0.3 to 0.75 cents per kilowatt-hour (¢/kWh) in 2006 to approximately 9.7 ¢/kWh in Oregon and 12.9 ¢/kWh in California in 2016. With these changes, the average water pumping cost on the Klamath Project in 2015 was $45 per acre as compared to an average power cost of $2.25 per acre prior to the 1956 power contract's expiration.

It is important to note that the 1956 power contracts in place with PacifiCorp up until 2006 were unique in that low-cost power supplies were made available not only to Reclamation but also to individual On-Project and Off-Project irrigation customers as well. Therefore, the expiration of these agreements in 2006 and the subsequent phase-in to PacifiCorp's full retail tariff rates had a double impact of not only significantly increasing Reclamation's own costs in managing water supplies on the Project but also in increasing On-Project water users' individual at-site water distribution costs as well. Off-Project water users also endured significantly higher costs by virtue of having to purchase all of their on-farm power supply needs from PacifiCorp under full retail tariff rates.

Additional historical context regarding power rates for irrigation and drainage use in the Upper Klamath Basin and the impacts of higher power costs in the Basin following the expiration of the PacifiCorp power purchase agreements in 2006 is provided in Chapter 3.

## PCB Analysis Public Stakeholder Process

An important component of the PCB Analysis was the opportunity for interested stakeholders to participate in the study process and provide meaningful input into the production of the final PCB Report. In particular, many stakeholders have long histories of living and working in the Upper Klamath Basin and their informed insights on the impacts of higher electricity prices on irrigation practices in the Basin were invaluable to the PCB Analysis Team.

Interested stakeholders had several different avenues available in which to stay informed of and/or provide input to the PCB Analysis throughout the life of the project. Additional information regarding the public stakeholder process and the multiple opportunities for interested parties to provide feedback to the PCB Analysis Team is contained in Chapter 5.

## Power Supplies for Irrigation and Drainage Loads in the Pacific Northwest Region

The electric utility industry in the United States encompasses both retail and wholesale markets. Retail power sales are made directly to end-use customers while wholesale transactions involve sales made by one entity to another entity for ultimate resale to the purchasing entity's end-use consumers. Electricity that is ultimately used for irrigation and drainage purposes can be sold at the retail level, the wholesale level, and in some cases at both levels.

There are various ways that power is sold to agricultural users for irrigation and drainage purposes in the Pacific Northwest Region; this includes the roles of the Federal Power Marketing Administrations in providing "Project-use Power" to Reclamation (and some irrigation districts) and publicly-owned and investor-owned utilities in providing power to agricultural customers. In the PCB Analysis, an emphasis was placed upon the retail and wholesale power market structures that are in place in the Pacific Northwest since the Enhancement Act directs that the PCB is to be derived using power cost data for Reclamation projects located in this particular geographic region. Chapter 6 provides additional details on this topic.

One key defining characteristic of the Pacific Northwest Region is that there is a very large number (approximately 133) different electric utilities that serve end-use customers located throughout the region. In the PCB Report, these utilities are broadly organized into two categories: 1) Publicly-Owned utilities ("POUs"), and 2) Investor-Owned utilities ("IOUs"). Most of the POUs in the region purchase a large portion of their wholesale power supplies from the Bonneville Power Administration ("BPA") under cost-based "preference rates". The vast majority of the wholesale power provided by BPA to its POU customers is supplied by hydroelectric generation produced from a network of 31 Federally-owned dams located within the Columbia River watershed. In contrast, the IOUs in the region have developed their own power supply portfolios which contain a mixture of hydro, coal, natural gas, wind and solar resources.

Another defining feature of the power markets in the Pacific Northwest Region is the "layered" nature of power costs; for example, agricultural customers located within a Reclamation irrigation project area could be subject to paying for power-related costs on 1) the Reclamation/Project level, 2) the irrigation district level, and 3) the individual on-farm level. Chapter 7 discusses in more detail the different types of Federal Project-use Power and electric utility-supplied power costs that were incorporated into the calculation of the PCB.

## Identification of the Similar Projects

Section 4(a)(3) of the Enhancement Act states that the PCB is to be derived for Reclamation projects that "are similarly situated" to the Klamath Project. In addition, Sec 4(a)(3) also instructs that such projects be "located in the Pacific Northwest" and "receive project-use power". Therefore, one of the first steps in the PCB calculation process was to identify a set of Similar Projects that meet these criteria.

From a starting list of 15 Reclamation irrigation projects located in the Pacific Northwest Region, the PCB Analysis Team selected five projects to be the "Similar Projects" used in deriving the PCB. Table ES-1 lists the five Similar Projects along with their general locations.

Table ES-1. PCB Similar Projects

| Project | Location |
|---|---|
| Boise | South-western Idaho |
| Columbia Basin | East-central Washington |
| Minidoka | East/South-central Idaho |
| Owyhee | South-western Idaho/Eastern Oregon |
| Yakima | South-central Washington |

A summary of each of the five Similar Projects is provided in Chapter 8. In addition, this same chapter also identifies the full starting list of 15 Reclamation Projects and discusses the primary reasons why many of these projects were not considered to be similarly situated to the Klamath Project for the purpose of deriving the PCB.

## Current Power Costs for Irrigation/Drainage use in the Upper Klamath Basin

Following the termination of the 1917 and 1956 Reclamation/PacifiCorp power purchase agreements in 2006, Reclamation began purchasing power from PacifiCorp under full tariff rates in effect in Oregon and California. In addition, both On-Project and Off-Project covered users who previously received power under the 1956 agreements also began purchasing power from PacifiCorp under the same full tariff rates.

PacifiCorp has established retail rate tariffs in Oregon and California that apply specifically to irrigation and/or drainage customers. The standard irrigation rate tariff in Oregon is Schedule 41

while in California the irrigation tariff is Schedule PA-20. While the two rate schedules have some common characteristics, the actual charges incorporated into the rate schedules differ due to several different factors. Overall, during 2017 and 2018 PacifiCorp's irrigation customers located in California paid, on average, about 29% more for power (on a per-unit basis) than PacifiCorp's irrigation customers located in Oregon.

When discussing power costs for irrigation and drainage in the Upper Klamath Basin, it is important to recognize that these costs are not uniform across all covered water users, rather there are three discrete sectors of users:

A. On-Project covered users located in Oregon
B. Off-Project covered users located in Oregon
C. On-Project covered users located in California

Average 2017 – 2018 per-unit power costs for each of the above referenced sectors were derived separately; additional details regarding these calculations are contained in Chapter 10.

During calendar years 2017 and 2018, power costs in the Upper Klamath Basin were a function of the base charges contained in PacifiCorp's Oregon and California retail irrigation rate tariffs, plus the applicable "rider" charges that were in place during that time. Power costs for water users located in the Klamath Basin (which includes Reclamation, multiple irrigation districts, and individual on-farm customers) can therefore be reasonably determined by first computing the average per-unit cost of power for irrigation/drainage customers located in PacifiCorp's Oregon and California service territories and then making appropriate adjustments to reflect known local conditions. In particular, Reclamation's actual 2017 – 2018 costs for power in operating the Klamath Project were incorporated into the computations for On-Project water users as were the actual power costs for several of the larger irrigation districts.

Per-unit 2017 – 2018 power costs for the three sectors of irrigation and drainage customers located in the Upper Klamath Basin are summarized in Table ES-2.

Table ES-2. Per-unit Irrigation/Drainage Power Costs in the Upper Klamath Basin 2017-2018

| Year | Oregon On-Project Average Per-unit Power Cost (¢/kWh) | Oregon Off-Project Average Per-unit Power Cost (¢/kWh) | California On-Project Average Per-unit Power Cost (¢/kWh) | Combined Klamath Basin Average Per-unit Power Cost (¢/kWh) |
|---|---|---|---|---|
| 2017 | 11.103 | 11.044 | 15.031 | 11.814 |
| 2018 | 11.066 | 11.029 | 15.443 | 11.868 |
| Weighted Ave | 11.085 | 11.036 | 15.237 | 11.841 |

## Power Costs for Irrigation/Drainage use in the Similar Projects

To assess power costs in each of the Similar Projects, the PCB Analysis Team first identified all of the electric utilities that serve the majority of the irrigation and drainage loads located within each Similar Project. Once these utilities were identified, the Team then assembled Calendar Year 2017 and 2018 historical irrigation/drainage power cost and usage figures for each individual utility. Table ES-3 lists the utilities that serve the majority of the end-use irrigation/drainage electric loads in each of the five Similar Projects.

Table ES-3. Electric utilities in the Similar Projects

| Similar Project | Local Utility Provider | Utility Type |
|---|---|---|
| Boise | Idaho Power – ID Rates | Investor-owned |
| Columbia Basin | Avista Corporation – WA Rates<br>Big Bend Electric Coop<br>Franklin County PUD<br>Grant County PUD | Investor-owned<br>Publicly-owned<br>Publicly-owned<br>Publicly-owned |
| Minidoka | Fall River Electric Coop – ID Rates<br>Idaho Power – ID Rates<br>PacifiCorp – ID Rates | Publicly-owned<br>Investor-owned<br>Investor-owned |
| Owyhee | Idaho Power – ID Rates<br>Idaho Power – OR Rates | Investor-owned<br>Investor-owned |
| Yakima | Benton County PUD<br>Benton REA<br>Columbia REA – WA Rates<br>Kittitas PUD<br>PacifiCorp – WA Rates<br>Puget Sound Energy | Publicly-owned<br>Publicly-owned<br>Publicly-owned<br>Publicly-owned<br>Investor-owned<br>Investor-owned |

Additional information regarding how power cost and usage datasets were acquired and assembled for the utilities shown in Table ES-3 is provided in Chapter 9 while Chapter 11 describes how this information was aggregated in order to compute the 2017 - 2018 average irrigation/drainage power costs in each of the five Similar Projects. Historical power costs and usage for Federal Project-use Power in each of the five Similar Projects was also assembled from various datasets provided by Reclamation. Table ES-4 summarizes the average 2017 – 2018 per-unit cost of power for irrigation and drainage use in each of the Similar Projects:

Table ES-4. Average Power Costs in the Similar Projects 2017 - 2018

| Project | 2017/2018 Average Per-unit Power Cost (¢/kWh) |
|---|---|
| Boise | 7.248 |
| Columbia Basin | 3.959 |
| Minidoka | 6.613 |
| Owyhee | 5.740 |
| Yakima | 6.938 |

## Calculation of the PCB

Calendar Year 2017 and 2018 average power costs and associated usage for irrigation and drainage purposes in each of the five Similar Projects was aggregated on a usage-weighted basis in order to derive the final PCB value. These computations are summarized in Table ES-5.

Table ES-5. Calculation of the PCB

| Similar Project | 2017/18 Average Power Cost ($) | 2017/18 Average Power Usage (Mwh) | 2017/18 Average Per-unit Power Cost (¢/kWh) |
|---|---|---|---|
| Boise | 15,761,036 | 217,463 | 7.248 |
| Columbia Basin | 18,449,513 | 466,025 | 3.959 |
| Minidoka | 52,411,355 | 792,545 | 6.613 |
| Owyhee | 6,183,432 | 107,720 | 5.740 |
| Yakima | 16,659,885 | 240,134 | 6.938 |
| Total | 109,465,222 | 1,823,886 | 6.002 |

As can be seen from the above table, the PCB, as derived across the five Similar Projects, is 6.002 ¢/kWh.

## Power Cost Comparisons

Several different comparisons can be made between power costs paid by irrigation and drainage customers located in the Upper Klamath Basin versus the power costs paid by water users in the five Similar Projects (as represented by the PCB). However, as was previously noted, power costs for pumping and drainage purposes in the Upper Klamath Basin are not uniform across all water users located in the Basin but rather fall into three discrete sectors: 1) Oregon customers that receive water deliveries from Reclamation's Klamath Project, 2) Oregon customers that do not receive water deliveries from the Klamath Project but are classified as "covered users" in the Enhancement Act, and 3) California customers that receive water deliveries from the Klamath Project.

Table ES-6 provides a summary comparison of the PCB against the average 2017 – 2018 power costs for each of the three sectors of Upper Klamath Basin irrigation and drainage customers.

ES-6. Power cost comparisons for Irrigation and Drainage Use 2017 – 2018

| Sector | 2017/18 Average Per-unit Power Cost (¢/kWh) | Difference from the Similar Project PCB (%) |
|---|---|---|
| Similar Project PCB | 6.002 | |
| Oregon On-Project | 11.085 | +84.7 |
| Oregon Off-Project | 11.036 | +83.9 |
| California On-Project | 15.237 | +153.9 |
| Total Upper Klamath Basin | 11.841 | +97.3 |

# Chapter 1 Purpose and Scope

This Power Cost Benchmark ("PCB") Analysis and Report has been prepared by the United States Bureau of Reclamation ("Reclamation") as the Secretary of the Interior's (Secretary's) response to certain provisions outlined in the America's Water Infrastructure Act of 2018 (Pub. L. 115-270, "AWIA") regarding the reduction of power costs to agricultural water users in the Upper Klamath River Basin. Specifically, Section 4308 of the AWIA amended the Klamath Basin Water Supply Enhancement Act of 2000 (Pub. L. 106-498) to address power and water management in the Klamath Basin, including reduction of power costs (Enhancement Act as amended, Section 4(c)). The Enhancement Act as amended will hereafter be referred to as the "Enhancement Act."

The AWIA amended the Enhancement Act by inserting a new Section 4 into the Enhancement Act as follows (portions of the amendment not pertaining to reduction of power costs are omitted for clarity):

SEC. 4. POWER AND WATER MANAGEMENT.

(a) DEFINITIONS.—In this section:

(1) COVERED POWER USE.—The term 'covered power use' means a use of power to develop or manage water from any source for irrigation, wildlife purposes, or drainage on land that is—

(A) associated with the Klamath Project, including land within a unit of the National Wildlife Refuge System

that receives water due to the operation of Klamath Project facilities; or

(B) irrigated by the class of users covered by the agreement dated April 30, 1956, between the California

Oregon Power Company and Klamath Basin Water Users Protective Association and within the Off Project Area (as defined in the Upper Basin Comprehensive Agreement entered into on April 18, 2014), only if each applicable owner and holder of a possessory interest of the land is a party to that agreement (or a successor agreement that the Secretary determines provides a comparable benefit to the United States).

(3) POWER COST BENCHMARK.—The term 'power cost benchmark' means the average net delivered cost of power for irrigation and drainage at Reclamation projects in the area surrounding the Klamath Project that are similarly situated to the Klamath Project, including Reclamation projects that—

(A) are located in the Pacific Northwest; and

(B) receive project-use power.

(c) REDUCING POWER COSTS.—

(1) IN GENERAL.—Not later than 180 days after the date of enactment of America's Water Infrastructure Act of 2018, the Secretary, in consultation with interested irrigation interests that are eligible for covered power use and organizations representative of those interests, shall submit to the Committee on Energy and Natural Resources of the Senate and the Committee on Natural Resources of the House of Representatives

a report that—

(A) identifies the power cost benchmark; and

(B) recommends actions (other than direct payments to persons making covered power uses or to other entities for the purposes of subsidizing power rates) that, in the judgment of the Secretary, are necessary and appropriate to ensure that the net delivered power cost for covered power use is equal to or less than the power cost benchmark, including a description of—

(i) actions—

(I) to immediately reduce power costs; and

(II) to ensure that the net delivered power cost for covered power use is equal to, or less than, the power cost benchmark in the near term, while longer-term actions are being implemented;

(ii) actions that prioritize—

(I) water and power conservation and efficiency measures that could assist in achieving the power cost benchmark;

(II) to the extent actions involving the development or acquisition of power generation are included, renewable energy technologies (including hydropower); and

(III) regional economic development;

(iii) the potential costs and timeline for the actions recommended under this subparagraph;

(iv) provisions for modifying the actions and timeline to adapt to new information or circumstances;

and

(v) a description of public input regarding the proposed actions, including—

(I) input from water users that have covered power use; and

(II) the degree to which those water users concur with the recommendations.

In satisfaction of these requirements, this PCB Report is being submitted to the Committee on Energy and Natural Resources of the U.S. Senate and the Committee on Natural Resources of the U.S. House of Representatives (collectively "the Committees"). A separate companion report - referred to as the Affordable Power Measures ("APM") Report - is also being submitted to the Committees as directed by the Enhancement Act.

## The Power Cost Benchmark

Section 4(a)(3) of the Enhancement Act defines the Power Cost Benchmark as follows:

> The term 'power cost benchmark' means the average net delivered cost of power of irrigation and drainage at Reclamation projects in the area surrounding the Klamath Project that are similarly situated to the Klamath Project, including Reclamation projects that (A) are located in the Pacific Northwest; and (B) receive project-use power.

Several later chapters of this report are focused on providing additional details and insights regarding: 1) the key concepts that are referenced in this definition of the PCB, and 2) how these concepts were incorporated into the computational methodologies utilized to derive the PCB.

## Prior Power Cost Studies for the Upper Klamath Basin

Prior to the passage of the AWIA, Reclamation conducted internal analyses of power costs in several different Reclamation irrigation projects located in various areas of the Pacific Northwest region. The impetus behind the previous analysis was the expected passage of legislation authorizing the Klamath Basin Restoration Agreement (KBRA), which identified a "power cost target" as an aspirational objective for Klamath Basin irrigation and drainage power costs. Details regarding this analysis were contained in the Draft Klamath Power Cost Target Study Report ("Draft PCT Report") which was prepared by Reclamation in November 2015. This draft report, however, was ultimately not finalized and publicly released due to insufficient information being available at the time to complete some portions of the power cost studies. The expiration of the KBRA ended the effort until passage of the AWIA.

This PCB Report presents the results of an updated power cost analysis for the Upper Klamath Basin that utilizes multiple newly developed datasets and computational methodologies while also incorporating some of the general background information that was previously assembled for use in preparing the earlier Draft PCT Report.

