# Department of Commerce

Innovation is in our nature.

commerce.wa.gov/eia

**Washington State Energy Independence Act**

**Application for Advisory Opinion and Renewable Energy Facility (WREGIS) Certification**

***All information provided in this application or any supplemental or additional materials is subject to public disclosure.***

FACILITY NAME: **Chelan Hydroelectric Project**
WREGIS Generating Unit ID (if already registered): **W7076**

A separate Washington application is required for each generating unit with a separate WREGIS GU ID. Applicant must select Washington in WREGIS generating unit registration.

## Section 1: Agency Action Requested

☒ Advisory Opinion and WREGIS Certification ☐ Advisory Opinion Only

## Section 2: Applicant Information

Applicant Contact: **Melissa Lyons** Title: **Trader/Analyst**
Applicant Phone: **509.661.4369**
Applicant E-mail: **melissa.lyons@chelanpud.org**
Applicant Company Name: **Public Utility District No. 1 of Chelan County**
Company Address: **327 N. Wenatchee Avenue**
City: **Wenatchee** State/Province: **WA**
Zip Code: **98801** Country: **USA**

## Section 3: Facility Information

**Facility Owner**

Name of Facility Owner:
**OR** ☒ The Facility Owner is the same as the Applicant.
Address:
City/State/ZIP:
Contact Name, Phone, and Email:

**Facility Identification and Location**

Unit Name: **A2**
Facility Name: **Chelan Hydroelectric Project**
Unit location (street address, legal description, or GPS coordinates):
**200 Powerhouse Road, Chelan Falls, WA 98817**
City: **Chelan Falls** County: **Chelan**
State/Province: **WA** Zip: **98817** Country: **USA**

Provide a description of the facility.
**The project consists of Lake Chelan, a 40-foot-high 490-foot-long concrete gravity dam, a 2.2-mile-long penstock, and a powerhouse containing two turbines/generators.**

**Facility Identification Numbers**

WREGIS Generating Unit ID: **W7076** Other External ID:

EIA Utility Code: **3413** EIA Plant Code: **6424**

## Section 4: Facility Eligibility

### A. Facility Profile

Nameplate Capacity (MW): **29.6**

If this value will change, please explain:

Commercial Operation Date (COD): **08 / 01 / 1928**

Is your facility considered repowered by WREGIS? ☐ Yes ☒ No

If yes, please explain:

### B. Facility Fuel

Indicate each energy source used by the facility. For definitions, refer to RCW 19.285.030. For multi-fuel generating facilities indicate all fuels used.

| | | | |
|---|---|---|---|
| ☐ | Wind | ☐ | Wave power |
| ☐ | Solar energy | ☐ | Ocean power |
| ☐ | Geothermal energy | ☐ | Tidal power |
| ☐ | Landfill gas | ☐ | Gas from sewage treatment facility |
| ☐ | Biomass energy (must complete Section 5) | ☐ | Biodiesel fuel (must complete Section 6) |
| ☒ | Water (must complete Section 7) | ☐ | Other (please specify): |

Will the facility use any fossil fuel or other non-qualifying fuel? ☐ Yes ☒ No

- Type of fossil fuel or other non-qualifying fuel:
- Average annual amount of non-qualifying fuel used (percent of net heat input):

## Section 5: Biomass Energy Supplement (complete only if "biomass energy" is checked in Section 4)

**Allowed Fuel Sources.** Indicate each source of biomass energy used by the facility.

| | | | |
|---|---|---|---|
| ☐ | Organic by-products of pulping and the wood manufacturing process | ☐ | Food waste and food processing residuals |
| ☐ | Animal manure | ☐ | Liquors derived from algae |
| ☐ | Solid organic fuels from wood | ☐ | Dedicated energy crops |
| ☐ | Forest or field residues | ☐ | Yard waste |
| ☐ | Untreated wooden demolition or construction debris | | |

**Prohibited Fuel Sources.** The following materials will NOT be used as a source of biomass energy by the facility.

| | | | |
|---|---|---|---|
| ☐ | Wood pieces that have been treated with chemical preservatives such as creosote, pentachlorophenol, or copper-chrome-arsenic | ☐ | Wood from old growth forests |
| | | ☐ | Municipal solid waste |

**Legacy Biomass.** The Washington Energy Independence Act allows a biomass energy facility commencing operation before March 31, 1999 to qualify as an eligible renewable resource in certain circumstances. Contact Commerce to obtain application requirements.