## The PCB Analysis Team

The completion of the PCB Analysis and the accompanying Report was a group effort that involved multiple individuals from several organizations including Reclamation's Klamath Basin Area Office, the Klamath Water Users Association ("KWUA") and Kleinschmidt Associates.[1] Collectively, this group is referred to throughout this Report as the "PCB Analysis Team" or "the

[1] Reclamation retained Kleinschmidt Associates to provide consulting services for the PCB and APM analyses pursuant to Contract #140R2019F0015 AWIA Klamath Power Studies.

Team.” Appendix A contains a list of the individuals who were part of the PCB Analysis Team and the organizations with which they are affiliated.

# Chapter 2 Description of the Klamath Project

## Overview

The Secretary of the Interior authorized development of the Klamath Project on May 15,

1905, under provisions of the Reclamation Act of 1902 (32 Stat. 388). The irrigable lands of the Klamath Project are in south-central Oregon (62 percent) and north-central California (38 percent) and cover lands in Klamath County, Oregon, and Siskiyou and Modoc counties in northern California. The Project provides full-service water and drainage to approximately 210,000 acres of cropland and rangeland located within the Upper Klamath River Basin.

The Upper Klamath River Basin has extensive land and water resources which are not fully developed. The terrain varies from rugged, heavily timbered mountain slopes to rolling sagebrush bench lands and broad, flat valleys. The Project plan includes construction of facilities to divert and distribute water for irrigation of basin lands, including reclamation of Tule and Lower Klamath Lakes, and control of floods in the area.

The two main sources of water for the Project are: 1) Upper Klamath Lake and the Klamath River; and 2) Clear Lake Reservoir, Gerber Reservoir, and Lost River, which are located in a naturally closed basin. The total drainage area, including the Lost River and the Klamath River watershed above Keno, Oregon, is approximately 5,700 square miles. Principal irrigated crops within the Project are include alfalfa hay and grass hay, irrigated pasture, grains, potatoes, and onions, with smaller acreage in mint and horseradish.

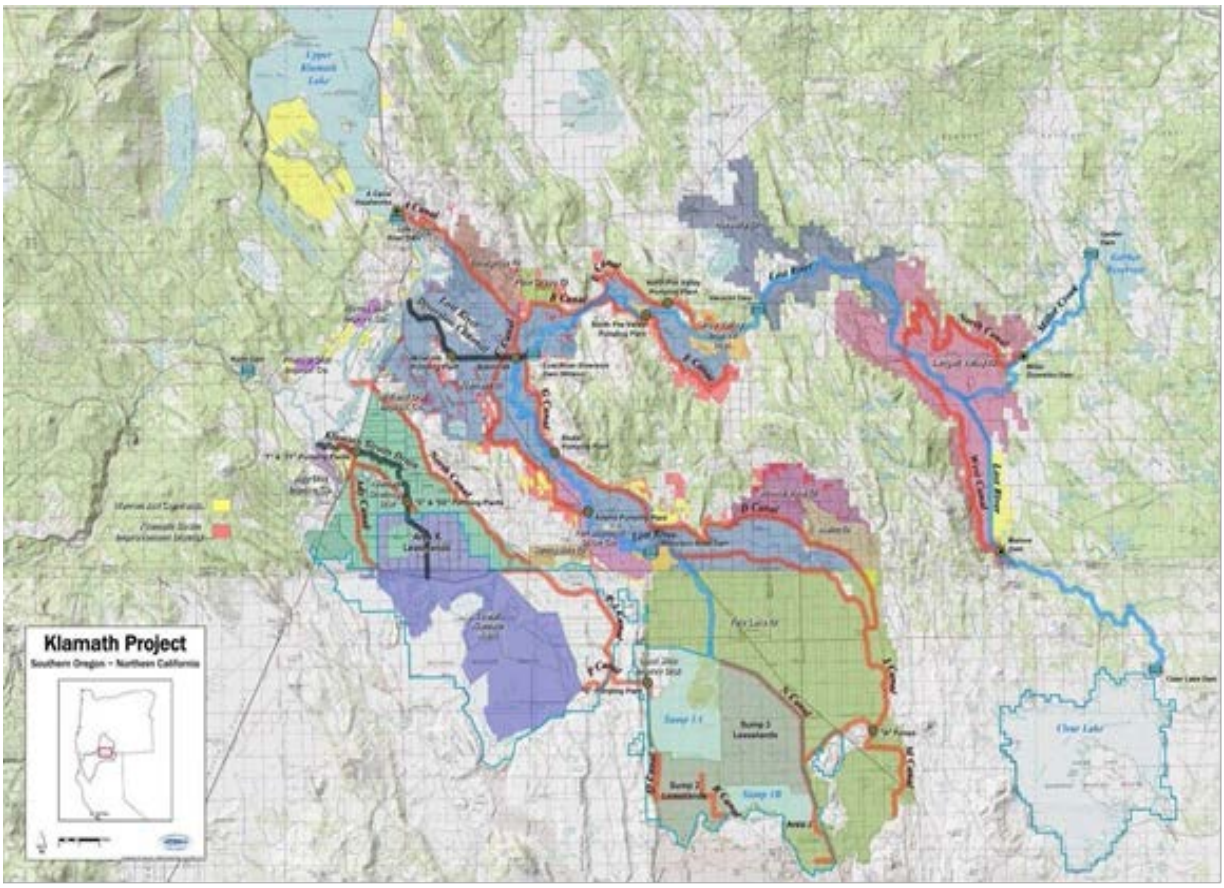


Figure 2-1. Klamath Irrigation Project

In addition to irrigation customers that are served by the Project, there are a significant number of additional water users irrigating lands that are located within the larger Upper Klamath Basin. These so-called “Off-Project areas” include irrigated lands in Oregon within the watersheds of the Lost, Sprague, Williamson, and Wood rivers. Figure 2-2 below shows the boundaries of the Off-Project areas located within the Klamath Basin and how these areas relate to the Project’s boundaries.


Figure 1-2. Upper Klamath Basin On-Project and Off-Project Areas

For the purposes of the PCB Report (and the accompanying APM Report as well), there are water uses located in the Off-Project areas that are considered to be "covered users" under the Enhancement Act (Section 4(a)(1)). Therefore, this PCB analysis incorporates power cost information for irrigation and/or drainage customers that are located both within the Klamath Project's boundaries and the covered users that are located in the Upper Klamath Basin Off-Project areas.

Several of the key elements and characteristics of the Klamath Project are summarized in Table 2-1. below.

Table 2-1. Klamath Project Elements and Characteristics

| Project Elements | Data |
|---|---|
| Irrigated acres | 191,592 – 230,769 acres* |
| Average annual precipitation | 13.8 in |
| Mean temperature | 49 F |
| Growing season | 120 days |
| Elevation of irrigable areas | 4,093 ft |
| Project authorization | 1905 |
| Storage Dams | 3 |
| Diversion Dams | 4 |
| Canals | 185 mi |
| Laterals | 532 mi |
| Pumping Plants | 28 |
| Drains | 728.2 mi |
| Tunnels | 1.9 mi |

Source: Reclamation website
https://www.usbr.gov/projects/index.php?id=470https://www.usbr.gov/projects/index.php?id=470
*191,592 figure is from Reclamation project website; 230,769 from GIS data.

What is not reflected in Table 2-1, however, is the complexity of the system's actual operation which includes a network of gravity fed canals, along with significant electrical loads associated with numerous pumps in the system that lift and recirculate water. In particular, the Klamath Project is unique in that very little pumping is required to initially deliver water into the upstream portions of the Project, however significant amounts of pumping are required to lift water out of the downstream portions of the Project (which are located in a closed basin) in order to provide return flows back into the Klamath River. The system is often noted as one of the more complex "plumbing" designs for irrigated lands served by Reclamation water, as well as for its high efficiency in the use of water.

# Chapter 3 Historical Power Costs for Irrigation and Drainage in the Upper Klamath River Basin

## Overview and Historical Context

At the time of the Klamath Project's development, Reclamation filed for all unappropriated water in the Klamath Basin along with the right to appropriate water for power development at several locations, the largest of which was the Keno Canal. Reclamation recognized that in order to irrigate the land it was necessary to access inexpensive power for both drainage and pumping purposes. Although Reclamation had the authority and intent to develop and provide power to the Klamath Project irrigators at the time of the Project's development, inadequate funding in the early years of development had prevented it from doing so.

In 1917 the California Oregon Power Company ("COPCO"), now PacifiCorp, approached Reclamation and proposed building a dam on Upper Klamath Lake to provide better water regulation for COPCO's existing and planned hydropower facilities to be developed on the Klamath River. Later that same year Reclamation entered into a 50-year contract with COPCO for the construction and operation of Link River Dam that also included provisions for COPCO to provide power at discounted rates to the Klamath Project beneficiaries. Reclamation's contract with COPCO protected irrigation rights and provided the Klamath Project water users with power rates locked in at 1917 levels; this agreement therefore allowed Reclamation to provide the Klamath Project with affordable power for Basin irrigators as was its original intent.

The original COPCO/Reclamation contract was amended in 1956, featuring essentially the same power rates for an additional 50-year period; this agreement was a condition of PacifiCorp's Klamath Hydroelectric Project FERC operating license becoming effective. Later in 1956, a separate COPCO contract provided Off-Project agricultural power users located in the Upper Klamath Basin with reduced power rates similar to those of the On-Project users.

At the expiration of PacifiCorp's FERC license in 2006, Reclamation and the Upper Klamath Basin irrigation community appealed to FERC and the Oregon and California Public Utility Commissions (PUCs) to preserve the reduced power rate agreements provided for in the 1956 FERC license, initially in connection with the automatic one-year renewals of the license. Despite these appeals, FERC and the PUCs ultimately did not compel PacifiCorp to continue to provide r power at reduced costs, and allowed PacifiCorp to phase in full tariff rates over a period of several years. The 1956 contract expiration and FERC and the PUCs ruling ended nearly 90 years of reduced or at-cost power rates for Upper Klamath Basin irrigators.

## Current Conditions

The termination of the 1956 PacifiCorp power supply agreements resulted in an increase in power rates for agricultural water users in the Klamath Basin from 0.3 to 0.75 cents per kilowatt-hour (¢/kWh) in 2006 to approximately 9.7 ¢/kWh in Oregon and 12.9 ¢/kWh in California in

2016. With these changes, the average water pumping cost on the Klamath Project in 2015 was $45 per acre as compared to an average power cost of $2.25 per acre prior to the 1956 power contract's expiration.

It is important to note that the 1956 power contracts in place with PacifiCorp up until 2006 were unique in that low-cost power supplies were made available not only to the Klamath Project itself, [2] but also to districts for their own pumps, and individual On-Project and Off-Project irrigation customers as well. Therefore, the expiration of these agreements in 2006 and the subsequent phase-in to PacifiCorp's full retail tariff rates had a double (or triple) impact of not only significantly increasing costs in federal pumps delivering water supplies (and drainage) to ultimate On-Project users but also in increasing these same water users' individual at-site water distribution costs, and those of their irrigation districts as well. Off-Project water users also endured significantly higher costs by virtue of having to purchase all of their on-farm power supply needs from PacifiCorp under full retail tariff rates.

[2] In this regard, the 1917 and 1956 power contracts between Reclamation and PacifiCorp were akin to Federal Project-use Power arrangements that were historically established at multiple Reclamation irrigation projects located throughout the Pacific Northwest Region (and that remain in place today).

# Chapter 4 The Comprehensive Agricultural Power Plan Report

In October 2016, Reclamation publicly released the Comprehensive Agricultural Power Plan ("CAPP") Report for the Klamath Basin. The CAPP was an extensive effort initiated by Reclamation and multiple stakeholders to identify, discuss, and screen multiple different alternatives that might help lower overall power costs for both On-Project and Off-Project covered irrigation water users located in the Oregon and California portions of the Upper Klamath Basin. The development of the CAPP was a direct result of the 2006 expiration of the previously discussed PacifiCorp discounted power contracts.

The CAPP was also initiated in the context of a broader effort to assess many different facets of water use in the Klamath Basin; that process had resulted in the Klamath Basin Restoration Agreement ("KBRA") which was finalized by Reclamation and multiple stakeholders in 2010. The CAPP represented an attempt to provide an implementation plan for the Power for Water Management Program of the KBRA. As part of the development of the CAPP, Reclamation worked with PacifiCorp to assemble historical power usage information for the Upper Klamath Basin On-Project and Off-Project water users; some of this information was utilized by the PCB Analysis Team in deriving the usage-weighted average power cost in the Basin during calendar years 2017 and 2018.[3] A complete copy of the 2016 CAPP Report is available via the website link listed in the reference section of the Report.

[3] These computations are discussed in more detail in Chapter 10.

# Chapter 5 PCB Report Public/Stakeholder Process

## Overview

An important component of the PCB analysis was the opportunity for interested stakeholders to participate in the study process and provide meaningful input into the production of the final PCB Report. In particular, many stakeholders have long histories of living and working in the Upper Klamath Basin and their informed insights on the impacts of higher electricity prices on irrigation practices in the Basin were invaluable to the PCB Analysis Team.

Interested stakeholders had several different avenues available in which to stay informed of and/or provide input to the PCB analysis throughout the life of the project, including the following:

- Regular bi-weekly PCB project status conference calls with Reclamation and the PCB Analysis Team.
- A project kickoff meeting with Reclamation and the PCB Analysis Team on March 19, 2019.
- A Power User Survey was conducted in May and June of 2019 to solicit feedback on power costs and usage profiles. Several stakeholders voluntarily provided their own actual power cost and power usage information to the PCB Analysis Team so that the Team could gain a better appreciation of electricity usage patterns and the associated power costs for water users located in the Upper Klamath Basin.
- A focused progress review session with Reclamation and the PCB Analysis Team on June 11, 2019.
- A public meeting held in Klamath Falls on September 10, 2019 (see Chapter 5).
- An opportunity to review and provide written comments on the Draft PCB Report that was made available to the general public on November 1, 2019. Interested parties were provided a 14-day period of time to review the Draft PCB Report and submit comments to Reclamation.

## Klamath Basin Stakeholder Public Meeting

On September 10, 2019, the PCB Analysis Team jointly hosted a public meeting in Klamath Falls, Oregon to present general information regarding the PCB (and APM topics) and to provide and discuss some of the preliminary findings. Approximately 65 persons attended the meeting and many of those present were actively engaged in asking questions of the PCB Analysis Team and providing constructive feedback. In addition, several local organizations that assist consumers in lowering and/or more efficiently managing their energy costs attended the meeting and made short presentations regarding the services they can provide to agricultural water users in the Upper Klamath Basin.

A more detailed synopsis of the September 10 public stakeholder meeting is contained in Appendix B.

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# Chapter 6 Power Supplies for Irrigation and Drainage Loads in the Pacific Northwest Region

## Overview

The electric utility industry in the United States encompasses both retail and wholesale markets. Retail power sales are made directly to end-use customers while wholesale transactions involve sales made by one entity to another entity for ultimate resale to the purchasing entity's end-use consumers. Electricity that is ultimately used for irrigation and drainage purposes can be sold at the retail level, the wholesale level, and in some cases at both levels.

The following sections describe the various ways that power is sold to agricultural users for irrigation and drainage purposes in the Pacific Northwest Region. One section describes the role of the Federal Power Marketing Administrations and the associated provision of Project-use Power to some entities. A further section then describes the role of publicly-owned and investor-owned utilities in providing power to agricultural customers. In both cases, an emphasis is placed upon the retail and wholesale power market structures that are in place in the Pacific Northwest since the Enhancement Act directs that the PCB is to be derived using power cost data from Reclamation projects located in this particular geographic region.

## Federal Project-Use Power for Irrigation and Drainage Loads

### Federal Power Marketing Administrations

Between 1937 and 1977, the Federal Government formed a total of four Power Marketing Administrations (PMAs); these PMAs were established primarily to sell and transmit electricity generated at federally owned hydroelectric facilities to multiple different entities.[4] These hydroelectric plants were constructed as part of a larger government effort to develop multipurpose water projects that have functions in addition to power generation such as navigation, flood control, irrigation, water supply, and recreation. Most of these facilities were originally constructed, and continue to be owned and operated by Reclamation and the U.S. Army Corps of Engineers (Corps).

The PMAs receive their authority to set cost-based rates from the Reclamation Project Act of 1939 (Act of August 4, 1939, chapter 418, 53 Stat. 1187) and the Flood Control Act of 1944 (P.L. 78-534). By federal statute, PMAs sell power primarily to so-called "preference customers" which consist mainly of publicly-owned and cooperative-owned utilities, although small amounts of power are also sold to Native American tribes, federal entities, investor-owned utilities, and some industrial customers.

[4] One of the PMAs – the Bonneville Power Administration – also markets the output of the Columbia nuclear generating station that is owned by Energy Northwest.

The four PMAs market wholesale power almost exclusively within their own established service territories with little overlap. Most of the power marketed by the PMAs to preference customers is relatively inexpensive since these sales are tied to the cost of production at hydroelectric dams that were built decades ago. By law, PMAs are required to set rates to cover costs "at the lowest possible rates to consumers consistent with sound business principles," forgoing profits (GAO, March 2000). However, the Federal Energy Regulatory Commission ("FERC") also has regulatory authority over the PMA's power rates to ensure that they are set high enough to repay the U.S. Treasury (U.S. EIA, June 12, 2013).

Figure below shows the service territories of the four Federal PMAs along with the hydroelectric projects owned by the Federal Government and operated by Reclamation and the Corps.

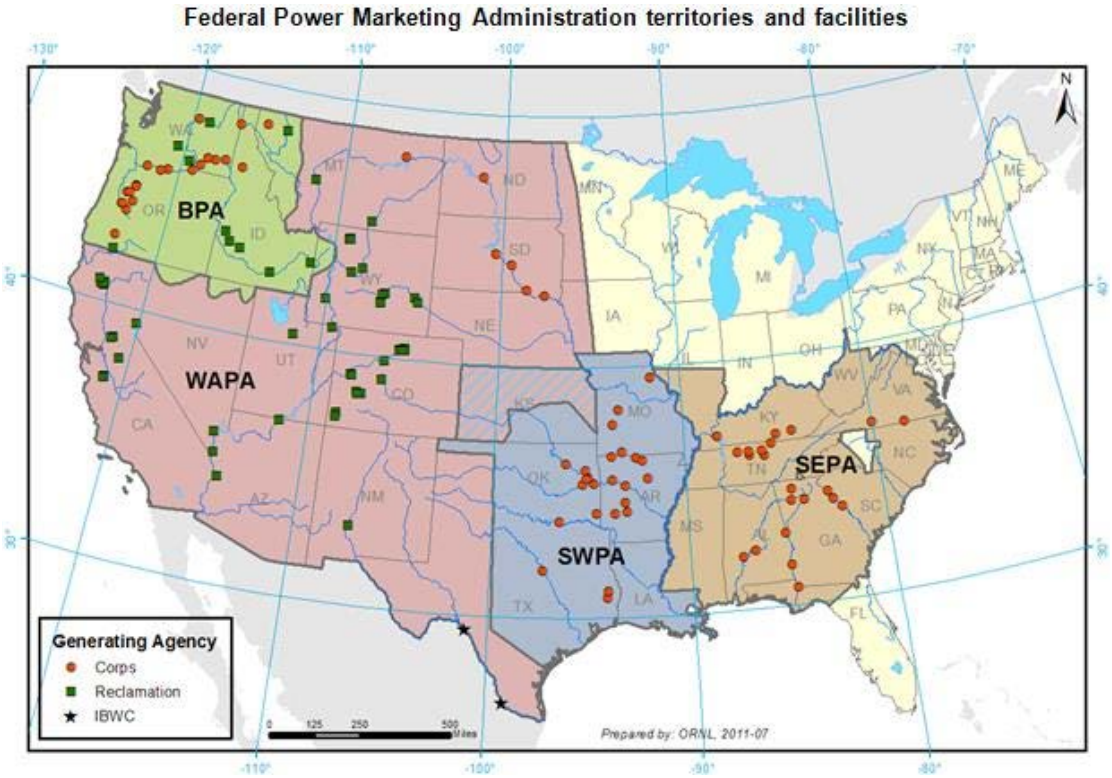


Figure 6-1 Wholesale Power Service Territories of the Federal Power Marketing Administrations.

Source: U.S. EIA website http://www.eia.gov/todayinenergy/detail.cfm?id=11651

Many – but not all – of Reclamation's irrigation projects that are located within a PMA territory receive power for Reclamation's own pumping and drainage usage under one or more of the PMA's cost-based preference rates. This class of wholesale power is commonly referred to as "Project-use Power" or "Federal Reserved Power".[5] In addition, some irrigation districts located within the PMA areas also receive Project-use Power for district-level pumping to move water to

[5] This report uses "Project-use Power", consistent with the terminology used in the AWIA.

on-farm locations and for district-level drainage. However, it should be noted that in almost all cases, Project-use Power *is not* available for on-farm irrigation pumping or drainage usage within the PMA's service areas; on-farm usage is instead normally assessed at commercial retail electricity rate(s) established by the local electric utilities.

The PMAs operate in an electricity industry that is changing from a highly regulated environment, in which cost is the main factor in determining rates, to one that increasingly relies upon competitive markets to set prices. For example, recent increases in the efficiency of renewable wind and solar generating facilities are placing downward price pressures in some of the wholesale markets where the PMAs operate (including the Pacific Northwest Region). While the PMAs are taking steps to reduce costs and prepare for a more competitive market situation, they continue to set their preference rates based on cost, as required by current law.

### Reclamation's Pacific Northwest Region

As shown below in Figure 6-2, Reclamation's Columbia Pacific Northwest ("PN") Region 9 roughly coincides with BPA's service territory which was previously shown in Figure 6-2:


Figure 6-2. Reclamation's PN Region Boundary and BPA's Service Territory

Source: https://www.doi.gov/employees/reorg/unified-regional-boundaries

Section 4(a)(3)(A) of the Enhancement Act states that the PCB is to be derived based upon Reclamation projects that are similarly situated to the Klamath Project and that are specifically located in the Pacific Northwest. Therefore, for the purposes of this Report, the Pacific Northwest Region has been defined as the area that is co-located with BPA's service territory as

defined in the Pacific Northwest Electric Power Planning and Conservation Act (P.L. 96-501, commonly referred to as the Northwest Power Act).

As described in the previous section, BPA was formed in 1937 to market electricity produced at Federally-owned dams to be constructed in the Pacific Northwest Region. As part of its mission, BPA subsequently developed an extensive high-voltage transmission system that allows it to deliver wholesale power supplies to multiple customers located throughout the PNW Region. In addition, BPA also acts as the power balancing authority for a large portion of the Pacific Northwest region.[6]

Many of the dams developed by the Federal Government in the PNW were constructed as multi-purpose facilities that provide a number of different benefits besides just power production. In particular, many of these facilities were developed by Reclamation as part of its program to create multiple different irrigation Projects in the region. A portion of the power produced from these Federally-owned dams is therefore utilized to operate Reclamation's irrigation projects, with the largest usage apportioned for the bulk pumping of water into, through and (in some cases) out of the projects.

As previously noted, the PMAs - including BPA - give preference in the sale of wholesale power to public power customers such as irrigation districts, municipally owned utilities, customer-owned cooperatives, and, in some cases, state governments and other Federal Government entities (GAO, 2000). The primary statute governing BPA's wholesale power and transmission rate setting process is the Northwest Power Act although as previously mentioned the rates established under the Act are also subject to approval by the FERC.

### Project-use Power Rates in the Pacific Northwest Region

Although BPA's service territory largely follows the boundaries of Reclamation's PN Region, multiple different Project-use Power rates have been established in the Pacific Northwest that apply to power purchased by Reclamation for irrigation and drainage purposes. The Draft PCT Report identified six Project-use Power rates under which Reclamation purchases power from BPA; these rates are 1) the Spokane Valley rate, 2) the Chief Joseph rate, 3) the PN Region rate, 4) The Dalles rate, 5) the Roza rate, and 6) the Southern Idaho rate. In addition to this list, the PCB Analysis Team also identified a seventh Project-use Rate in the Pacific Northwest Region referred to as the Columbia Basin Project rate.

In addition to Reclamation's own purchases of Project-use Power from BPA, some of the individual irrigation districts located within Reclamation irrigation project boundaries are also eligible to purchase Project-use Power (pursuant to multiple different legal authorizations) for district-level irrigation and drainage purposes.

Details regarding the specific Project-use Power rates that were incorporated into the PCB analysis are discussed further in Chapters 6.

[6] Pacific Northwest Balancing Area Authority operators such as BPA ensure that the total electric supply within their areas matches the total electric load every 4 seconds in order to maintain the system frequency at a constant 60 Hertz.

It should be noted that although BPA provides at-cost *wholesale* power supplies to multiple publicly-owned and tribally-owned electric utilities located within the Pacific Northwest Region, many of the irrigation and drainage loads in the region are actually supplied under *retail* sales tariffs established by these individual utilities for agricultural customers located within their own local service territories. The irrigation/drainage rate tariffs established by the publicly-owned utilities incorporate not only their BPA wholesale power purchase costs but other costs as well such as transmission, distribution and general overheads. In addition, six investor-owned electric utilities that do not purchase wholesale power supplies from BPA under at-cost/public preference rates also provide electricity to irrigation and drainage customers located within large portions of the Pacific Northwest Region. Overall, approximately 133 different publicly-owned, investor-owned, and tribally-owned utilities serve electric customers in the Pacific Northwest Region pursuant to retail sales tariffs; some of these tariffs have been established specifically for irrigation and drainage usage.

### Project-Use Power for the Klamath Project

As is discussed in more detail in the APM Report, Reclamation's Klamath Project currently does not – and historically never has – received federal Project-use Power. In addition, none of the irrigation districts located within the Klamath Project receive Project-use Power. This situation is a direct consequence of the 1917 agreement with PacifiCorp whereby Reclamation allowed PacifiCorp to construct Link River Dam in exchange for PacifiCorp entering into a long-term power sales agreement with Reclamation. In essence, Reclamation's power purchase agreement with PacifiCorp acted as a substitute for Federally produced Project-use Power. Furthermore, as the Klamath Project was being developed by Reclamation, potential hydropower sites within the Project and downstream that might have been sources of Project-use Power were not, in fact, developed since Reclamation's power supply needs were being met (at that time) through the agreement with PacifiCorp.

In 1956, PacifiCorp and Reclamation agreed to extend the original power sales agreement through 2006 and individual irrigation and drainage customers located within the Klamath Project's boundaries (along with a specified set of Off-Project customers located within the Upper Klamath Basin) were also allowed to purchase power from PacifiCorp at preferential rates. However, following the expiration of the PacifiCorp power purchase agreements in 2006, rates to Reclamation and individual irrigation and drainage users were raised significantly up to PacifiCorp's full agricultural retail tariff rates. At this point in time the Klamath Project no longer had access to low-cost power under the bargain that Reclamation originally entered into in 1917 with PacifiCorp (which was, for all practical purposes, a proxy for Federal Project-use Power).

## Electric Utility Power for Irrigation and Drainage Loads

### Electric Utilities in the Pacific Northwest Region

One key defining characteristic of the Pacific Northwest Region is that there is a very large number (approximately 133) different electric utilities that serve end-use customers located throughout the region. These utilities can be broadly organized into two categories: 1) Publicly-Owned utilities (POUs), and 2) Investor-Owned utilities ("IOUs").

Publicly-Owned Utilities

Publicly-Owned electric utilities are not-for-profit entities that: 1) may or may not have developed their own power supply portfolios, and 2) constructed or purchased the transmission and distribution facilities necessary for the utility to reliably deliver its owned and purchased power supplies to their end-use retail loads. The POUs that serve end-use electric loads in the Pacific Northwest region are preference customers of BPA; therefore, these utilities are entitled to receive cost-based wholesale power supplies from BPA. Because of this situation, many POUs purchase a large portion, and in some cases all, of their power supply needs from BPA under long-term agreements. The POU category also includes three tribally-owned utilities in the region that purchase wholesale power from BPA under preference rates.

The retail rates charged by POUs are subject to the jurisdiction of the local utility governing body, for example a city/tribal council or a county board of commissioners.

Investor-Owned Utilities

Investor-Owned electric utilities (such as PacifiCorp) are for-profit entities that: 1) have developed their own power supply portfolios, and 2) constructed or purchased the transmission and distribution facilities necessary for the utility to reliably deliver its own power supplies to their end-use retail loads. The IOUs that serve end-use electric loads in the Pacific Northwest Region are not considered to be preference customers of BPA; therefore, these utilities are not entitled to receive cost-based wholesale power from BPA although they may from time-to-time purchase wholesale power from BPA at market-based rates.

The retail rates charged by IOUs are subject to the jurisdiction of state-level public utility commissions.[7]

It should be noted that the size of the service territories for the individual POUs and IOUs in the Pacific Northwest Region vary widely, both on the basis of area and number of customers. In addition, the individual service territory boundaries of the POUs and IOUs in the region form a massive “patchwork” pattern - often with irregular shapes and occasional areas of overlap - such that in many instances it is difficult to identify exactly which individual utility is serving customers at a particular location. This situation is graphically illustrated in 6-3 below:

[7] IOUs that serve end-use retail electric loads in more than one state (such as PacifiCorp) are subject to the jurisdiction of multiple state rate commissions. Due in part to this situation, it is not uncommon for such utilities to have different retail rates in effect in different states for the same class of customers (which includes agricultural power users).

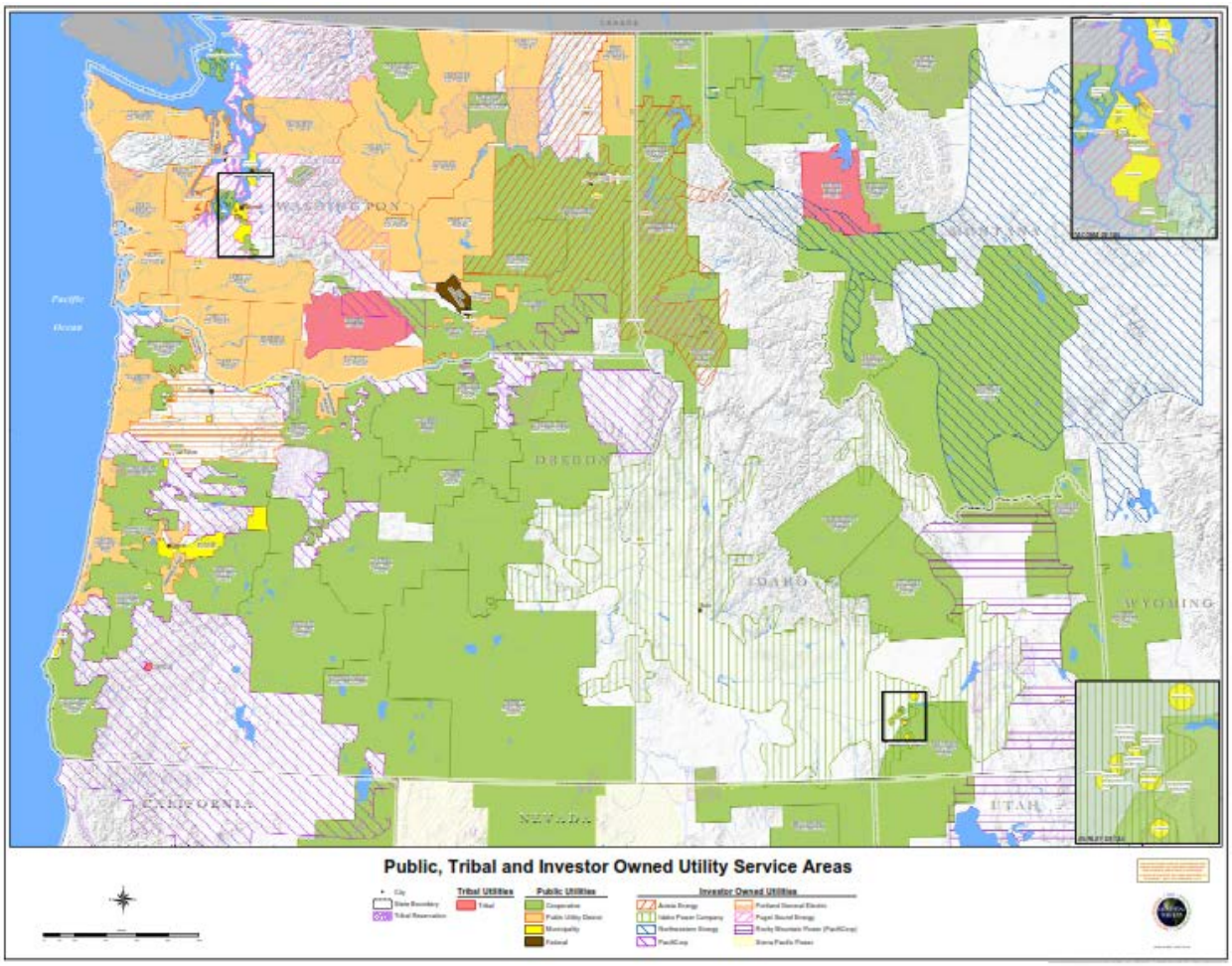


Figure 6-3. Electric Utility Service Territories in the Pacific Northwest Region.

Source: BPA

The following two sub-sections provide additional details regarding the POUs and the IOUs that provide retail electric service in the Pacific Northwest Region.

## Publicly-Owned Utilities/BPA Public Preference Customers

Most of the POUs that serve electric end-use retail loads in the Pacific Northwest Region purchase a large portion of their wholesale power supplies from BPA under what is referred to as the Priority Firm or "PF" rate. Some POUs also own their own generating plants which act to augment their wholesale power purchases from BPA. The PF rate is further broken down into so-called "Tier-1" and "Tier-2" categories. The Tier-1 rates charged by BPA are based upon BPA's cost of producing power from its core power system which consists primarily of a network of 31 Federally-owned hydroelectric projects (commonly referred to as the Federal Columbia River Power System) and one non-Federal nuclear power plant (the Columbia Generating station).[8]

[8] BPA's core power portfolio also contains several small non-Federal hydro and wind generating plants.

The Tier-2 rates are based upon the pooled cost of generating resources or wholesale purchases that BPA may acquire that are not part of its core power system.

It is important to note that while BPA sells wholesale power to its Preference Customers/POUs under the same set of PF rates, it is the individual POUs (and not BPA) that establish the retail rates to be charged to the end-use electricity customers located within their respective service territories. The retail rates charged by the individual POUs reflect not only the cost of purchasing wholesale power supplies from BPA but also incorporate transmission, distribution, and general overhead costs that the POU incurs in delivering power supplies to its customers. Therefore, power costs for end-use customers (including irrigation and drainage customers) served by POUs located in different portions of the Pacific Northwest Region can vary moderately - and in some cases significantly - depending upon local conditions.

### Investor-Owned Utilities

There are six IOUs that provide electric service to end-use retail customers located in the Pacific Northwest Region.[9] These IOUs are not entitled to purchase wholesale power from BPA under the cost-based Tier-1 PF Rates that are available to POUs; rather they have developed their own power supply portfolios. In addition, the IOUs have developed their own bulk transmission systems for the purpose of delivering the generation produced at their owned and contracted-for generating facilities to their end-use retail loads.[10]

The specific characteristics of the IOU's resource portfolios vary from utility to utility, however in general each of these utilities possess a mixture of hydroelectric, coal, natural gas, and wind generating plants. In addition, many of the IOUs have entered into short-term and long-term wholesale purchase power agreements at negotiated rates in order to augment their own generating resource portfolios. Because of these differences in generating plant mixes, the power supply costs for the Pacific Northwest IOUs tend to be more variable than the power supply costs for the POUs that purchase the majority (or all) of their wholesale power supplies from BPA under the same PF rates.