**Section 6: Biodiesel Fuel Supplement** (complete only if "biodiesel fuel" is checked in Section 4)

The biodiesel fuel used by the facility meets each of the identified conditions:

| | |
|---|---|
| ☐ | The fuel (a) is a mono alkyl ester of long chain fatty acids derived from vegetable oils or animal fats for use in compression-ignition engines and (b) meets the requirements of the American society of testing and materials specification D 6751 in effect as of January 1, 2003. |
| ☐ | The fuel is NOT from crops raised on land cleared from old growth or first-growth forests where the clearing occurred after December 7, 2006. |

**Section 7: Water/Hydroelectric Power** (complete only if "water" is checked in Section 4)

The facility uses water as a fuel in the following manner:

| | | |
|---|---|---|
| ☒ | **Incremental Hydro.** Incremental electricity produced as a result of efficiency improvements completed after March 31, 1999, to hydroelectric generation projects owned by a qualifying utility and located in the Pacific Northwest where the additional generation does not result in new water diversions or impoundments. | |
| | Date efficiency improvement completed: **4/30/2010** | |
| | Method of measuring incremental generation: | |
| | ☐ | Incremental generation is separately metered or measured. |
| | ☐ | Incremental generation is modeled each year based on actual stream flows. |
| | ☒ | Incremental generation is modeled as a fixed percentage of total generation.<br>Fixed percentage: **5.42%** |
| | ☐ | Incremental generation is modeled as a fixed generation amount.<br>Fixed amount: megawatt-hours |
| | Note: If any box but the first is checked, the facility must register in WREGIS as a multi-fuel facility. Non-incremental generation will be classified as Large Hydro (LHN) and excluded from certificate creation. | |
| ☐ | **Canal or pipe.** Hydroelectric generation from a project completed after March 31, 1999, where the generation facility is located in irrigation pipes, irrigation canals, water pipes whose primary purpose is for conveyance of water for municipal use, and wastewater pipes located in Washington where the generation does not result in new water diversions or impoundments. | |

**Section 8: Eligibility for Washington Multipliers (Optional)**

The facility qualifies for the following multipliers under the Washington Energy Independence Act:

| | |
|---|---|
| ☐ | **Distributed Generation.** The facility has a generating capacity of 5 MW or less and is not part of any integrated cluster of facilities with an aggregate generating capacity of 5 MW or more. |
| ☐ | **Apprentice Labor.** The facility commenced operation after December 31, 2005 and in construction used an apprenticeship program approved by the Washington State Apprenticeship and Training Council. |

**NOTE:** Commerce requests optional multiplier eligibility from facility owners for informational purposes only. Owners seeking certification of a facility as eligible for a multiplier should contact Commerce for application requirements.

**Section 9: Reservation**

The Washington Department of Commerce makes a determination of resource eligibility under the Washington Energy Independence Act based on the information provided by the applicant and does not independently verify that information. An applicant must promptly notify Commerce of any changes to the information submitted for certification that may affect the facility's eligibility. Commerce reserves the right to modify or withdraw a designation if it determines that the information supplied by the applicant was incomplete or inaccurate.

## Section 10: Attestation

I declare that the information provided in this application and any supplemental forms and attachments are true and correct to the best of my knowledge, that the information contained in this submission is consistent with information on file with WREGIS unless otherwise indicated, that no information materially affecting the facility's eligibility has been withheld, and that I am authorized to file this submission on the facility owner's behalf.

Signature:
Date Signed: **7/5/18**
Authorized Officer/Agent: **Gregg Carrington**
Officer Title and Company: **Managing Director- Energy Resources**
Name of Facility: **Chelan Hydroelectric Facility**

## Application Checklist for Submission

Applicants must select the Washington program administrator in the generating unit's WREGIS static data.
Applicants should ensure that the following documents are provided:

1. Electronic copy of entire application, including a signed attestation page.
2. WREGIS "static data" if the facility is already registered in WREGIS. A printout of your generator account profile screen in WREGIS.
3. Optional project background documentation. Background documentation can be submitted or published in regulatory settings (FERC or state commission filings) or informal forums (websites, articles or factsheets).
4. Payment of advisory opinion fee of **$1,250**. A separate application and application fee are required for each generating unit. However, if a facility owner has multiple WREGIS generating unit IDs for a single facility and all the static characteristics of the facility (other than the generating capacity) are identical, it may request that Commerce treat the combined generating units as a single application. The owner must document at the time of application that all GU IDs are part of a single facility in a single location. If GU IDs are added later, a separate application will be required.

To submit your facility for certification, e-mail the application and any supplemental materials listed above to (wregis@commerce.wa.gov). Submit payment of the advisory opinion fee to:

Department of Commerce
Attn: State Energy Office
P.O. Box 42525
Olympia, WA 98504-2525

Commerce will post each application on its website. Applications are subject to a public comment period.

## Advisory Opinion and WREGIS Certification (to be completed by Commerce)

It is the opinion of the Washington Department of Commerce that the facility identified in this application meets the statutory legal standard for an eligible renewable resource as defined in RCW 19.285.030, based on the factors set out below The facility will be designated in WREGIS as an eligible renewable resource under the Washington Energy Independence Act:

| Facility Name: | Chelan Hydroelectric Project A2 | WREGIS GU ID: | W7076 |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| [X] | The fuel source for the facility is identified in RCW 19.285.030 as renewable energy: | | | |
| | [ ] | Wind | [ ] | Wave, ocean, or tidal power |
| | [ ] | Solar energy | [ ] | Gas from sewage treatment facilities |
| | [ ] | Geothermal energy | [ ] | Biodiesel fuel |
| | [ ] | Landfill gas | [ ] | Biomass energy |
| | [X] | Water (incremental efficiency hydro) | [ ] | Water (pipe or canal) |
| [X] | The facility commenced operation after March 31, 1999, as required by RCW 19.285.030. | | | |
| [X] | The facility is located in the Pacific Northwest, or the electricity from the facility is delivered into Washington state on a real-time basis without shaping, storage, or integration services, as required by RCW 19.285.030. | | | |

Additional Provisions: Incremental generation is 5.42 percent of total generation.