Four out of the six IOUs in the Pacific Northwest Region (Avista, Idaho Power, Northwestern and PacifiCorp) provide retail electric service in more than one state. The retail rates charged by these utilities to end-use customers (including agricultural customers) are established on a state-by-state basis even though, in many cases, customers in multiple states are served via the same power supply portfolios. However, the transmission and distribution costs involved for the four IOUs to deliver electricity to end-use customers can vary from state to state such that the overall retail rates for similarly situated power users are moderately different between states.

The retail rates established by the IOUs are on a "cost plus" basis whereby the utility is allowed to: 1) recover its full cost of providing electric service to its end-use customers, and 2) earn a reasonable rate-of-return on the investments it has made in developing its power supply system. In addition, retail rates charged by the PNW IOUs generally also incorporate a number of additional charges imposed by state or local authorities – typically referred to as "Rider Charges"

[9] The six Investor Owned utilities are: 1) Avista Corporation, 2) Idaho Power Company, 3) Northwestern Energy, 4) PacifiCorp, 5) Portland General Electric, and 6) Puget Sound Energy.

[10] Some of the Pacific Northwest IOU have also purchased long-term transmissions rights on BPA's transmission system in order to augment the capabilities of their own transmission systems.

or "Public Purpose Charges" – that act to fund certain defined public benefits programs.[11] Since different states can (and do) establish different public benefits programs, monthly electric bills for two similar-situated customers served by the same IOU but located in two different states can differ due to the specific sets of Rider Charges that have been enacted by the respective state-level Public Utility Commissions.

Historically in the Pacific Northwest Region, BPA's PF Rate (which is based upon BPA's cost of producing power from its primarily hydroelectric system) has been less expensive than the IOU's cost of producing power from their own respective resource portfolios. Therefore, even after factoring in transmission, distribution, and general overhead costs, the retail rates charged to end-use retail customers in the Region tend to be lower for those customers who purchase electricity from POU providers as compared to IOU providers.

### The BPA Residential Exchange Program

The 1980 Northwest Power Act established a process known as the Residential Exchange Program ("ResEx"). Under the ResEx, residential and qualifying small farm customers are entitled to receive a credit on their monthly power bills that reflects the difference in the power supply costs of their local electric utility provider versus BPA's power supply costs. In this fashion, residential and small farm customers located in BPA's Pacific Northwest Region service territory are allocated a portion of the benefits from BPA's relatively low-cost hydroelectric power system. Pursuant to the language contained in the Act and several associated implementation agreements, small farm customers may qualify to receive the ResEx credit if their electricity usage is less than 222,000 kWh per month.[12]

The ResEx credit amounts are computed on an annual basis for each participating (i.e. "Exchanging") electric utility. Either an IOU or a POU can be an Exchanging utility; during Fiscal Years 2018 and 2019 six IOUs (including PacifiCorp) and two POUs were participants in the ResEx Program.[13] The total dollar amount of the ResEx credits to be allocated among the eight Exchanging utilities varies from year to year – in Fiscal Years 2018 and 2019 the annual credit amounts totaled approximately $241M with PacifiCorp's share being approximately $68M per year.

The ResEx benefits are passed along to residential and qualifying small farm customers via a separate line item credit on the monthly power bills that customers receive from their local electric utility. For PacifiCorp's customers located in Oregon, the ResEx credit is titled BPA Columbia River Benefits. In 2018 the ResEx credit amount for qualifying small farm customers in Oregon was 0.785 ¢/kWh. It should be noted that PacifiCorp's residential and small farm customers located in the California portion of the Upper Klamath Basin do not receive the ResEx credit since these customers are located outside of BPA's Pacific Northwest service territory.

[11] For example, in Oregon, PacifiCorp's retail rates include a Rider Charge that contributes to the funding of the Energy Trust of Oregon. Low income assistance programs are another common example of electric utility Public Purpose Charges.
[12] *See* BPA's Customer Load Eligibility Guidelines for the Residential Exchange Program's Residential Purchase and Sales Agreements and Residential Exchange Program Settlement Implementation Agreements, May 2019.
[13] The number of Exchanging Utilities can vary from year to year.

## Varying Rates for Irrigation/Drainage Usage

As was described in the above sections, the Pacific Northwest Region has approximately 133 different electric utilities, many of which provide power to agricultural customers for irrigation and/or drainage purposes. In addition, the Federal Government – through BPA – also supplies power to Reclamation's irrigation/drainage facilities (and in some limited cases to individual irrigation districts as well) under separate sets of Project-use Rates. Therefore, it is important to note that the cost of power to irrigation/drainage customers located within the Pacific Northwest Region *is highly dependent upon that customer's exact location and the identity of their local electric utility provider.*

Furthermore, the boundaries of Reclamation's irrigation projects located in the Region *almost never line up with the service territories of the local electric utilities.* This leads to the situation where similarly situated agricultural customers located within a single Reclamation project could end up purchasing electricity from multiple different local electric utilities and at multiple different rates depending upon the *specific location* of their respective irrigation/drainage loads. This is an important consideration for the calculation of the PCB since the Enhancement Act instructs that the PCB is to be derived from net delivered power costs as measured on a Reclamation project level. This topic is discussed in more detail in Chapters 8 and 11.

# Chapter 7 PCB Analysis Methodology

## Introduction

The fundamental purpose of the PCB, as defined in the Enhancement Act, is to provide an objective measure by which power costs for irrigation and drainage purposes in the Upper Klamath Basin can be directly compared to such costs in other similarly situated Reclamation projects that are located in the Pacific Northwest Region. In addition, Section 4(a)(3) of the Enhancement Act also specifies that the PCB is to represent "the average net delivered cost of power for irrigation and drainage…"

While the above concepts are fairly straightforward in principle, in practice the derivation of the PCB entailed a complex, multi-step process. The PCB Analysis Team encountered many challenges in deriving the PCB. In particular, there are many different factors that influence the average cost of power for irrigation and drainage purposes on a Reclamation project scale. Most importantly, irrigation and drainage customers located within the same project's boundaries often purchase electricity from different utility providers under different sets of rates. Also, some irrigation district-level irrigation and drainage loads located within the same Reclamation project area are supplied via Federal Project-use Power while others are not.

The following sub-sections describe how the PCB Analysis Team first clarified the definition of the PCB and then identified several associated key concepts to be incorporated into the PCB computational methodology.

## Clarifying the Definition of the PCB

One of the first actions undertaken as part of the PCB analysis was for the PCB Analysis Team to review and discuss the definition of the PCB as contained in Section 4(a)(3) of the Enhancement Act. Given that the PCB definition is somewhat broad, the Team nevertheless strived to interpret this definition such that the PCB derived by the Team would comply with Congress' intent while also recognizing the limited granularity of some of the datasets to be to be incorporated into the computations.

A key attribute of the PCB as specified by Congress is that this figure is to represent the "net delivered cost of power".[14] The PCB Analysis Team interpreted this phrase to mean that the PCB should incorporate all electricity-related costs required to deliver irrigation water onto a crop, including associated drainage pumping (if any). The Team also agreed that transmission and distribution costs associated with delivering electricity to an on-farm irrigation customer should be included in the calculation of the PCB as well as other applicable charges (for example, the annual "customer" charges accessed in November of each year to irrigation customers by PacifiCorp). Finally, the Team agreed that the PCB is to be a single value, as measured across a to-be-defined set of similarly situated Reclamation irrigation projects located in the Pacific Northwest Region.

[14] Enhancement Act Section 4(a)(3).

Another key attribute of the PCB which is not clearly defined in the Enhancement Act are the units to be associated with this metric. However, in discussing the broad intent of the language contained in the Enhancement Act and considering other contextual information regarding historical power costs in the Upper Klamath Basin, the Team agreed that the PCB should represent the per-unit cost of power, which is typically expressed in terms of dollars per megawatt-hour ($/MWh) or cents per kilowatt-hour (¢/kWh). These per-unit quantifications are widely used in the electric utility industry and they are suitable for making direct comparisons of power costs charged by different electric utility providers. However, since the rate schedules established by electric utilities for use in serving end-use retail customers are generally expressed in terms of ¢/kWh, the PCB Analysis Team agreed to express the PCB in terms of ¢/kWh.[15]

A more detailed discussion of the universe of power costs that were incorporated into the derivation of the PCB is included in Chapter 11.

## Electricity Use for Irrigation Pumping and Drainage

Most IOUs and POUs that provide electricity to end use customers located in the Pacific Northwest Region have established one or more rates that apply specifically to irrigation customers. In particular, since irrigation power usage tends to be very seasonal in nature – with peak usage usually occurring during the summer season - the utilities have specifically designed their irrigation rate tariffs to incorporate this important operational characteristic. Usually, the same irrigation rate tariff applies to both pumping-related and drainage-related power usage.

When attempting to compare electricity usage and costs for irrigation customers located in different sub-regions of the Pacific Northwest, it is important to recognize that not only are there differences in the power rates being charged by the local utilities, but also that significant differences in pumping/drainage power usage patterns may exist as well. For example, the Klamath Project not only uses electricity to pump water uphill (including from drains) into the portions of its water delivery network, it must also pump water up and out from a series of sumps in order both to use for irrigation and to send to Lower Klamath National Wildlife Refuge and to return water back into the Klamath River downstream of the Klamath Project. There is also groundwater pumping, primarily to supplement surface water when that supply is insufficient due to regulatory constraints, with groundwater used exclusively on a few crops.

Therefore, the amount of electricity needed to irrigate and drain an acre of land on the aggregate Project level is not necessarily constant across the different Reclamation Projects located in the Pacific Northwest; rather this quantity can vary significantly from Project to Project due to local geography and other factors. This is an important attribute in the context of interpreting the PCB since this metric is designed to quantify the per unit cost of power for irrigation/drainage purposes, which is different from an irrigation customer's overall cost of power.

[15] Wholesale power prices in the Pacific Northwest Region are usually expressed in terms of $/MWh while retail prices are usually expressed in ¢/kWh. A power price expressed in ¢/Kilowatt-hour can easily be converted into a $/MWh value by multiplying the original figure by a factor of ten.

## Multiple Levels of Irrigation/Drainage Power Costs

Section 4(a)(3) of the Enhancement Act specifies that the PCB is to represent "the average net delivered cost of power for irrigation and drainage…". The PCB Analysis Group interpreted this statement to mean that the PCB should include all identifiable power costs that are incurred in delivering water from its initial source onto an on-farm crop. Pursuant to this guiding principle, the Team identified *three separate and distinct levels of power costs* that could factor into an irrigation customer's ultimate costs of applying water onto a crop. However, a complicating factor to this three-level power cost structure is that electricity-related costs for irrigation and/or drainage purposes may not always be clearly labeled as such. In addition, in some circumstances – for example the invoicing of water delivery charges by an irrigation district to an end-use water customer - power costs may be lumped together into a single charge along with other non-power related costs.

The following three sub-sections describe the three levels of power costs associated with irrigation and drainage activities that were identified by the PCB Analysis Team:

### Reclamation Project-Level Power Costs

All Reclamation irrigation projects located in the Pacific Northwest Region require some amount of electricity in order to operate. For projects that are primarily gravity-fed systems, there may be very little power usage for water pumping purposes with the bulk of the project's power usage being used to support general O&M functions (like powering office buildings). However, many Reclamation projects have considerable water pumping loads and, in some cases, considerable drainage loads as well. Electricity usage for these purposes can therefore be a major component of the water delivery charges that the project assesses to water delivery entities like irrigation districts who, in turn, generally pass these charges along to end-use irrigation customers via their own district-level water-delivery charges.[16]

In discussing this topic with several Upper Klamath Basin stakeholders, the PCB Analysis Team learned that Reclamation's costs for pumping/drainage purposes are rarely broken out as a separate component of its operation and maintenance charges; rather, the assessed amounts are usually invoiced as a single lump sum. Therefore, the Team identified a need to develop a mechanism whereby Reclamation's power costs related to pumping and drainage at the project-level could be separately identified from the rest of Reclamation's overall operations costs (which typically include many non-power related items such as repayment of the project's original construction costs and ongoing O&M costs).

### Irrigation District-Level Power Costs

As is the case at the Reclamation project-level, some irrigation districts have significant pumping loads on their system while others are primarily gravity-fed. For those districts who have pumping loads, the associated power costs are usually rolled into the district's own water delivery charges that it assesses to its irrigation customers. In discussing this topic with several Upper Klamath Basin stakeholders, the PCB Analysis Team again learned that many - and

[16] It should be noted that not all of Reclamation's power costs are necessarily recovered via water delivery assessments made to irrigation districts. For example, in some Reclamation Projects a portion of power-related costs may be allocated as non-reimbursable flood control costs that are paid for via appropriated funds.

perhaps most - irrigation districts do not separate out pumping related power costs as a separate line item in their water delivery/drainage assessments. Therefore, the Team identified a need to develop a mechanism whereby each irrigation district's power costs related to pumping (and drainage if applicable) on its system could be separately identified from the rest of the district's overall water-delivery costs (which include many non-power related items such as district O&M costs).

### Individual On-Farm Customer Power Costs

Power costs associated with an individual irrigation customer's delivery of water onto a crop and drainage pumping can usually be fairly easily identified by analyzing the customer's monthly bills from its local electric utility provider. Most electric utilities have established power rates that apply specifically to electricity usage for irrigation pumping and/or drainage purposes. In addition, because water pumping loads can be fairly large as compared to other uses (like powering a house or out building), irrigation pumping usage is, in many cases, measured by the local utility using a separate dedicated meter.

While identifying the irrigation-related power costs of a single customer or small group of customers can be achieved by analyzing monthly billing information from the customers' local utility (as voluntarily supplied by the customer), identifying the average power costs of a large group - numbering perhaps in the hundreds or thousands - of irrigation customers located in a specific sub-area of the electric utility's service territory is a more difficult task. This topic is addressed in more detail in Chapter 11.

# Chapter 8 Identification of the PCB Similar Projects

## Selection of the Similar Projects for the Calculation of the PCB

Section 4(a)(3) of the Enhancement Act states that the PCB is to be derived for Reclamation projects that "are similarly situated" to the Klamath Project. In addition, Sec 4(a)(3) also instructs that such projects be "located in the Pacific Northwest" and "receive project-use power". Therefore, the first step in the PCB calculation process was to identify a set of Similar Projects that meet these criteria.

As part of the development of the Draft PCT Report (which pre-dated the passage of the Enhancement Act), Reclamation and stakeholders reviewed a large body of information and compiled a list of 16 Reclamation irrigation projects located in Reclamation's PN region that might be similarly situated to the Klamath Project. These 16 candidates were then analyzed and evaluated using a variety of criteria such as proximity to the Klamath Project, size, and similar climate. In addition, the candidate projects were also categorized by whether or not the project received Project-use Power or, alternatively, if the project purchased power for irrigation and drainage purposes from a local electric utility provider.

The 15 projects that were identified in the Draft PCT Report as potentially being similarly situated to the Klamath Project were as follows:

Table 8-1. List of Reclamation Projects along with their geographical locations that were considered as potential Similar Projects.

| Project | Location |
|---|---|
| Boise | South-western Idaho |
| Chief Joseph | East-central Washington |
| Columbia Basin | East-central Washington |
| Crooked River | East-central Oregon |
| Deschutes | East-central Oregon |
| Michaud Flats | South-central Idaho |
| Minidoka | East/South-central Idaho |
| Owyhee | South-western Idaho/Eastern Oregon |
| Rathdrum Prairie | North-eastern Washington |
| Spokane Valley | North-eastern Washington |
| The Dalles | North-eastern Oregon |
| Tualatin | North-western Oregon |
| Umatilla | North-central Oregon |
| Vale | East-central Oregon |
| Yakima | South-central Washington |

For the PCB Report, the PCB Analysis Team first reviewed the information previously assembled for the Reclamation projects identified in the Draft PCT Report and determined that this set of projects represented a reasonable starting list of candidates to potentially be designated as Similar Projects for use in deriving the PCB.

Finally, a total of five Reclamation projects were selected to be the Similar Projects for use in deriving the PCB. These five projects are: 1) the Boise Project, 2) the Columbia Basin Project, 3) the Minidoka Project, 4) the Owyhee Project, and 5) The Yakima Project.

## Overview of the Similar Projects

The following sections contain brief overviews of the five Similar Projects that were selected by the PCB Analysis Team; agricultural power cost and power usage information assembled from these five Reclamation project areas were primary components in the calculation of the PCB.

Each of the five Similar Projects is reviewed in more detail in the following Sub-sections.[17] In addition, several of the key reasons why each project was selected to be a Similar Project are highlighted. Finally, the ten additional Reclamation projects that were evaluated by the PCB Analysis Team as potential Similar Project candidates - but for various reasons ultimately not selected as such - are discussed following the five similar project descriptions.

## Boise Project

### General Description

The Boise Project was authorized for development in 1905. The Project furnishes a full irrigation water supply to roughly 224,000 acres and a supplemental supply to about 173,000 acres (for a total Project area of approximately 397,000 acres). Irrigable lands are located primarily in Southwestern Idaho with a small area also located in Eastern Oregon. Major crops grown in the Boise Project include sweet corn seed, grain, alfalfa hay, sugar beets, corn, potatoes, onions, apples, and alfalfa seed.

Major Project features include six storage dams,[18] two diversion dams, and seven large pumping plants. The Project also includes three hydroelectric power plants: 1) Anderson Ranch (40,000 kW), 2) Black Canyon (20,400 kW), and 3) Boise River Diversion (3,300 kW). In addition, non-Federal entities have constructed generating plants at two Reclamation dams that are part of the Project: 1) Arrowrock (15,000 kW) and 2) Cascade (12,800 kW).

### Similarities to the Klamath Project

The Boise Project has a high desert climate similar to the Klamath Project. It is also similar in size. The Boise Project serves 16 different irrigation districts. There are a number of on project-level pumping plants to lift water to elevations that cannot be gravity fed, utilizing power developed at on-project storage dams. The pumps are Reclamation facilities, some which are

[17] Some of the general information for the PCB Similar Projects was sourced from the Draft PCT Report.
[18] This total excludes Lucky Peak Dam, which was originally constructed by the Corp for both irrigation and flood control purposes. In 1988, a non-Federal entity installed a total of 101,250 kW of generating capacity at the dam; all power produced at the facility has been sold to Seattle City Light under a long-term agreement.

operated by Reclamation and some operated by the districts, similar to Klamath Project. The Boise Project also has a large drainage system similar to Klamath Project.

### Irrigation Districts/Boards of Control

A total of 8 individual entities (including irrigation districts/companies and boards of control) were identified that deliver irrigation water to end-use customers located within the Boise Project's boundaries. A complete list of these 8 entities is included in Appendix C.

### Federal Project-use Power

The Boise Division of the Boise Project receives Federal Project-use Power at the Southern Idaho Rate. In addition, the Black Canyon Irrigation District and the Boise Board of Control also receive Project-use Power at the Southern Idaho Rate for use in operating portions of their district-level water delivery systems. Individual on-farm irrigation/drainage customers in the Boise Project are not eligible to purchase Project-use Power.

During 2017 and 2018, the average base Southern Idaho Project-use Power rate was 2.700 ¢/kWh, excluding transmission charges. Including the applicable transmission charges (which varied between 0 ¢/kWh and 0.51¢/kWh) the overall weighted average rate for all Project-use Power was approximately 3.165 ¢/kWh.[19]

### Electric Utility Providers

A single IOU – Idaho Power – provides retail electricity service to the majority of the irrigation pumping/drainage loads located within the Boise Project area.[20] Irrigation customers located within the Boise Project's boundaries purchase electricity from Idaho Power under the State of Idaho retail rates established by the Idaho Public Utility Commission.[21] Several municipally-owned utilities also provide electricity service to a small number of end-use irrigation customers.

### Project Map

A map of the Boise Project showing the Project's boundaries and major features is shown in the project brochure contained in Appendix C.

### Electric Utility Service Territory Map

A map of electric utility providers that serve end-use retail customers located within the boundaries of the Boise Project and the surrounding area is contained in Appendix D.

## Columbia Basin Project

### General Description

The Columbia Basin Project was authorized for development in 1935 although many of the Project's major features were not developed until the 1950s and 1960s. The Project currently

[19] The cited average rates for Project-use Power for the Boise Project (and in the other four Similar Projects as well) incorporates both Reclamation's own power costs/usage and the power costs/usage by the individual irrigation districts that also received Project-use Power.

[20] Idaho Power supplies the majority of the power used by the Project and the irrigation districts located within the Project's boundaries that is not supplied by Project-use Power at the Southern Idaho Rate.

[21] A very small amount of irrigation load in the Boise Project is located in Oregon and is served by Idaho Power under its Oregon retail rate tariffs.

furnishes irrigation water supply to roughly 671,00 acres, or approximately 65% of the 1,029,000 acres originally authorized by Congress. Irrigable lands are located in east-central Washington. Major crops grown in the Columbia Basin Project include potatoes, grain, alfalfa, dry beans onions and corn.

Major Project features include Grand Coulee Dam and Lake Roosevelt, which provides the entire water supply for the Project, the John Keys III pump/generating plant, Banks Lake, and five smaller storage reservoirs. Electricity generated at Grand Coulee Dam provides the power supply for Reclamation's pumping facilities on the Project. In addition, the three irrigation districts within the Project have jointly developed seven non-Federal hydroelectric plants with a combined capacity of 144,600 kW.

### Similarities to the Klamath Project

The Columbia Basin Project has a high desert climate that is similar to the Klamath Project but with a slightly longer growing season than Klamath. While the Columbia Basin Project is larger in size, it is very comparable to the Klamath Project in that a large amount of pumping is required to deliver irrigation water to the farms. The largest pumps, located at Grand Coulee Dam, lift all of the water supplying the project to a higher elevation where it can be delivered by gravity, but there are also many re-lift pumps throughout the project (much like in the Klamath Project) that are operated by both Reclamation and the three individual districts.

### Irrigation Districts/Boards of Control

Three individual irrigation districts - The Quincy-Columbia, East-Columbia, and South-Columbia Districts - were identified that deliver irrigation water to end-use customers located within the Columbia Basin Project's boundaries.

### Federal Project-use Power

The Columbia Basin Project receives Federal Project-use Power at the Columbia Basin Project Rate. None of the three irrigation districts receives Project-use Power. Individual on-farm irrigation/drainage customers in the Columbia Basin Project are not eligible to purchase Project-use Power.

During 2017 and 2018, the average base Grand Coulee Project-use Power rate was 0.3616 ¢/kWh, excluding transmission charges. Including the applicable transmission charges the overall weighted average rate for all Project-use Power purchases was approximately 0.655 ¢/kWh.

### Electric Utility Providers

A total of four IOUs and POUs provide retail electricity service to the majority of the irrigation pumping/drainage loads located within the Columbia Basin Project area.[22] Avista Utilities (an IOU) provides electricity to end-use irrigation customers located in its service territory under the State of Washington retail rates on file with the Washington Utility and Transportation Commission. Grant County PUD, Franklin County PUD, and Big Bend Electric Cooperative (all

[22] These four utilities also supply the majority of the power used by the three irrigation districts located within the Project.

POUs) provide electricity to end-use irrigation customers located in their respective service territories under the retail rates established by their local governing Boards.

### Project Map
A map of the Columbia Basin Project showing the Project's boundaries and major features is shown in the project brochure contained in Appendix C.

### Electric Utility Service Territory Map
A map of electric utility providers that serve end-use retail customers located within the boundaries of the Columbia Basin Project and the surrounding area is contained in Appendix D.

## Minidoka Project

### General Description
The Boise Project was authorized for development in 1905. The Project furnishes a full irrigation water supply to roughly 224,000 acres and a supplemental supply to about 173,000 acres (for a total Project area of approximately 397,000 acres). Irrigable lands are located primarily in Southwestern Idaho with a small area also located in Eastern Oregon. Major crops grown in the Boise Project include sweet corn seed, grain, alfalfa hay, sugar beets, corn, potatoes, onions, apples, and alfalfa seed.

Major Project features include six storage dams,[23] two diversion dams, and seven large pumping plants. The Project also includes three hydroelectric power plants: 1) Anderson Ranch (40,000 kW), 2) Black Canyon (20,400 kW), and 3) Boise River Diversion (3,300 kW). In addition, non-Federal entities have constructed generating plants at two Reclamation dams that are part of the Project: 1) Arrowrock (15,000 kW) and 2) Cascade (12,800 kW).

### Similarities to the Klamath Project
The Minidoka Project has a high desert climate that is similar to the Klamath Project. The Minidoka Project is larger in size with a large portion of the land area irrigated by pumping groundwater wells. Reclamation in conjunction with the multiple different irrigation districts operates 177 wells that provide full water supplies to 224,000 acres. This is similar to the Klamath Project where, in some years, there can be significant groundwater pumping to supplement what was formerly a full surface supply. There a number of re-lift pumping stations in addition to the ground water pumps, which use power produced at Reclamation dams on the project.

### Irrigation Districts/Boards of Control
A total of 40 individual entities (including irrigation districts/companies and boards of control) were identified that deliver irrigation water to end-use customers located within the Minidoka Project's boundaries. A complete list of these 40 entities is included in Appendix C.

[23] This total excludes Lucky Peak Dam, which was originally constructed by the Corp for both irrigation and flood control purposes. In 1988, a non-Federal entity installed a total of 101,250 kW of generating capacity at the dam; all power produced at the facility has been sold to Seattle City Light under a long-term agreement.

### Federal Project-use Power

The Minidoka Project receives Federal Project-use Power at the Southern Idaho Rate. In addition, the A & B Irrigation District, the Burley Irrigation District, the Milner Irrigation District and the Minidoka Irrigation District also receive Project-use Power at the Southern Idaho Rate for use in operating portions of their district-level water delivery systems. Individual on-farm irrigation/drainage customers in the Minidoka Project are not eligible to purchase Project-use Power.

During 2017 and 2018, the average base Southern Idaho Project-use Power rate was 2.700 ¢/kWh, excluding transmission charges. Including the applicable transmission charges (which varied between 0 ¢/kWh and 0.914 ¢/kWh) the overall weighted average rate for all Project-use Power purchases was approximately 3.497 ¢/kWh.

### Electric Utility Providers

A total of three IOUs and POUs provide retail electricity service to the majority of the irrigation pumping/drainage loads located within the Minidoka Project area. Idaho Power and Rocky Mountain Power (a/k/a PacifiCorp), both of which are IOUs, provide electricity to end-use irrigation customers located in their respective service territories under the State of Idaho retail rates on file with the Idaho Public Utility Commission. Fall River Electric Cooperative, a POU, provides electric service to end-use irrigation customers located in Idaho under the retail rates established by its local governing body. Several municipally-owned utilities also provide electricity service to a small number of end-use irrigation customers.

### Project Map

A map of the Minidoka Project showing the Project's boundaries and major features is shown in the project brochure contained in Appendix C.

### Electric Utility Service Territory Map

A map of electric utility providers that serve end-use retail customers located within the boundaries of the Minidoka Project and the surrounding area is contained in Appendix D.

## Owyhee Project

### General Description

The Owyhee Project was authorized for development in 1926. The Project furnishes full irrigation water supplies to approximately 105,000 acres of farmland located in south-western Idaho and eastern Oregon. An additional 13,000 acres are furnished supplemental water. Main crops grown in the Owyhee Project are alfalfa, onions, potatoes, corn, beans and sugar beets.

Major Project features include Owyhee Dam and reservoir – which is the primary water supply for the Project - and 9 pumping plants that pump water out of the Snake River. Three non-Federal hydroelectric generating plants have been constructed at Project facilities: Owyhee Dam (5,000 kW), Tunnel No. 1 (8,000 kW) and Mitchell Butte Lateral (2,000 kW).

### Similarities to the Klamath Project

The Owyhee Project has a high desert climate that is similar to the Klamath Project. The Owyhee Project is smaller with the project being served by two different water sources. The primary

source is the Owyhee River, where water is stored in the reservoir behind Owyhee Dam and diverted directly from the reservoir. This allows for gravity diversion to much of the project's area. However, this water supply is limited, so Reclamation has built 9 pumping plants that divert water directly from the Snake River, which forms the eastern boundary of the project. Drainage for project lands, and pumping to maintain levels in the drainage system are a vital aspect of the Owyhee Project.

### Irrigation Districts/Boards of Control

A total of 12 individual entities (including irrigation districts/companies and boards of control) were identified that deliver irrigation water to end-use customers located within the Owyhee Project's boundaries. A complete list of these 12 entities is included in Appendix C.

### Federal Project-use Power

The Owyhee Project receives Federal Project-use Power at the Southern Idaho Rate. In addition, the Old Owyhee Ditch Improvement District, the Owyhee Irrigation District and the South Board of Control also receive Project-use Power at the Southern Idaho Rate for use in operating portions of their district-level water delivery systems. Individual on-farm irrigation/drainage customers in the Owyhee Project are not eligible to purchase Project-use Power.

During 2017 and 2018, the average base Southern Idaho Project-use Power rate was $27.00/MWh, excluding transmission charges. Including the applicable transmission charges (which varied between 0.398 ¢/kWh and 0.506 ¢/kWh) the overall weighted average rate for all Project-use Power purchases was approximately 3.153 ¢/kWh.

### Electric Utility Providers

A single IOU - Idaho Power - provides retail electricity service to the majority of the irrigation pumping/drainage loads located within the Owyhee Project area However, since the Owyhee Project covers lands located in two different adjacent states - Idaho and Oregon – two separate sets of irrigation rate tariffs apply to end-use irrigation customers located within the Project's boundaries. End-use irrigation customers located in Idaho purchase electricity from Idaho Power under the State of Idaho retail rates approved by the Idaho Public Utility Commission while customers located in Oregon purchase electricity from Idaho Power under the State of Oregon retail rates approved by the Oregon Public Utility Commission.

### Project Map

A map of the Owyhee Project showing the Project's boundaries and major features is shown in the project brochure contained in Appendix C.

### Electric Utility Service Territory Map

A map of electric utility providers that serve end-use retail customers located within the boundaries of the Owyhee Project and the surrounding area is contained in Appendix D.

## Yakima Project

### General Description

The Yakima Project was authorized for development in 1905. The Project furnishes irrigation water supply to roughly 464,000 acres. Irrigable lands are located in central Washington and

extend down the Yakima River valley from near the town of Easton to the city of Richland. Most of the Yakima Project is gravity-fed, however the Roza irrigation district has a significant pumping load which is supplied from generation produced at the Roza located in the Roza hydroelectric plant. Main crops include a variety of fruits, hops, alfalfa, onions and pasture.

Major Project features include 7 dams and storage reservoirs and 5 additional diversion dams. The Project also has three hydroelectric generating plants: Roza (12,937 kW), Chandler (12,000 kW) and two small units at French Canyon Dam (total of 2,200 kW).

### Similarities to the Klamath Project

The Yakima Project has a high desert climate that is similar to the Klamath Project. The Yakima Project is larger and a variety of diversions and pumps are required to deliver water to much of the project area. Some of the pumping plants are operated by Reclamation, and some by the individual irrigation districts, similar to Klamath Project. The Yakima Project serves a large number of irrigation districts as does the Klamath Project. The pumping operations in the project utilizes most of the energy that is generated at the three hydroelectric power plants which are part of the project. The Yakima Project also includes a drainage system for much of the irrigated lands.

### Irrigation Districts/Boards of Control

A total of 24 individual entities (including irrigation districts/companies and boards of control) were identified that deliver irrigation water to end-use customers located within the Yakima Project's boundaries. A complete list of these 24 entities is included in Appendix C.

### Federal Project-use Power

The Yakima Project itself does not receive Federal Project-use Power. However, the Roza Irrigation District receives Project-use Power at the Roza Rate for use in operating portions of its district-level water delivery system. Individual on-farm irrigation/drainage customers in the Yakima Project are not eligible to purchase Project-use Power.

During 2017 and 2018, the average base Roza Project-use Power rate was 2.231 ¢/kWh. There were no additional transmission charges associated with these Project-use Power purchases.

### Electric Utility Providers

A total of seven IOUs and POUs provide retail electricity service to the majority of the irrigation pumping/drainage loads located within the Yakima Project area. PacifiCorp and Puget Sound Energy (both IOUs) provide electricity to end-use irrigation customers located in their respective service territories under the State of Washington retail rates on file with the Washington Utility and Transportation Commission. Kittitas County PUD, Benton County PUD, Benton County REA, Columbia REA and Yakima Power (all POUs) provide electricity to end-use irrigation customers located within their respective service territories under the retail rates approved by their local governing bodies. Several municipally-owned utilities also provide electricity service to a small number of end-use irrigation customers.

### Project Map

A map of the Yakima Project showing the Project's boundaries and major features is shown in the project brochure contained in Appendix C.

### Electric Utility Service Territory Map

A map of electric utility providers that serve end-use retail customers located within the boundaries of the Yakima Project and the surrounding area is contained in Appendix D.

## Additional Information for the Similar Projects

Additional detailed descriptions of each of the five Similar Projects, as originally incorporated into the Draft PCT Report, are contained in Appendix E.

## Other Reclamation Projects Evaluated by the PCB Analysis Team

As was previously mentioned above, the PCB Analysis Team evaluated a full list of 15 different Reclamation irrigation projects located in the Pacific Northwest region as potential candidates to be the Similar Projects utilized in the calculation of the PCB. Ultimately, from this initial list the Team selected 5 of these projects to be the Similar Projects. The remaining ten excluded projects are listed below, along with some of the key reasons why they were deemed not to be similar to the Klamath Project for the purpose of deriving the PCB.

### Chief Joseph

The Chief Joseph Project is only 30,000 acres in size, which is much smaller than the Klamath Project. While still technically a high desert climate, it is a warmer climate than the Klamath Project and therefore the crops grown are considerably different. A considerable majority of the project's area is in fruit orchards, mainly apples and cherry. Also, the project serves a considerable amount municipal and industrial water supply in the area.

### Crooked River

The Crooked River Project is similar in climate to Klamath Project, but it is much smaller with approximately 20,000 acres being served. While some crops are similar, the Crooked River project is primarily forage crops and lack the high value row crops found in the Klamath Project. There is a small amount of pumping required to project lands, but no generation facilities. The Crooked River project also has no drainage facilities or drainage pumping requirements.

### Deschutes

The Deschutes Project is considerably smaller than Klamath Project, with the project providing full water supplies to less than 50,000 acres. The Deschutes Project has never had any power generation facilities, and no project features are used in power generation. The project is exclusively supplied by gravity canals, with only one pumping plant which was added much later than initial construction as a supplemental water supply in drought years. The Deschutes Project also has no drainage facilities.

### Michaud Flats

The Michaud Flats Project in Idaho serves 11,200 acres by water pumped from the Snake River and supplemented by groundwater. The small acreage and lack of storage and major infrastructure lack similarity to the Klamath Project.

### Rathdrum Prairie

Rathdrum Prairie is a very small project, originally at 10,000 acres and currently at 7,000 acres. The project was initial developed by private irrigation districts although Reclamation rehabilitated the original development in the 1940's. Since that time, increasing urban sprawl has changed the project to a mostly municipal and industrial water supplier, differentiating it from the Klamath Project.

### Spokane Valley

The Spokane Valley Project is similar to the neighboring Rathdrum Prairie Project in that it currently serves very little production agriculture. The project mostly supplies municipal and industrial water to the Spokane urban area. The surface water developments that supplied both the Spokane Valley and the Rathdrum Prairie projects have been abandoned and replaced with groundwater wells. The project has never used or had any project power generation.

### The Dallas

The Dallas Project, at approximately 6,000 acres in size, is much smaller than the Klamath Project. In addition, the elevation of the project ranges from 200 feet to only 1,200 feet, which is much lower than the Klamath Project. A significant portion of the project's area, about 75%, has been devoted to orchards.