Washington Certification Number: WA2018-012

**WASHINGTON DEPARTMENT OF COMMERCE**

Director or Designee — Date: 8/20/2018

# Renewable Incremental Hydro Engineering Report

## Lake Chelan Hydroelectric Project

Public Utility District No. 1 of Chelan County

New Turbines & Generators


P.U.D.
CHELAN COUNTY
POWER

March 2018

# Renewable Incremental Hydro Engineering Report

## Lake Chelan Hydroelectric Project

## TABLE OF CONTENTS

Lake Chelan Hydroelectric Project
PUD No. 1 of Chelan County- February 2018

## OVERVIEW

Public Utility District No. 1 of Chelan County (District) is providing an engineering review of the incremental energy gains that are generated from new turbines and generators at the Lake Chelan Hydroelectric Project (Lake Chelan). The incremental energy gains are eligible under both the Oregon Renewable Portfolio Standard (Oregon RPS) and Washington Renewable Portfolio Standard (Washington RPS) due to the timing and nature of the efficiency gains. The following report summarizes the engineering review and the District's analysis.

***Summary of Work***

Oregon RPS

Incremental hydro is qualified under ORS 469A.025 (4)(b), which allows hydroelectric facilities that have installed efficiency upgrades on or after January 1, 1995 to receive RPS eligible credit for the electricity attributable to the efficiency upgrades.

The District is submitting this report and supporting documentation to receive renewable credit for these efficiency gains under the Oregon RPS.

Washington RPS

Incremental hydro is qualified under RCW 19.285.030(12)(b), which allows incremental electricity produced as a result of efficiency improvements completed after March 31, 1999 to qualify as an eligible renewable resource.

The District is submitting this report and supporting documentation to register the incremental hydro efficiency gains in WREGIS in accordance with both WAC 194-37-130(3)(c)(ii) and WAC 480-109-200(7)(c).

The District performed the following work:

1. Calculated the qualified efficiency gains under both the Washington RPS and Oregon RPS at Lake Chelan using the District's Computer Hydroelectric Operations Planning Software (CHEOPS) Simulation Model.
2. Prepared a report summarizing the results.

***Project Owner***

Project owner information for Lake Chelan is summarized in the following table.

| | |
|---|---|
| Project Owner: | Public Utility District No. 1 of Chelan County, Washington |
| Street/P.O. Box: | 327 N. Wenatchee Ave. |
| City: | Wenatchee |
| State/Region: | Washington |
| Post/Zip: | 98801 |
| Country: | United States of America |
| Telephone: | (509) 663-8121 |
| Fax: | (509) 661-8155 |
| Website: | www.chelanpud.org |
| Project Representative: | John Wasniewski |
| Title: | Energy Analyst |
| Department: | Energy Planning & Trading |
| Mobile Number: | (541) 630-0375 |
| Direct Telephone: | (509) 661-4269 |
| E-mail: | John.Wasniewski@chelanpud.org |

***Site Description***

Lake Chelan

*Project Location*

The Lake Chelan Hydroelectric Project is located approximately 32 miles north of the city of Wenatchee in Chelan County, near the geographic center of Washington state. The dam is at the lower, or southeasterly end of 55-mile-long Lake Chelan, adjacent to the city of Chelan. The Powerhouse is located near the community of Chelan Falls.

*Project Description*

The Lake Chelan Project consists of (a) Lake Chelan, a 1,486-foot deep, 55-mile-long natural glacial lake that was raised 21 feet by the construction of the dam to a normal maximum water surface elevation of 1,100 feet mean sea level (msl); (b) a 40-foot-high, 490-foot-long concrete gravity dam; (c) a reinforced-concrete side discharge intake structure that is integral with the dam; (d) a 14-foot-diameter, 2.2-mile-long penstock that transitions 14 feet in diameter to 12 feet in diameter before bifurcating to tow 90-foot-long, 9-foot-diameter steel penstocks; (g) a powerhouse containing two, vertical-axis, Francis-type turbines each rated at 44,525 horsepower and connected to a 29,600-kW generator for a total nameplate capacity of 59,200 kW; and (h) a 1,700-foot-long excavated tailrace adjacent to the confluence of the Chelan River and the Columbia River that returns the project flows to the Columbia River.