### Tualatin

The Tualatin Project is much smaller than Klamath Project. While the project historically irrigated up to approximately 17,000 acres of crop land, rapid urbanization has converted much of the irrigated land to suburban housing and industrial developments. As such, the project's focus has shifted to become raw municipal and industrial water. The area has seen a rapid growth in high tech manufacturing, and the pressurized system of the Tualatin Project has been utilized extensively. Land that has remained in agricultural production is mostly nursery crops, vineyards and blueberries, all very high value specialized production.

### Umatilla

The Umatilla Project, at approximately 17,000 acres in size, is much smaller than the Klamath Project. A later extension of the project supplied some lands with supplemental water from the Columbia River in exchange for water being left in the lower Umatilla River to enhance the fishery. While there is a limited amount of pumping required, the pump development was not part of the original irrigation development and was added solely to provide mitigation and fishery habitat. There are no power development or drainage facilities associated with the Umatilla Project.

### Vale

The Vale Project, at 35,000 acres in size, is much smaller than the Klamath Project. The project was originally settled as a private irrigation development. In the 1920's the lack of storage caused water shortages, and two storage reservoirs were built by the private irrigation districts. After a feasibility study, Reclamation determined the most cost-effective storage for further development was to purchase capacity in those privately-owned reservoirs. None of the dams have ever been developed for hydropower production, and the project was designed as a gravity delivery project, making it a poor comparison to Klamath Project.

# Chapter 9 Power Cost/Power Usage Data Sources for the PCB

## Historical Data Period for the Calculation of the PCB

Section 4(a)(3) of the Enhancement Act does not specify any particular time period to be associated with the derivation of the PCB. However, given the overall context of the definition of the PCB, the PCB Analysis Team felt that it would be appropriate to compute the PCB based on the following general parameters:

A. The calculation of the PCB should be based upon either: a) actual historical datasets, or b) weather-normalized datasets that reasonably reflect historical conditions.

B. The historical datasets utilized should be as recent in time as possible so as to be representative of current conditions.

C. The historical datasets should represent, to the extent possible, normal weather conditions.

D. Historical power cost and power usage datasets should, at a minimum, cover a continuous 12-month period in order to capture the seasonal impacts of irrigation operations.

After several discussions, the PCB Analysis Team decided to use calendar year 2017 and 2018 conditions as the basis for the calculation of the PCB. These two recent years represented a relatively wet water year (2017) and a relatively dry water year (2018) in the Klamath Basin; therefore, using historical power cost and power usage data from both years and then averaging the results should result in figures that reasonably reflect normal weather/power usage conditions.[24]

Once the historical data period for the calculation of the PCB had been defined, the Team then began the process of identifying, locating, and reviewing multiple different sources of calendar year 2017 and 2018 historical information for potential use in deriving the PCB. The specific information sources that were ultimately utilized in the calculation of the PCB are discussed in more detail below in this chapter.

## Summary of the Electric Utility Providers in the Similar Projects

As was previously highlighted in chapter 6, one of the challenges in deriving the PCB is that the physical boundaries of Reclamation irrigation projects located in the Pacific Northwest Region rarely match up with electric utility service territories. This attribute means that even if a project itself receives Federal-use Power at a single rate, most of the irrigation districts and all of the individual end-use irrigation customers located within the project area nevertheless purchase

[24] Some of the single year 2017 and 2018 datasets used in the calculation of the PCB had already been adjusted to reflect normal weather and power usage conditions. In these cases, averaging figures from both 2017 and 2018 was not necessary.

electricity from multiple different power providers based upon their physical location within the project's boundaries.

For the five selected Similar Projects, these types of geographic discontinuities between Reclamation project boundaries, individual irrigation district boundaries, and electric utility service territories are the norm rather than the exception. Therefore, in order to quantify irrigation-related power costs for each of the Similar Projects, it was first necessary to break down each project area into multiple sub-areas based on electric utility service boundaries.

As was previously described in Chapter 6, there are approximately 133 different electric utilities that serve end-use retails loads in the Pacific Northwest Region. With regard to the five selected Similar Projects, four different IOUs and eight different POUs were identified as serving the majority of the agricultural irrigation and drainage loads located within the boundaries of the projects; this information is summarized below in Table 9-1.

Table 9-1. Electric Utilities that Serve Irrigation/Drainage Loads in the Similar Projects

| Similar Project | Local Utility Provider | Utility Type |
|---|---|---|
| Boise | Idaho Power – ID Rates | Investor-owned |
| Columbia Basin | Avista Corporation – WA Rates | Investor-owned |
| | Big Bend Electric Coop | Publicly-owned |
| | Franklin County PUD | Publicly-owned |
| | Grant County PUD | Publicly-owned |
| Minidoka | Fall River Electric Coop – ID Rates | Publicly-owned |
| | Idaho Power – ID Rates | Investor-owned |
| | PacifiCorp – ID Rates | Investor-owned |
| Owyhee | Idaho Power – ID Rates | Investor-owned |
| | Idaho Power – OR Rates | Investor-owned |
| Yakima | Benton County PUD | Publicly-owned |
| | Benton REA | Publicly-owned |
| | Columbia REA – WA Rates | Publicly-owned |
| | Kittitas PUD | Publicly-owned |
| | PacifiCorp – WA Rates | Investor-owned |
| | Puget Sound Energy | Investor-owned |

It should be noted that although twelve individual electric utilities serve the majority of the agricultural load located within the five Similar Projects, two of these utilities – PacifiCorp and Idaho Power – are listed twice in Table 9-1 since these companies have different power rates established in different states.[25]

## Irrigation/Drainage Power Cost and Power Usage Data for the Similar Projects

Once all of the electric utilities that serve the majority of the irrigation loads located in each Similar Project were identified, the next step in the derivation of the PCB was to locate and

[25] In addition to the utilities listed in Table 9-1, there are several small utilities – mainly publicly-owned municipal utilities – that serve irrigation loads located in some of the Similar Projects. However, the amount of irrigation and drainage loads served by these utilities is very small as compared to the twelve utilities listed in Table 9-1; therefore, the impact of not including the small utilities in the PCB calculation is *di minimus.*

assemble irrigation-related power costs and associated irrigation power usage for each utility. However, collecting this information on an individual water user basis was not possible or practical for several reasons. First, due to strict confidentiality requirements, electric utilities do not publicly release information on individual customers without the customer's permission. Therefore, obtaining releases for potentially hundreds of thousands of individual irrigation customers located in the Similar Projects was clearly not an achievable goal.

Second, electric utility customer information systems are not, in general, configured to be able to identify which specific irrigation customers are located within the boundaries of a Reclamation irrigation project versus customers that are located outside of a project's area. And finally, while some electric utilities might be able to produce one or more requested customized reports containing aggregated power cost and power usage data for specifically defined sub-sets of irrigation customers, such reports would likely: 1) be very time-consuming to produce, and 2) the utility could always deny the request.

Therefore, in order to be able to derive the PCB as envisioned in the Enhancement Act, it was necessary to rely upon various utility-supplied datasets that contained aggregated information regarding irrigation customer power costs and power usage. Fortunately, for the purpose of deriving the PCB – which is itself an average-based metric – there is little loss in precision in relying upon aggregated input datasets. In addition, as was discussed above, the use of at least some level of aggregated power cost and usage datasets is a virtual requirement of the PCB calculation process given how individual customer information is collected, organized, and protected by the electric utilities.

In order to assemble the irrigation-related power cost and usage datasets needed to derive the PCB, the PCB Analysis Team investigated multiple different potential sources of publicly available information. The primary information sources ultimately utilized in the PCB Analysis are summarized in the following sub-sections.[26]

## Electric Utility Rate Schedules

Electric utilities sell power to their end-use retail customers under a variety of different prices, terms and conditions. Collectively, these sets of prices/terms/conditions are typically referred to as "rate schedules" or "rate tariffs". Each individual rate tariff is designed to be utilized by a particular customer group or type of electric load. Utility rate tariffs are applied in a non-discriminatory fashion so that all electricity users that are part of the same customer class purchase electricity under the exact same set of prices (although some customers may have a choice to be served under more than one rate tariff). Many, if not most, of the IOUs and POUs that serve electric loads in the Pacific Northwest Region have one or more irrigation rate tariffs in place for end-use customers that purchase electricity for irrigation pumping and/or water drainage purposes.

[26] Some of the desired input datasets for the five Similar Projects that were originally identified by the PCB Analysis Team for use in computing the PCB were either: 1) not publicly available, or 2) exhibited inconsistences in the way the data was reported across the different utilities. In these cases, the Team was forced to either utilize secondary dataset sources and/or modify some sub-portions of the PCB calculation methodology in order complete the computations using the available alternate datasets.

The specific prices, terms, and conditions contained in electric utility rate tariffs can vary significantly between different utilities, even for rate tariffs that apply to the same customer groups (like irrigation customers). Because of these structural differences, it is often difficult to make an "apples-to-apples" comparison of power costs between individual electric utilities since different sets of input data and calculations may be involved. In addition, in order to directly compare power costs between different utilities for the same type of customer, one has to make some assumptions regarding not just how much total electricity the customer used across a given time period (like a monthly billing cycle) but also how the customer's electricity usage varied with time across that same period.

While the specific charges incorporated into the rate tariffs of the 12 utilities that serve the majority of the irrigation and drainage loads located in the five Similar Projects varied significantly between the different utility providers, the general categories of charges that are assessed to irrigation customers can be broadly broken down into four categories:

Customer Charges
Customer Charges, which are usually expressed as a fixed dollar amount, are usually assessed by electric utilities on either a monthly or annual basis. Most utilities assess some form of Customer Charge to help cover their fixed costs of doing business. For irrigation/drainage customers, it is common for the Customer Charges to be assessed on an annual basis.

Demand Charges
Demand Charges (also sometimes referred to as Capacity Charges) are usually assessed on a monthly basis and are based upon the customer's highest rate of electricity usage that occurred during that month, as measured on an hourly (or shorter) timeframe. Demand Charges are usually assessed on a dollar/Kilowatt basis, however other similar units are sometimes used for irrigation/drainage customers.

Energy Charges
Energy Charges are usually assessed on a monthly basis and are based on the total volume of electricity used by the customer during that month, as measured in kilowatt-hours. Many utilities have established so-called "tiered" Energy Charges whereby the cents/kilowatt-hour energy rate decreases as the customer's monthly usage increases.

Riders/Other Charges
Many – but not all – utilities assess a variety of other miscellaneous charges (or credits) to their customers on a monthly basis that are collectively referred to as "Riders". Usually, Rider charges are assessed based on customers' total monthly energy usage. Many Riders are assessed by the utility at the same rate across multiple different customer classes.[27] Rider charges are usually shown as individual line items on customers' bills. The various rider charges and credits that were assessed by PacifiCorp to their Schedule 41 irrigation customers located in Oregon during 2017 and 2018 are highlighted in the Oregon Price

[27] Some Riders, for example the BPA Residential Exchange credit, only apply to select customer classes and/or customers that meet certain qualifying criteria.

Summaries that are contained in Appendix G. PacifiCorp's 2017 – 2018 California Price Summaries for Schedule PA-20 irrigation customers are also contained in Appendix G.

### Electric Utility Annual Reports

All electric utilities, whether they are investor-owned or publicly-owned, produce some type of annual report. These reports, which are typically released on a calendar year basis, contain a mix of operational, financial, and general information. Although the overall purpose of these reports is more-or-less the same - to provide customers and shareholders a summary of the utility's primary activities for the previous year - the level of detail contained in these reports can vary considerably across different utilities. In general, the Annual Reports from the IOUs and larger POUs tend to be very comprehensive in nature while the reports for the smaller POUs tend to be shorter and less detailed.

Most electric utility Annual Reports, however, contain some form of statistics regarding the revenues earned by the utility and the volume of its electricity sales for the preceding 12-month reporting period. Many times, but not always, these general statistics will be broken down by customer categories such as residential, industrial and commercial. For utilities that have a significant amount of irrigation load - for example Idaho Power - the utility may also provide separate operating/financial statistics for the irrigation customer class. In these cases, the average rate paid by all irrigation customers across the reporting period (measured in ¢/kWh) can be derived by dividing the total revenue received by the utility by the total electricity usage.

### Electric Utility Rate Cases

When an electric utility proposes to adjust the prices at which it sells electricity to one or more of its end-use retail customer classes, it will generally do so through some type of formal rate case process. However, the specific processes involved can differ quite a bit among different utilities depending upon the type of the utility organization:

Investor-Owned Utilities – In the Pacific Northwest and California regions, the retail rates of IOUs are generally subject to the jurisdiction of state-level regulatory bodies. For example, PacifiCorp's retail power rates in Oregon are regulated by the Oregon Public Utilities Commission while in California the retail rates are established by the California Public Utilities Commission. Rate case processes for IOUs tend to follow very structured guidelines that allow for significant input from interested stakeholders. The rate adjustments resulting from these processes must be approved by the rate commission having appropriate jurisdiction before they can go into effect.

Publicly-Owned Utilities - In the Pacific Northwest and California regions, the retail rates of POUs are generally subject to the jurisdiction of local-level regulatory bodies. For example, retail electricity rates for municipally-owned utilities are typically established by a city-level body such as a city council while retail rates for public utility districts are usually established by a county-level body such as a board of commissioners. These local bodies are free to establish their own retail rate-setting processes and polices as long as such policies are not inconsistent with the organic statutes that govern these organizations (which are usually state-level in nature).

When an electric utility (either an IOU or POU) proposes to change its retail rates, the utility will usually conduct a broad analysis to determine the amounts of revenue that it proposes to recover from each specific customer class. Furthermore, the utility will usually further break down these annual "revenue requirements" to the individual rate tariff level. In addition, the utilities will usually also forecast the amount of electricity usage they expect under each individual rate tariff assuming normal weather conditions.

Since many electric utilities have one or more rate tariffs in place for irrigation pumping/drainage customer, by carefully analyzing recent or ongoing utility retail rate cases it is usually possible to identify both; 1) the anticipated annual revenue that the utility expects to receive from irrigation customers (under one or more specified rate tariffs), and 2) the expected annual total electricity usage of all irrigation customers. By dividing these two quantities the average electricity rate (in ¢/kWh) can then be determined.

## Electric Utility Integrated Resource Plans

All of the IOUs in the Pacific Northwest Region and many of the larger POUs produce long-term load and resource planning documents known as Integrated Resource Plans ("IRPs"). IRPs typically look out up to twenty years in the future and are used by the utilities to help inform many long-range decisions such as acquiring new generating resources or investing in energy conservation measures. State-level regulatory bodies typically establish the specific IRP requirements for the electric utilities that serve end-use loads in that state. Therefore, utilities that serve retail electric loads in multiple states – such as PacifiCorp – are required to file separate IRPs in each individual state. Electric utility IRPs are typically updated every 2 or 3 years.

Electric utility IRP processes are focused on identifying the utility's forecasted future need to acquire new generation or demand side resources pursuant to its defined reliability-of-service criteria. While the IRP process can identify the expected overall costs of different resource alternatives, an IRP does not necessarily determine how those future costs will impact the rates to be paid by individual customer classes. However, most IRPs do contain forecasts of future electricity usage by individual customer class, including in some cases irrigation customers. Therefore, the PCB Analysis Team reviewed the most recent IRPs for several of the Pacific Northwest IOUs in order to acquire additional irrigation electricity usage information that, in turn, was utilized to inform the power cost calculations for the five Similar Projects.[28]

## The Power Cost Survey

In addition to locating and reviewing multiple electric utility public records, the PCB Analysis Team also believed that it would be beneficial to attempt to assemble additional historical information regarding pumping and/or drainage power costs and power usage from some of the individual irrigation districts that serve water users located in each of the five Similar Projects. In particular, having irrigation-related power cost and usage data available from individual irrigation districts would help to provide cross-checks against the more highly aggregated information assembled from the various electric utility-provided sources. In addition, having detailed power cost information from individual irrigation districts would also help the Team

[28] The most recent IRPs published by Avista Utilities, Idaho Power, PacifiCorp and Puget Sound Energy were reviewed by the PCB Analysis Team as part of the PCB computation process.

better define potential power cost and power usage differentials for water users located inside of, and outside of, the Similar Projects' boundaries.

The Power Cost Survey Form was developed by the PCB Analysis Team with additional input from KWUA and individual stakeholders. This short (one page) form requested that the irrigation district provide its actual power costs and actual power usage figures for calendar years 2017 & 2018 along with also identifying its local electric utility provider. In addition, the Survey Form asked each district to identify if it purchased all or a portion of its power needs under a Federal Project-use Rate and, if so, to identify the specific rate. Lastly, the Survey Form requested information on each districts' 2017 and 2018 total water delivery volumes and number of water use customers on its system. A copy of the Power Cost Survey Form is included in Appendix H.

After first identifying all of the irrigation districts/companies in each of the five Similar Projects (as described in Chapter 8), the PCB Analysis Team then developed a targeted list of recipients to receive the Power Cost Survey form. Individual Irrigation Districts were specifically selected so that actual historical power cost information for calendar years 2017 and 2018 could (hopefully) be obtained for at least one large irrigation customer in every one of the electric utility service territories that overlap with one or more of the Similar Projects' boundaries. The Survey mailing list was also targeted toward the larger irrigation districts in each Similar Project, as measured in terms of total irrigated acreage.

KWUA volunteered to distribute the Power Cost Survey Forms and a total of 43 forms were sent by KWUA to irrigation districts located in four out of the five Similar Projects. Survey forms were sent via both e-mail and US Mail. Survey forms were not sent to any of the three irrigation districts located in the Columbia Basin Project since the PCB Analysis Team was able to collect the desired power cost information from these districts by making individual data requests.

Survey forms were returned by 6 recipients (for a response rate of 14 percent). After receiving and reviewing these initial responses, the PCB Analysis Team contacted several of the irrigation districts that had not returned Survey Forms in an attempt to assemble power cost and power usage information for specifically targeted electric utility service areas where the Team wanted to collect additional actual power cost/usage data.

### Energy Information Administration Reports

The U.S. Energy Information Administration ("EIA") publishes numerous reports that contain various energy-related statistics for the United States, including information regarding historical electricity production and usage. In particular, EIA's annual Form-861 Report summarizes a large body of historical electric utility operational data; examples of the datasets included in the EIA Form-861 and reported on an individual utility basis include: 1) total annual electricity sales revenue, and 2) total annual electricity usage.

Several of the electric utilities that serve irrigation and drainage loads in the five Similar Project did not, on their own, publicly report 2017 and/or 2018 power cost/power usage figures for their irrigation customers. In addition, some of these same utility organizations – all of which happen to be cooperatives – also did not publicly report their irrigation customer rate tariffs that were in place during 2017 and/or 2018.

For the electric utilities where irrigation customer power cost and/or power usage information could not be obtained via the utilities' own published reports, the PCB Analysis Team instead relied upon data contained in the EIA's Form-861 as a proxy for such information.[29] It should be noted, however, that the utility-specific datasets contained in Form-861 are organized only into residential, commercial and industrial customer categories, with irrigation customers being included in the industrial category. However, this information was still useful in the context of deriving average power costs for irrigation customers located in the service territories of the cooperative utilities that serve irrigation customers in portions of the Similar Projects.

### USDA/NASS Database

The U.S. Department of Agriculture's National Agricultural Statistical Service ("NASS") regularly collects and publishes multiple reports and datasets regarding different facets of the agriculture industry. In particular, NASS publishes a comprehensive Census of Agriculture report every five years that contains detailed statistics on an individual state and county basis. In addition, some of the Census datasets are available at a resolution down to individual zip codes and congressional districts.

The latest Census of Agricultural report was published by NASS for calendar year 2017. The PCB Analysis Team utilized several datasets from this Census to help determine the agricultural acreage and number of agricultural customers that are located within the sub-areas of the local electric utility service territories that overlap with the boundaries of the Similar Projects. This information was then used in deriving the usage-weighted average cost of power in the Similar Projects for irrigation and drainage purposes.

### Targeted General Information Requests

For some of the electric utilities that serve irrigation loads in one (or more) of the Similar Projects, publicly available historical information regarding irrigation power rates, revenue, and usage information could not be located by the PCB Analysis Team. In these cases, the Team directly contacted the utilities involved and made special requests for the utility to provide this information for calendar years 2017 and 2018. Responses to these targeted requests helped the Team fill in several gaps in the data collection process and contributed to increasing the overall precision of the PCB calculations.

### Targeted Reclamation Data Requests

Reclamation personnel in the Klamath Basin Area Office provided multiple datasets to the PCB Analysis Team regarding: 1) Reclamation's own 2017 and 2018 power usage for the Klamath Project, and 2) additional historical power usage data for the Upper Klamath Basin that had been provided to Reclamation by PacifiCorp as part of an earlier Reclamation power cost study. Klamath Falls personnel also provided the Team with a substantial body of general information regarding the physical design and operation of the Klamath Project.

Reclamation personnel from its Boise, ID Area Office provided the PCB Analysis Team with detailed 2017 and 2018 power cost and power usage datasets for Federal Project-use in the five Similar Projects. This information was assembled from Reclamation's Project-use Power billing

[29] Data contained in the EIA's Form-861 that is shown on an individual electric utility basis is provided to the EIA by the utilities themselves.

records with BPA and Reclamation’s own billing records with the individual irrigation districts located in the five Similar Projects that were eligible to receive Federal Project-use Power.

# Chapter 10 Computation of Irrigation/Drainage Power Costs in the Upper Klamath Basin

## Introduction

Following the termination of the 1917 and 1956 Reclamation/PacifiCorp power purchase agreements in 2006, Reclamation began purchasing power from PacifiCorp under full tariff rates in effect in Oregon and California. In addition, both On-Project and Off-Project covered users who previously received power under the 1956 agreements also began purchasing power from PacifiCorp under full tariff rates. This chapter discusses the power costs in the Upper Klamath Basin for irrigation and drainage purposes during calendar years 2017 and 2018.[30]

## Three Sectors of Power Costs for Covered Users in the Upper Klamath Basin

When discussing power costs for irrigation and drainage in the Upper Klamath Basin, it is important to recognize that these costs are not uniform across all covered water users, rather there are three discrete sectors of users:

A. On-Project covered users located in Oregon
B. Off-Project covered users located in Oregon
C. On-Project covered users located in California

Irrigation and drainage power costs for 2017 and 2018 for each of these three sectors of water users are addressed separately in Chapter 11.

## Reclamation's Cost of Power in the Klamath Project

Reclamation purchases relatively large amounts of electricity from PacifiCorp in order to operate its project-level pumping and drainage facilities. While these power costs are directly invoiced to Reclamation by PacifiCorp, it is ultimately the On-Project water users that pay these costs via the water delivery/drainage charges that are assessed by Reclamation to the local irrigation districts who, in turn, pass these power costs thru to their individual water users via district-level water delivery charges. Therefore, as in the Similar Projects, On-Project covered users are assessed power costs associated with irrigation and/or drainage activities at three different levels: 1) Reclamation project-level costs, 2) irrigation district-level costs, and 3) on-farm costs.[31]

[30] 2018 was a relatively dry year in the Upper Klamath Basin while 2017 was a relatively wet year. Averaging Basin power costs across these two years is therefore believed to represent "normal" conditions.
[31] In contrast, Off-Project covered users in the Upper Klamath Basin have only one level of power costs associated with their irrigation and/or drainage activities, which is their own on-farm costs.

Reclamation's Klamath Project-level power costs for calendar years 2017 and 2018 are summarized below in Table 10-1.

Table 10-1. Reclamation Klamath Project Power Costs and Usage 2017-2018

| Year | Total Power Costs ($) | Total Power Usage (kWh) | Average Per-unit Power Cost (¢/kWh) |
|---|---|---|---|
| 2017 | 262,287 | 2,042,276 | 12.84 |
| 2018 | 160,393 | 1,242,524 | 12.91 |

Source: U.S. Bureau of Reclamation, Klamath Basin Area Office

The above noted annual power costs and associated usage figures were assembled from the monthly invoices that Reclamation received from PacifiCorp. All of these purchases were made pursuant to PacifiCorp's retail irrigation tariffs that were in place at the time in Oregon and California.[32]

## PacifiCorp's Retail Irrigation Rates

PacifiCorp has established retail rate tariffs in Oregon and California that apply specifically to irrigation and/or drainage customers. The standard irrigation rate tariff in Oregon is Schedule 41 while in California the irrigation tariff is Schedule PA-20. While the two rate schedules have some common characteristics, the actual charges incorporated into the rate schedules differ due to several different factors.[33] Overall, during 2017 & 2018 PacifiCorp's irrigation customers located in California paid, on average, about 23% more for power (on a per-unit basis) than PacifiCorp's irrigation customers located in Oregon.

Copies of PacifiCorp's Oregon Schedule 41 and California Schedule PA-20 irrigation rate tariffs are contained in Appendix F.

In addition to its standard Schedule 41 and Schedule PA-20 irrigation rate tariffs, PacifiCorp has also established two additional pilot rate schedules in Oregon and one pilot rate schedule in California under which irrigation customers can voluntarily take service under. Schedule 215 is PacifiCorp's Oregon Time of Use irrigation tariff whereby customers can reduce their overall power costs by shifting irrigation pumping loads off of certain "on-peak" hours of the day when PacifiCorp experiences its highest daily peak load demand for electricity. PacifiCorp's California customers can elect to take service under a similar Time of Use tariff (Schedule PA-115). In addition, Oregon customers can also elect to take service under PacifiCorp's Schedule 105 Irrigation Load Control tariff; under this tariff PacifiCorp makes dollar payments to customers that have the flexibility to quickly reduce their electricity usage when requested by PacifiCorp.

[32] The vast majority of Reclamation's power purchases from PacifiCorp – approximately 99.6% in 2017/2018 - were associated with facilities that are located in Oregon.

[33] For example, PacifiCorp irrigation customers located in California are not eligible to receive the BPA Residential Exchange Credit.

## Average Cost of Power under PacifiCorp's Irrigation Rate Tariffs

While PacifiCorp's Oregon Schedule 41 and California Schedule PA-20 irrigation rate tariffs contain useful information, these schedules alone do not indicate what the average per-unit cost of power will be (measured in ¢/kWh) for customers located in Oregon or California. In order to quantify per-unit power costs using PacifiCorp's irrigation rate tariffs, one also needs to make some assumptions regarding *power usage* and how that usage varies through time. For larger pumping loads in particular, the loads' monthly capacity factor – the ratio of the pump's average power consumption divided by the pump's maximum power consumption – is a key driver in what the monthly average per-unit cost of power will be.

Another reason not to derive average per-unit power costs solely from PacifiCorp's irrigation rate schedules is that these base tariffs do not include the additional rider charges and credits that will ultimately show up on an irrigation customer's monthly power bill. Also, some of these rider charges are regularly adjusted even though the base tariff charges may remain unchanged.

Therefore, for the above stated reasons, the PCB Analysis Team relied upon data sources in addition to PacifiCorp's irrigation rate tariffs in order to quantify the average per-unit cost of power to irrigation customers located in Oregon and California. In particular, PacifiCorp regularly publishes "Price Summary" reports which contain not only each rate tariff's base pricing components but also include all of the applicable rider charges/credits as well. Also, when PacifiCorp makes a general rate case filing (in either Oregon or California), these filings contain historical and forecasted information regarding the total amount of PacifiCorp load that is served under each individual rate tariff.

Combining the information contained in PacifiCorp's 2014 Oregon General Rate Case, PacifiCorp's 2019 California General Rate Case, and the Price Summaries for the Oregon Schedule 41 and California Schedule PA-20 irrigation rate schedules, the PCB Analysis Team derived the average per-unit cost of power for PacifiCorp's irrigation/drainage customers; these figures are summarized in Table 10-2.

Table 10-2. PacifiCorp Average Per-Unit Irrigation/Drainage Costs 2017-2018

| Year | Oregon Average Per-unit Power Cost (¢/kWh) | California Average Per-unit Power Cost (¢/kWh) |
|---|---|---|
| 2017 | 11.044 | 15.417 |
| 2018 | 11.029 | 15.476 |

## Power Use for Irrigation in the Upper Klamath Basin

When developing the CAPP Report, Reclamation requested that PacifiCorp assemble and provide information regarding historical power usage in the Upper Klamath Basin

for irrigation and drainage purposes. In response to this request, PacifiCorp provided high-level statistics regarding annual power usage and the annual peak load demand in the Klamath Basin

across the period 1992 – 2013 for each of the three sectors; this information is shown in Figure 10-1.

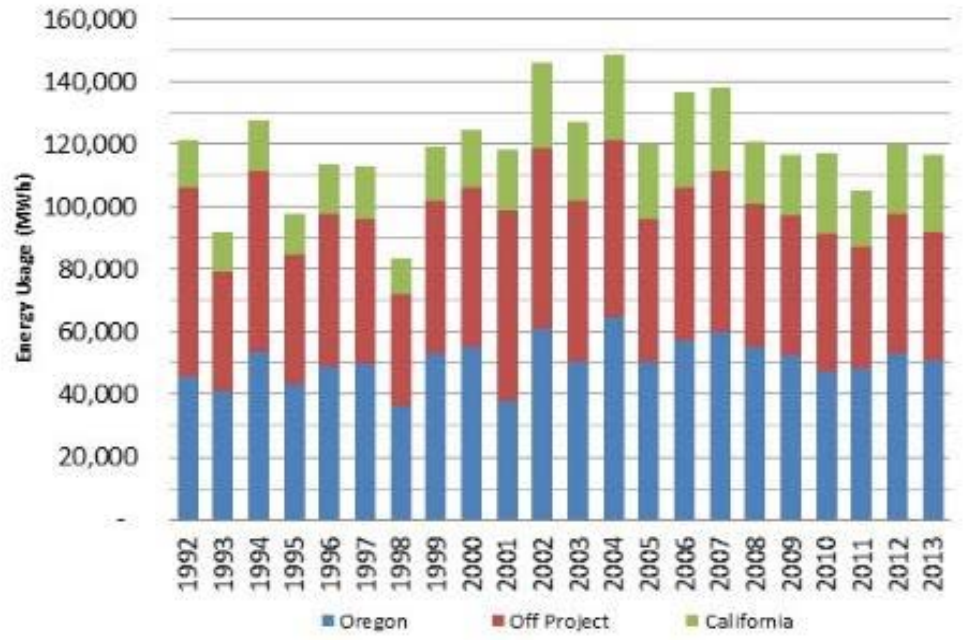


Figure 10-1. Annual Irrigation Power Usage in the Upper Klamath Basin, 1992-2003

The annual average power usage and peak power demand for each sector across the period 1992 – 2013 is summarized in Table 10-3.

Table 10-3. Annual Average Power Usage and Peak Power Demand in the Upper Klamath Basin 1992-2013

| Sector | Energy Use (kWh) | Peak Power Demand (KW) |
|---|---|---|
| Oregon On-Project | 52,000,000 | 47,000 |
| Oregon Off-Project | 44,000,000 | 30,000 |
| Oregon Total | 96,000,000 | |
| California On-Project | 22,000,000 | 29,000 |
| Project Total | 1186,000,000 | |

## Power Costs in the Upper Klamath Basin for Irrigation and Drainage

As previously mentioned, the per-unit cost of power for irrigation and drainage in the Upper Klamath Basin is not uniform but rather falls into three separate sectors. However, while PacifiCorp provided Reclamation with annual power usage information for the Upper Klamath

Basin broken down into these three sectors for use in the CAPP Report, PacifiCorp did not provide similar information regarding the historical *power costs* paid by water users in the Basin following the termination of the 1956 long-term purchase power agreements in 2006.

During calendar years 2017 and 2018, power costs in the Upper Klamath Basin were a function of the charges contained in PacifiCorp's Oregon and California retail irrigation rate tariffs, plus the applicable rider charges, that were in place during that time (as shown above in Table 10.3). Power costs for water users located in the Klamath Basin can therefore be reasonably determined by first computing the average per-unit cost of power for irrigation/drainage customers located in PacifiCorp's Oregon and California service territories and then making appropriate adjustments to reflect known local conditions. In particular, Reclamation's actual 2017 – 2018 cost for power in operating the Klamath Project can be incorporated into the computations for On-Project water users. In addition, actual 2017 – 2018 power costs and usage for several of the larger irrigation districts in the Project have been incorporated into these calculations as well.[34]

Per-unit power costs for the three sectors of irrigation and drainage customers located in the Upper Klamath Basin are summarized in Table 10-4.

Table 10-4. Per-Unit Irrigation/Drainage Power Costs in the Upper Klamath Basin 2017-2018

| Year | Oregon On-Project Average Per-Unit Power Cost (¢/kWh) | Oregon Off-Project Average Per-Unit Power Cost (¢/kWh) | California On-Project Average Per-Unit Power Cost (¢/kWh) | Combined Klamath Basin Average Per-Unit Power Cost (¢/kWh) |
|---|---|---|---|---|
| 2017 | 11.103 | 11.044 | 15.031 | 11.814 |
| 2018 | 11.066 | 11.029 | 15.443 | 11.868 |
| Weighted Average | 11.085 | 11.036 | 15.237 | 11.841 |

[34] Actual 2017 and 2018 power cost and usage information were provided by the Klamath Irrigation District, the Klamath Drainage District, the Landell Valley Irrigation District, the Shasta View Irrigation District, the Malin Irrigation District, and the Tulelake Irrigation District.

# Chapter 11 Computation of Irrigation/Drainage Power Costs in the Similar Projects

## Overview

The definition of the PCB in the Enhancement Act indicates that the PCB is to represent the net delivered cost of power associated with irrigation pumping and drainage activities as measured across the universe of the identified Similar Projects. The PCB Analysis Team further clarified that the PCB should be a single per-unit power cost figure referenced to the specific historical time period from which the supporting data was collected.

As has been previously discussed in multiple chapters of this Report, the calculation of the PCB first required that a large amount of data and information be located and assembled from many different sources for each of the individual five Similar Projects. In particular, since a majority of the Similar Projects have more than one local electric utility provider and that some irrigation districts purchase power under Project-use Rates but many do not, per-unit irrigation and drainage power costs (as measured in ¢/kWh) tend to vary across different sub-areas within each project's overall boundaries.

This patchwork of different per-unit power costs within a single project's area resulted in a need for the Team to develop a weighed averaging methodology in order to aggregate all of the per-unit power costs from each individual Similar Project sub-area into one overall representative PCB figure. This is due to the fact that the multiple sub-areas contained within each Similar Project's exhibit large variations in overall annual irrigation and drainage power usage. In other words, in the calculation of the PCB, sub-areas that have higher overall irrigation-related power usage are weighted to a greater degree than sub-areas with lower power usage.

## Average Irrigation Power Cost Calculation Methodology

As was previously described in Chapter 7, the initial methodology identified by the PCB Analysis Team for computing the average irrigation power cost in each Similar Project was to locate detailed power cost and usage information at three different levels: 1) the Reclamation/project level, 2) the irrigation district level, and 3) the on-farm customer level. All of this information would then be aggregated in order to derive the weighted average cost of power for irrigation and drainage in each Similar Project.

The required information desired for this method was not publicly available for the majority of the irrigation districts located within the five Similar Projects. However, the Team recognized that irrigation districts that do not receive Project-use Power purchase power for district-level pumping/drainage uses from their local electric utility provider under those utilities' retail irrigation rate tariffs. Furthermore, when utilities report their overall annual irrigation power revenue and power usage figures, the figures include all customer in the irrigation class (which includes both irrigation districts and individual on-farm water users).

Therefore, given the lack of detailed power cost data being available for the majority of the irrigation districts located in the Similar Projects, the PCB Analysis Team developed an alternate "two category" methodology for the derivation of the average power costs in each of the Similar Projects; this approach utilized power costs and usage data for Federal Project-use Power (category 1), and local utility provider power (category 2). In this fashion, the average cost of power for irrigation and drainage purposes in each Similar Project could still be reasonably determined using publicly available information.