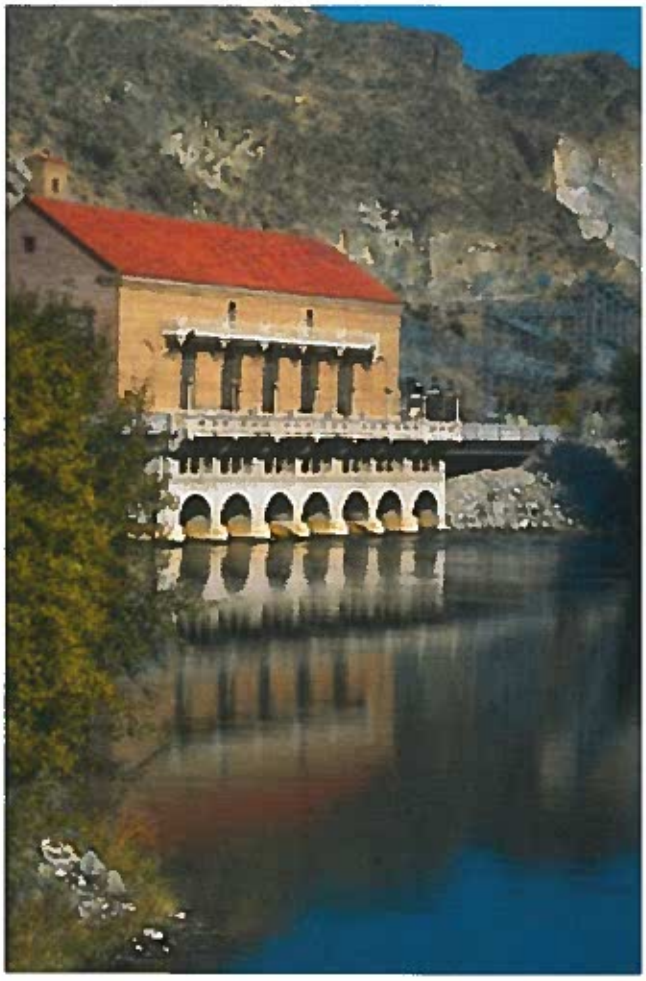

**Photo 1: Lake Chelan Powerhouse**

## ENGINEERING REVIEW

An engineering review of the revised data and incremental energy calculations is required under the Oregon RPS to modify the Lake Chelan unit efficiency gains. The Washington RPS does not require an engineering review, however the District included those efficiency gains in this review as the analyses are related and performed at the same time. John Wasniewski and Melissa Lyons, Trader/Originator, collected the data and performed the calculations which were reviewed by Professional Engineer, Brett Bickford. Between John Wasniewski and Melissa Lyons, they have over thirteen years of power management experience and have worked on incremental hydro analyses for other renewable and carbon programs. Brett Bickford has over 20 years' experience in hydro unit rehabilitation including model testing, design, construction, absolute flow measurement and index testing. Brett has also been involved with development and installation of real time unit dispatch optimization programs in hydro power plants.

## OREGON & WASHINGTON RPS ELIGIBILITY

### *Oregon RPS Summary*

The Oregon RPS requires Oregon utilities to deliver a percentage of their electricity from renewable resources by 2025. For Oregon's three largest utilities, the RPS starts at 5% in 2011, increases to 15% in 2015, 20% in 2020, and 25% in 2025. In 2016, the state standard was expanded and the state's largest utilities will now provide 50% of their electricity through renewable resources by 2040. Smaller utilities have similar but smaller requirements. Eligible resources include biomass, geothermal, hydropower, ocean thermal, solar, tidal, wave, wind, and hydrogen. Biomass and hydropower resources have conditional limitations. Facilities must be located in the Western Electricity Coordination Council (WECC).

*Hydro Eligibility*

ORS 469A.025(4)(b) states electricity generated by a hydroelectric facility may be used to comply with the Oregon RPS if the electricity is attributable to efficiency upgrades made to the facility on or after January 1, 1995. OAR 330-160-0050 further clarifies efficiency upgrades are limited to upgrades to existing generators, turbines and other Department-approved equipment changes.

Per OAR 330-160-0020, renewable energy credits (REC) must be tracked through the Western Renewable Energy Generation Information System (WREGIS).

### *Washington RPS Summary*

The Washington RPS establishes renewable energy targets as a percentage of customer load. The targets increase over time, from 3% in 2012, to 9% in 2016, to 15% in 2020. Eligible resources include water, wind, solar energy, geothermal energy, landfill gas, wave, ocean or tidal power, gas for sewage treatment plants and biodiesel fuel and biomass energy. Some of these resources have restricted eligibilities. Renewable resources must be located in the Pacific Northwest or delivered to Washington on a real-time basis.

*Hydro Eligibility*

RCW 19.285.030(12)(b) states that incremental electricity produced as a result of efficiency improvements completed after March 31, 1999, to hydroelectric generation projects owned by a qualifying utility, are an eligible renewable resource. On September 4, 2014, Commerce issued an Advisory Opinion to further clarify that operational efficiency gains (e.g. implementation of Habitat Conservation Plan) are eligible under the Washington RPS.

The use of unbundled freshwater generated RECs cannot be used for Washington RPS compliance per RCW 19.285.020(20), however the Washington Utility Transportation Commission (UTC) requires all eligible renewables be tracked through the WREGIS per WAC 480-109-200(1)(3) and under the Clean Air Rule (CAR) incremental hydro can create RECs per WAC 173-442-020(1)(r).

***Lake Chelan Eligibility***

Lake Chelan has two generating units. The first generating unit was place in commercial operation in September 1927, followed by the second unit 11 months later. The original generators were rewound in 1951 and 1952. The new generators and turbines were installed in 2009 and 2010.

The new turbines and generators are modeled in the Current Case which significantly changed the performance of the Lake Chelan Project.

The below table summarizes the commissioning dates for the new turbines and generating units and applicable modification dates.

| Lake Chelan Generating Unit | New Turbines | New Generators | OR RPS Eligible | WA RPS Eligible |
|---|---|---|---|---|
| A1 | 9/25/2009 | 9/25/2009 | Yes | Yes |
| A2 | 4/30/2010 | 4/30/2010 | Yes | Yes |

## LAKE CHELAN CHEOPS MODELING

The District used the CHEOPS™ model to calculate the incremental efficiency gain attributable to Lake Chelan. The consulting engineering firm HDR created the CHEOPS™ hydropower system simulation model as an accurate and easy-to-use tool for evaluating a wide range of physical changes (e.g. turbine upgrades) and operational constraints (e.g. minimum flows) associated with relicensing or upgrading single and multiple hydro systems. The District has used this model for the Lake Chelan Hydro project for over 10 years, including during the relicensing of the project in 2006.

The District ran five consecutive water years (2012-2016) through CHEOPS™ to determine the Base Case (old units) and Current Case (new units). The difference between the baseline generation and current generation determines the annual incremental energy gain. This approach complies with both the requirements under OAR 330-160-0050(2) and WAC 194-37-130(3)(c)(ii). Appendix A provides a summary of the key inputs and assumptions used in each model run.

***Lake Chelan Results***

The below table summarizes the average annual incremental energy gains for Lake Chelan under both the Oregon and Washington RPS using the CHEOPS™ model and the water years from 2012-2016.

Lake Chelan Hydroelectric Project
PUD No. 1 of Chelan County- February 2018

| Model Run | Ave. annual Total Lake Chelan Generation (MWh) | Lake Chelan Incremental Generation (MWh) | Energy Gain %[1] |
|---|---|---|---|
| Base Case (old units) | 389,845 | 22,343 | 5.421% |
| Current Case (new units) | 412,188 | | |

## SUMMARY

Beginning January 1, 2017, the below annual energy gain percentages will be multiplied by the actual monthly unit generation, less station service, to determine the incremental energy gain MWh to be certified as eligible for RPS compliance in both Oregon and Washington.

| WREGIS Category | Lake Chelan Efficiency Gain % |
|---|---|
| Washington RPS & Oregon RPS | 5.421% |

[1] See efficiency gain document for specific calculations.

## APPENDIX A

The District used the November 2014 version of the CHEOPS™ model to calculate the incremental efficiency gains using five consecutive water years (2012-2016). CHEOPS™ is essentially a combination of two models; the Rule Curve Module, and the Energy Module. The Rule Curve Module examines the seasonal reservoir operation to meet user-specified operational parameters. The Energy module uses the Rule Curve output and maximizes the value of the energy generated (usually prioritizing peak energy, then total energy) on a daily basis.[2] Extensive documentation is provided for all the CHEOPS™ inputs and assumptions.

### *Water years 2012-2016*

For the stream flow historical study period consisting of five consecutive water years, the District used the most recent five-year period of 2012-2016. That 5 year period is representative of dry, average, and wet water years. Those water years were run through the model via a hydrology file created using a historical water year database.

| Water Year | Total Inflows April 1 – July 31 (sfd) | % of Average Water Year |
|---|---|---|
| 2012 | 658,833 | 125% |
| 2013 | 506,230 | 96% |
| 2014 | 526,392 | 100% |
| 2015 | 334,789 | 64% |
| 2016 | 609,491 | 116% |

*Data Source - \\domain1.chelan\ccpud\shared\POWEROP\Lake Chelan\Operations - Data\Inflow - Lake Chelan Inflows

### *Key Model Constraints- Lake Chelan*

| | Baseline Pre-Modernization | Current Case | Reference |
|---|---|---|---|
| **Forebay Maximum Elevation** | 1100 ft. | 1100 ft. | *Set by FERC License* |
| **Forebay Minimum Elevation** | 1079 ft. | 1079 ft. | *Set by FERC License* |
| **Project Gen Max Outflow** | 2339cfs | 2585cfs | *Per Lake Chelan Unit Comparison Memorandum and tables by MWH dated 7/18/11* |