## Average Power Costs for Project-Use Power

As was previously described in Chapter 8, there are three different Federal Project-use Power Rates in effect in the five Similar Projects under which Reclamation and a limited set of irrigation districts purchase power for irrigation and/or drainage purposes. However, some of these Project-use Power purchases also have associated transmission costs that are in addition to the base Project-use Power Rates.

The total annual costs for Project-use Power and the associated total annual irrigation/drainage usage for each of the five Similar Projects was assembled for calendar years 2017 and 2018 using data that was supplied by Reclamation. Next, the average annual cost and average annual irrigation usage figures across the two-year data period were computed. Finally, the per-unit cost of Project-use Power in each Similar Project was derived by dividing the average cost figure by the average usage figure. The results of these computations are shown in Table 11-1.

Table 11-1. Federal Project-Use Power Costs in the Similar Projects, 2017-2018.

| Project | 2017/2018 Average Project-use Power Cost (¢/kWh) |
|---|---|
| Boise | 3.165 |
| Columbia Basin | 0.655 |
| Minidoka | 3.497 |
| Owyhee | 3.153 |
| Yakima | 2.231 |

Note: The above figures include transmission-related costs.

## Average Irrigation Power Costs for the Local Electric Utilities

The list of individual electric utilities that serve the majority of the irrigation/drainage loads located in the five Similar Projects were previously summarized in Table 11-2. For each of these twelve utilities, the total annual revenues earned from sales to irrigation customers and the associated total annual irrigation/drainage usage was assembled for calendar years 2017 and 2018 using the various data sources that were described in Chapter 9. If necessary, the publicly-reported total annual revenue figures for individual utilities were adjusted so that all identifiable "rider" charges and credits were included in the totals, as per the Enhancement Act's directive that the PCB should be based upon the "average net delivered cost of power".

Next, the average annual revenue and average annual irrigation usage figures across the two-year data period were computed. Finally, the per-unit cost of power for each utility was derived by dividing the average revenue figure by the average usage figure. The results of these computations are shown in Table 11-2 below.

Table 11-2. Average Irrigation/Drainage Per-Unit Power Costs for Electric Utilities That Serve Load in One or More Similar Projects 2017-2018

| Similar Project | Local Utility Provider | 2017/18 Average Annual Total Service Territory Irrigation Revenue ($) | 2017/18 Average Annual Total Service Territory Irrigation Usage (Mwh) | 2017/18 Average Per-Unit Service Territory Irrigation Rate (¢/kWh) |
|---|---|---|---|---|
| Boise | Idaho Power – ID Rates | 294,649,458 | 3,618,807 | 8.142 |
| Columbia Basin | Avista Corp – WA Rates | 25,318,000 | 291,615 | 8.682 |
| Columbia Basin | Big Bend Electric Coop | 52,843,000 | 851,210 | 6.208 |
| Columbia Basin | Franklin County PUD | 16,418,806 | 219,777 | 7.471 |
| Columbia Basin | Grant County PUD | 49,865,000 | 1,199,113 | 4.158 |
| Minidoka | Fall River Elec Coop – ID Rates | 16,773,000 | 208,432 | 8.047 |
| Minidoka | Idaho Power – ID Rates | 294,649,458 | 3,618,807 | 8.142 |
| Minidoka | PacifiCorp – ID Rates | 101,270,526 | 1,067,031 | 9.491 |
| Owyhee | Idaho Power – ID Rates | 294,649,458 | 3,618,807 | 8.142 |
| Owyhee | Idaho Power – OR Rates | 13,381,542 | 128,193 | 10.439 |
| Yakima | Benton County PUD | 45,342,000 | 830,415 | 5.460 |
| Yakima | Benton REA | 24,974,000 | 399,251 | 6.255 |
| Yakima | Columbia REA – WA Rates | 30,591,300 | 414,695 | 7.377 |
| Yakima | Kittitas County PUD | 1,593,406 | 15,410 | 10.340 |
| Yakima | PacifiCorp – WA Rates | 25,515,559 | 297,491 | 8.577 |
| Yakima | Puget Sound Energy | 2,530,886 | 32,019 | 7.904 |

Note: The total revenue and usage figures shown above incorporate irrigation/drainage loads that are located both inside, and outside, of the indicated Similar Projects.

## Defining Similar Project Sub-Areas

As has been previously described in various portions of this Report (and as summarized in Table 11-2), four out of the five Similar Projects have more than one local power provider that serves irrigation loads located within the project's boundaries.[35] Therefore, in order to derive the net average power cost for irrigation and drainage across the entirety of the project's area, it is first necessary to define multiple *power cost sub-areas* that are located within the project's overall boundaries. Essentially, each sub-area represents the portion of the local utility provider's service territory that overlaps with a Similar Project's area.

Once the various sub-areas were defined, the PCB Analysis Team then utilized a series of different datasets and mapping applications to estimate the area (measured in acres) of each of the identified sub-areas. As is shown later in Chapter 12, these area figures were then utilized to

[35] The one exception is the Boise Project which is served primarily by Idaho Power.

estimate the amount of the irrigation/drainage power loads that were being served within the Similar Project by each of the individual local utility providers. Appendix I contains the agricultural service territory areas ratios for each of the local utility providers; these sets of figures were also utilized as part of the usage-weighted average cost of power calculations for each of the Similar Projects.[36]

## Computation of Average Irrigation Power Costs in the Similar Projects

Once the primary datasets described in the previous chapters were assembled, the average per-unit power cost for irrigation and drainage purposes in each of the five Similar Projects was computed using the following multi-step process:

Step 1 - For each local utility provider, the utility's total agricultural service territory area was estimated (as described in Chapter 11 and Appendix I).

Step 2 - For each local utility provider, the area of each utility's sub-area located within a Similar Project was estimated (as described in Chapter 11 and Appendix I).

Step 3 – The total irrigation power costs and total irrigation power usage for each of the local utility providers were scaled down by the ratio of the area determined in Step 2 divided by the area determined in Step 1. The resultant figures are annual irrigation power costs (in dollars) and annual irrigation usage (in kWh) that are referenced to the Similar Project's total area.

It should be noted that this scaling process did not change the per-unit cost of power (in cents/kWh) for any of the utility providers (as was previously shown in Table 11-2).[37]

Step 4 – The usage-weighted average cost of power for irrigation and drainage in each Similar Project was then computed by summing the power costs (in dollars) for Federal Project-use Power and the scaled power costs (in dollars) from Step 3 for all of the local utility providers, divided by the sum of the Project-use Power usage (in kWh) and the scaled power usage (in kWh) from Step 3 for all of the local utility providers.

## Summary of Similar Project Power Costs

The per-unit weighted average cost of power used for irrigation and drainage in each of the five Similar Projects for calendar years 2017 and 2018 are summarized below in Table 11-3.

[36] In general, the referenced area estimates were derived utilizing a combination of information provided by the individual utilities and Reclamation, information extracted from the USDA's NASS database, and the use of several mapping applications.

[37] Federal Project-use Power costs and usage in the Similar Projects do not need to be scaled since these figures are already referenced to each Similar Project's total area.

Table 11-3. Average Power Costs for Irrigation and Drainage Use in the Similar Projects 2017-2018

| Project | 2017/18 Average Per-unit Power Cost (¢/kWh) |
|---|---|
| Boise | 7.248 |
| Columbia Basin | 3.959 |
| Minidoka | 6.613 |
| Owyhee | 5.740 |
| Yakima | 6.938 |

## Key Observations

As can be seen from the figures contained in Table 11-3, there is a wide range of irrigation-related power costs across the five Similar Projects. In particular, the irrigation power costs for the Columbia Basin Project are significantly lower than the costs for the other four Similar Projects. This is primarily due to two factors: 1) The Columbia Basin Project receives relatively low-cost Federal Project-use Power generated at Grand Coulee Dam that is not available to the other Similar Projects, and 2) the majority of the end-use irrigation customers located in the Columbia Basin Project purchase their retail power supplies from Grant County PUD, Franklin County PUD or Big Bend Electric Cooperative, all of which are POUs with relatively low retail irrigation rates as compared to other Pacific Northwest utility suppliers.

# Chapter 12 Computation of the PCB

## Overview

As defined in the Enhancement Act and clarified by the PCB Analysis Team, the PCB is to be a single figure calculated across the universe of identified Similar Projects. In this fashion, the power costs associated with irrigation pumping and drainage activities in the Upper Klamath Basin (including both On-Project and Off-Project covered water users) can be directly compared against a representative sample of other similarly situated water users located in other Reclamation project areas in the Pacific Northwest Region.

## Combining Power Costs in the Five Similar Projects to Derive the PCB

Total irrigation/drainage power costs (measured in dollars), total annual power usage (measured in kWh) and average per-unit power costs (measured in ¢/kWh) for each of the five Similar Projects were previously shown in Table 11-3. The PCB was then calculated by summing these individual power costs (in dollars) across all five Similar Projects, divided by the sum of the total power usage (in kWh) across the Similar Projects. These calculations and the final PCB value are shown below in Table 12-1.

Table 12-1. Calculation of the Power Cost Benchmark

| Similar Project | 2017/18 Average Power Cost ($) | 2017/18 Average Power Usage (Mwh) | 2017/18 Average Per-unit Power Cost (¢/kWh) |
|---|---|---|---|
| Boise | 15,761,036 | 217,463 | 7.248 |
| Columbia Basin | 18,449,513 | 466,025 | 3.959 |
| Minidoka | 52,411,355 | 792,545 | 6.613 |
| Owyhee | 6,183,432 | 107,720 | 5.740 |
| Yakima | 16,659,885 | 240,134 | 6.938 |
| Total | 109,465,222 | 1,823,886 | 6.002 |

As can be seen from 2, the PCB as derived across the five Similar Projects is 6.002 ¢/kWh. As has been previously described in other portions of this Report, this figure is based upon an average of irrigation and drainage-related power costs and power usage figures in the five identified Similar Projects for calendar years 2017 and 2018.

# Chapter 13 Irrigation/Drainage Power Cost Comparison

## Water User Sectors in the Upper Klamath Basin

Several different comparisons between power costs paid by irrigation and drainage customers located in the Upper Klamath Basin versus the power costs paid by water users in the five Similar Projects (as represented by the PCB) can be made. In particular, as was previously described in Chapter 10, power costs for pumping and drainage purposes in the Upper Klamath Basin are not uniform across all water users located in the Basin but rather fall into three discrete sectors: 1) Oregon customers that receive water deliveries from Reclamation's Klamath Project, 2) Oregon customers that do not receive water deliveries from the Klamath Project but are classified as "covered users" in the Enhancement Act, and 3) California customers that receive water deliveries from the Klamath Project.

## Power Cost Comparisons in the Upper Klamath Basin as Compared to the PCB

Table 13-1 provides a summary comparison of the PCB against the average power costs for 2017 and 2018 for each of the three sectors of Upper Klamath Basin irrigation and drainage customers.

Table 13-1. Comparison of 2017/2018 Power Costs for Irrigation and Drainage in the Upper Klamath Basin Against the PCB

| Sector | 2017/18 Average Per-unit Power Cost (¢/kWh) | Difference from the Similar Project PCB (%) |
|---|---|---|
| Similar Project PCB | 6.002 | |
| Oregon On-Project | 11.085 | +84.7 |
| Oregon Off-Project | 11.036 | +83.9 |
| California On-Project | 15.237 | +153.9 |
| Total Upper Klamath Basin | 11.841 | +97.3 |

## Power Cost Comparisons for Reclamation Irrigation/Drainage Loads Located in the Klamath Project and the Five Similar Projects

As has been discussed in various chapters of this report, the Klamath irrigation Project does not receive, and has never received, Federal Project-use Power to operate Reclamation's project-level pumping and drainage facilities. Prior to 2006, Reclamation purchased power to operate its project-level facilities from PacifiCorp under the 1917 and 1956 purchased power agreements.

Following the termination of these agreements in 2006 Reclamation has been purchasing power from PacifiCorp under full tariff rates in effect in Oregon and California.

Using some of the same datasets that were utilized in the computation of the PCB, it is also possible to directly compare the average power rate that Reclamation pays to operate pumping and drainage facilities in the Klamath Project against the average rate that Reclamation and select irrigation districts pay for Federal Project-use Power in the five Similar Projects. This comparison is shown in Table 13-2.

Table 13-2. Comparison of Reclamation's Klamath Project Power Costs Against the Average of Federal Project-use Costs in the Five Similar Projects

| Project | 2017/18 Average Per-unit Project-use Power Cost (¢/kWh) |
|---|---|
| Klamath | 12.868 |
| Similar Projects | 2.611 |

As can be seen from Table 13-2, Reclamation's own 2017/2018 per-unit power costs in the Klamath Project were almost *five times higher* than the average rate paid for Federal Project-use Power by Reclamation and the eligible irrigation districts in the five Similar Projects.

# Chapter 14 Conclusions

This Power Cost Benchmark Report was prepared by the United States Bureau of Reclamation as the Secretary of the Interior's response to certain provisions outlined in the America's Water Infrastructure Act of 2018 regarding the reduction of power costs to agricultural water users in the Upper Klamath River Basin. The fundamental purpose of the PCB is to provide an objective measure by which power costs associated with irrigation and drainage use in the Upper Klamath Basin can be directly compared to such costs in other similarly situated Reclamation projects that are located in the Pacific Northwest Region. This information, in turn, can be utilized by various stakeholders and policy makers when addressing potential actions to reduce power costs for On-Project and Off-Project covered water users in the Basin.

The process by which the PCB Analysis Team first identified, reviewed and ultimately selected five specific Reclamation Similar Projects to be used in deriving the PCB is described in Chapter 8. Historical power cost and electrical usage datasets for Calendar Years 2017 and 2018 were then assembled for twelve different electric utilities that supply power to irrigation and drainage customers located in one or more of the Similar Projects. In addition, information was also collected regarding the purchases of Federal Project-use Power in each of the Similar Projects by Reclamation and eligible irrigation districts.

Historical power costs for covered water users in the Upper Klamath Basin during Calendar Years 2017 and 2018 were computed using a variety of information sources, including actual PacifiCorp monthly bills provided by Reclamation and several of the Klamath Project irrigation districts. Average per-unit power costs were derived for each of three "sectors" of covered water users located in the Basin as was described in Chapter 10.

Utilizing the above referenced power cost and usage datasets, the average per-unit cost of power for irrigation and drainage use was computed for each individual Similar Project; this process is described in Chapter 11. The PCB was then derived in Chapter 12 by computing the usage-weighted power cost for irrigation and drainage use across all five Similar Projects. As was shown in Table 12-2, the Power Cost Benchmark was determined to be 6.002 ¢/kWh. This figure – which incorporates low-cost Federal Project-use Power that is available in each of the five Similar Projects but not in the Klamath Project – was then compared against the cost of power to covered users in the Basin, the results of which are summarized in Table 13.1.

The final results of the PCB Analysis indicate that during the period 2017 – 2018, per-unit power costs for covered water users in the Upper Klamath Basin ranged between 83.9% and 153.9% higher than the Power Cost Benchmark. These results demonstrate that power costs to agricultural water users in the Basin are moderately to significantly higher than for comparable users located in other similarly situated Reclamation irrigation projects located in the Pacific Northwest region.

# Abbreviations and Acronyms

| | |
|---|---|
| $/MWh | Dollars Per Megawatt-Hour |
| ¢/kWh | Cents Per Kilowatt-Hour |
| APM | Affordable Power Measures |
| AWIA | America's Water Infrastructure Act of 2018 (Pub L. 115-270) |
| BPA | Bonneville Power Administration |
| CAPP | Comprehensive Affordable Power Plan |
| CBP | Columbia Basin Project |
| COPCO | California Oregon Power Company |
| Corps | U.S. Army Corps of Engineers |
| Draft PCT Report | Draft Klamath Power Cost Target Study Report |
| EIA | U.S. Energy Information Administration |
| FERC | Federal Energy Regulatory Commission |
| GAO | Government Accountability Office |
| IOUs | Investor-owned Utilities |
| IRP's | Integrated Resource Plans |
| KBRA | Klamath Basin restoration Agreement |
| kW | Kilowatt |
| kWh | Kilowatt-Hour |
| KWUA | Klamath Water Users Association |
| M | Million |
| Measures | Potential Power Cost Savings Measures |
| MWh | Megawatt-Hour |
| NASS | U.S. Department of Agriculture's National Agricultural Statistical Service |
| O&M | Operations and Maintenance |
| PCB | Power Cost Benchmark |
| PF | Priority Firm |
| PMA | Power Marketing Administration |
| PNW | Pacific Northwest |
| POUs | Publicly-owned Utilities |
| Reclamation | Bureau of Reclamation |
| ResEx | Residential Exchange Program |
| USBR | United States Bureau of Reclamation |
| U.S. EIA | United States Energy Information Administration |

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# Second Table of Contents

Page

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# Appendix A – Chapter 1

## Power Cost Benchmark Analysis Team members/organization list

# Appendix B – Chapter 2

## Synopsis of the September 10, 2019 Public Stakeholder Meeting

# Appendix C – Chapter 3

## Informational brochures for the Similar Projects

# Appendix D – Chapter 4

## Electric Utility Service Territory maps for the Similar Projects

# Appendix E – Chapter 5

## Supplemental detailed descriptions of the Similar Project

# Appendix F – Chapter 6

# PacifiCorp’s currently-in-effect Oregon and California irrigation/drainage rate tariffs

# Appendix G – Chapter 7

# PacifiCorp's 2017 – 2018 Oregon and California Price Summaries for irrigation/drainage customers

# Appendix H – Chapter 8

## The Power Cost Survey Form

# Appendix I – Chapter 9

# Annual average 2017 – 2018 irrigation/drainage power cost summaries for the electric utilities that serve load in one or more Similar Projects

# Appendix J – Chapter 10

## Annual average 2017 – 2018 irrigation/drainage power cost calculations for the Similar Projects

# Appendix K – Chapter 11

# Irrigation/drainage service rate schedules for electric utilities that serve load in one or more Similar Project areas

# Appendix L – Chapter 12

# List of documents referenced in the PCB Report