[2] CHEOPS Model User Documentation, Lake Chelan Project, March 2017

***Minimum Generation Outflow - Lake Chelan***

The Chelan Hydro FERC Operating License requires that powerhouse flows be maintained such that velocities suitable for spawning and minimum levels of intragravel dissolved oxygen (6.0mg/l) are maintained and egg-to-fry survival (70%) is met for Chinook salmon and steelhead spawning in the project tailrace. Minimum tailrace flows are implemented to provide oxygen for spawning fish and for fish eggs and fry incubating in tailrace gravels to meet these objectives. Over time, the current minimum tailrace flow/generation requirements for fish have evolved through testing and actual operations.[3]

| Date Range | Hours | Desired Minimum Flows |
|---|---|---|
| Oct. 15 – Nov. 30 | HE8 – HE19 (7am to 7pm) | 1100 cfs (approx. 32 MW) |
| Oct. 15 – Nov. 30 | HE20 – HE7 (7pm to 7am) | 800 cfs (approx. 23 MW) |
| Dec. 1 – Mar. 31 | All hours – continuous flow | 800 cfs (approx. 23 MW) |

***Minimum Spill - Lake Chelan***

Minimum in-stream flow is required in the Chelan River to maintain a perennial flow regime that re-establishes naturally functioning ecosystems, provides for management of summer/fall chinook and steelhead, and for management of Reaches 1-3 (upper river) for cutthroat and other indigenous species. Chelan River in-stream flow requirements for the upper river are different than Reach 4 (lower river). Flow in the upper river is provided by spill from either spill gates or the Low Level Outlet. Flow in the lower river is provided by a combination of flow from the upper river and a Pump Station located in the lower river. Following is a table of minimum in-stream flows in the Chelan River from the Comprehensive Settlement Agreement.[4]

| Reach | Dry year (cfs) | Average year (cfs) | Wet year (cfs) |
|---|---|---|---|
| 1, 2 & 3[1] | 80 all months | 80: July 16-May14 | 80: July 16-May14 |
| | | Ramp to 200: May 14 | Ramp to 320: May 14 |
| | | 200: May 15-July15 | 320: May 15-July15 |
| | | Ramp down to 80: July 16 | Ramp down to 80: July 16 |
| 4[2] Spawning Flow | 320 by combination of spill & pumping Mar 15 to May 15 (Steelhead) and Oct 15 to Nov 30 (Chinook) Incubation flow as needed | 320 by combination of spill & pumping Mar 15 to May 15 (Steelhead) and Oct 15 to Nov 30 (Chinook) Incubation flow as needed | 320 by combination of spill & pumping Mar 15 to May 15 (Steelhead) and Oct 15 to Nov 30 (Chinook) Incubation flow as needed |

[1]Flows measured at the dam by calibarated gate rating

[2]Flows measured at the dam or through calibarted pump discharge curves.

[3] Chelan Hydro Operations Guideline No. 003, December 14, 2015

[4] Lake Chelan Comprehensive Settlement Agreement, Lake Chelan Hydroelectric Project FERC Project No. 637, October 8, 2003

***Target Elevations - Lake Chelan***

The District uses the CHEOPS™ model to simulate what could happen if we operate a certain way. The District models historical inflows to current constraints which produces a range of expected results. Evaluating that range of expected results helps us build operational target curves, so by aiming for the operational target curves in the future, we can reasonably expect to operate within a certain desirable range around the target elevations.

The CHEOPS simulation model follows a target curve as it simulates day-to-day operations. A target curve is a series of dates and elevations, which when connected creates a curve, or path, for the model to follow when processing day to day inputs and constraints. The model starts the first day of reservoir modeling at a specified reservoir elevation, adds historical inflow, subtracts required discharge (generation or spill) and determines if there is any excess water available for generation or if there is too much water and spill needs to occur, in order to approach the target curve. This occurs day-by-day until the entire year is processed. The model works within modeled constraints and is always trying to increase or decrease the reservoir elevation to meet the target curve. The below table summarizes the monthly elevation targets:

| Date | Dry/Average Year Target Elevation (ft) | Wet Year Target Elevation (ft) |
|---|---|---|
| Jan 1 | 1088.60 | 1087.00 |
| Feb 1 | 1086.50 | 1085.00 |
| Mar 1 | 1085.80 | 1083.80 |
| Apr 1 | 1085.60 | 1083.80 |
| May 1 | 1087.80 | 1087.80 |
| Jun 1 | 1095.20 | 1094.60 |
| Jul 1 | 1099.20 | 1098.80 |
| Aug 1 | 1099.40 | 1099.40 |
| Sep 7 | 1098.90 | 1098.90 |
| Oct 1 | 1097.45 | 1097.45 |
| Nov 1 | 1092.50 | 1092.50 |
| Dec 1 | 1089.65 | 1089.50 |
| Dec 31 | 1088.63 | 1087.08 |

***Unit Efficiencies- Lake Chelan***

The below table summarizes the unit performance curves used in each model run.

| Unit | Baseline – Pre-Modernization | Current Case |
|---|---|---|
| A1 | PME-14 – Relicensing performance | Post install 2010 index test |
| A2 | PME-14 – Relicensing performance | Post install 2010 index test |

Below is a summary of the applicable unit performance curves at the rated net head as inputs into the CHEOPS model.

Base Settings (pre-modernization – old units):

Head Loss Coefficient (ft/cfs^2)

| Common | Unit 1 | Unit 2 |
|---|---|---|
| 7.6000E-06 | 7.5600E-06 | 7.5600E-06 |

Unit 1 PME-14 - Relicensing powerhouse performance

| Minimum Net Head (ft) | | Net Head (ft) | | Rated Net Head (ft) | | Net Head (ft) | | Maximum Net Head (ft) | |
|---|---|---|---|---|---|---|---|---|---|
| 330 | | 360 | | 370 | | 380 | | 390 | |
| Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) |
| 462 | 82.34% | 469 | 82.34% | 465 | 80.84% | 462 | 79.25% | 462 | 79.25% |
| 521 | 85.44% | 528 | 85.44% | 518 | 84.76% | 510 | 83.85% | 510 | 83.85% |
| 581 | 87.68% | 589 | 87.68% | 577 | 87.10% | 566 | 86.47% | 566 | 86.47% |
| 644 | 89.14% | 653 | 89.14% | 638 | 88.77% | 626 | 88.09% | 626 | 88.09% |
| 707 | 90.40% | 717 | 90.40% | 702 | 89.82% | 687 | 89.35% | 687 | 89.35% |
| 775 | 90.93% | 786 | 90.93% | 766 | 90.74% | 749 | 90.34% | 749 | 90.34% |
| 851 | 90.62% | 863 | 90.62% | 837 | 90.84% | 815 | 90.78% | 815 | 90.78% |
| 943 | 88.99% | 956 | 88.99% | 919 | 89.93% | 890 | 90.32% | 890 | 90.32% |
| 999 | 87.45% | 1,013 | 87.45% | 970 | 88.68% | 934 | 89.54% | 934 | 89.54% |
| 1,069 | 85.05% | 1,084 | 85.05% | 1,029 | 86.93% | 986 | 88.16% | 986 | 88.16% |
| 1,152 | 82.13% | 1,168 | 82.13% | 1,102 | 84.38% | 1,050 | 86.00% | 1,050 | 86.00% |
| 1,262 | 78.05% | 1,280 | 78.05% | 1,194 | 80.97% | 1,130 | 83.00% | 1,130 | 83.00% |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Unit 2 PME-14 - Relicensing powerhouse performance

| Minimum Net Head (ft) | | Net Head (ft) | | Rated Net Head (ft) | | Net Head (ft) | | Maximum Net Head (ft) | |
|---|---|---|---|---|---|---|---|---|---|
| 330 | | 360 | | 370 | | 380 | | 390 | |
| Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) |
| 462 | 82.34% | 469 | 82.34% | 465 | 80.84% | 462 | 79.25% | 462 | 79.25% |
| 521 | 85.44% | 528 | 85.44% | 518 | 84.76% | 510 | 83.85% | 510 | 83.85% |
| 581 | 87.68% | 589 | 87.68% | 577 | 87.10% | 566 | 86.47% | 566 | 86.47% |
| 644 | 89.14% | 653 | 89.14% | 638 | 88.77% | 626 | 88.09% | 626 | 88.09% |
| 707 | 90.40% | 717 | 90.40% | 702 | 89.82% | 687 | 89.35% | 687 | 89.35% |
| 775 | 90.93% | 786 | 90.93% | 766 | 90.74% | 749 | 90.34% | 749 | 90.34% |
| 851 | 90.62% | 863 | 90.62% | 837 | 90.84% | 815 | 90.78% | 815 | 90.78% |
| 943 | 88.99% | 956 | 88.99% | 919 | 89.93% | 890 | 90.32% | 890 | 90.32% |
| 999 | 87.45% | 1,013 | 87.45% | 970 | 88.68% | 934 | 89.54% | 934 | 89.54% |
| 1,069 | 85.05% | 1,084 | 85.05% | 1,029 | 86.93% | 986 | 88.16% | 986 | 88.16% |
| 1,152 | 82.13% | 1,168 | 82.13% | 1,102 | 84.38% | 1,050 | 86.00% | 1,050 | 86.00% |
| 1,262 | 78.05% | 1,280 | 78.05% | 1,194 | 80.97% | 1,130 | 83.00% | 1,130 | 83.00% |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Current Settings (post modernization – new units):

Head Loss Coefficient (ft/cfs^2)

| Common | Unit 1 | Unit 2 |
|---|---|---|
| 8.1480E-06 | 3.4920E-06 | 4.7000E-06 |

Unit 1 A-1 unit from post install 2010 index test

| Minimum Net Head (ft) | | Net Head (ft) | | Rated Net Head (ft) | | Net Head (ft) | | Maximum Net Head (ft) | |
|---|---|---|---|---|---|---|---|---|---|
| 330 | | 360 | | 370 | | 380 | | 390 | |
| Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) |
| 325 | 67.56% | 340 | 67.56% | 344 | 67.56% | 349 | 67.56% | 354 | 67.56% |
| 335 | 68.74% | 350 | 68.74% | 355 | 68.74% | 360 | 68.74% | 365 | 68.74% |
| 420 | 74.64% | 439 | 74.64% | 445 | 74.64% | 451 | 74.64% | 457 | 74.64% |
| 471 | 77.96% | 492 | 77.96% | 499 | 77.96% | 505 | 77.96% | 512 | 77.96% |
| 569 | 84.91% | 594 | 84.91% | 603 | 84.91% | 611 | 84.91% | 619 | 84.91% |
| 625 | 87.99% | 653 | 87.99% | 662 | 87.99% | 671 | 87.99% | 679 | 87.99% |
| 718 | 89.27% | 750 | 89.27% | 760 | 89.27% | 770 | 89.27% | 780 | 89.27% |
| 781 | 90.16% | 816 | 90.16% | 827 | 90.16% | 838 | 90.16% | 849 | 90.16% |
| 849 | 91.16% | 887 | 91.16% | 899 | 91.16% | 911 | 91.16% | 923 | 91.16% |
| 927 | 91.37% | 968 | 91.37% | 982 | 91.37% | 995 | 91.37% | 1,008 | 91.37% |
| 1,028 | 92.15% | 1,074 | 92.15% | 1,088 | 92.15% | 1,103 | 92.15% | 1,117 | 92.15% |
| 1,088 | 91.94% | 1,137 | 91.94% | 1,152 | 91.94% | 1,168 | 91.94% | 1,183 | 91.94% |
| 1,159 | 91.15% | 1,211 | 91.15% | 1,227 | 91.15% | 1,244 | 91.15% | 1,260 | 91.15% |
| 1,232 | 89.76% | 1,287 | 89.76% | 1,304 | 89.76% | 1,322 | 89.76% | 1,339 | 89.76% |
| 1,282 | 89.00% | 1,339 | 89.00% | 1,357 | 89.00% | 1,376 | 89.00% | 1,394 | 89.00% |

Unit 2 A-2 unit from post install 2010 index test

| Minimum Net Head (ft) | | Net Head (ft) | | Rated Net Head (ft) | | Net Head (ft) | | Maximum Net Head (ft) | |
|---|---|---|---|---|---|---|---|---|---|
| 330 | | 360 | | 370 | | 380 | | 390 | |
| Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) | Flow (cfs) | Eff (%) |
| 325 | 68.52% | 340 | 68.52% | 344 | 68.52% | 349 | 68.52% | 353 | 68.52% |
| 376 | 71.74% | 393 | 71.74% | 398 | 71.74% | 404 | 71.74% | 409 | 71.74% |
| 442 | 75.02% | 461 | 75.02% | 468 | 75.02% | 474 | 75.02% | 480 | 75.02% |
| 513 | 80.75% | 536 | 80.75% | 543 | 80.75% | 550 | 80.75% | 558 | 80.75% |
| 600 | 86.39% | 627 | 86.39% | 636 | 86.39% | 644 | 86.39% | 653 | 86.39% |
| 669 | 88.10% | 699 | 88.10% | 709 | 88.10% | 718 | 88.10% | 728 | 88.10% |
| 751 | 89.11% | 784 | 89.11% | 795 | 89.11% | 806 | 89.11% | 816 | 89.11% |
| 813 | 90.36% | 849 | 90.36% | 861 | 90.36% | 872 | 90.36% | 884 | 90.36% |
| 895 | 90.00% | 935 | 90.00% | 948 | 90.00% | 960 | 90.00% | 973 | 90.00% |
| 960 | 90.71% | 1,003 | 90.71% | 1,017 | 90.71% | 1,030 | 90.71% | 1,044 | 90.71% |
| 1,042 | 91.35% | 1,089 | 91.35% | 1,104 | 91.35% | 1,119 | 91.35% | 1,133 | 91.35% |
| 1,106 | 90.86% | 1,155 | 90.86% | 1,171 | 90.86% | 1,186 | 90.86% | 1,202 | 90.86% |
| 1,192 | 89.36% | 1,245 | 89.36% | 1,262 | 89.36% | 1,279 | 89.36% | 1,296 | 89.36% |
| 1,251 | 88.31% | 1,307 | 88.31% | 1,325 | 88.31% | 1,343 | 88.31% | 1,360 | 88.31% |

STATE OF WASHINGTON
DEPARTMENT OF COMMERCE
1011 Plum Street SE • PO Box 42525 • Olympia, Washington 98504-2525 • (360) 725-4000
www.commerce.wa.gov

August 20, 2018

To: Michael Furze, Assistant Director, Energy Division

From: Glenn Blackmon, Senior Energy Policy Specialist

RE: Decision Memo – Advisory Opinions 2018-011 (Lake Chelan A1) and 2018-012 (Lake Chelan A2)

---

**Recommendation**

Issue an advisory opinion concluding that the incremental generation due to efficiency improvements at the Lake Chelan A1 and Lake Chelan A2 projects (the "Projects") qualifies as an eligible renewable resource for purposes of the Energy Independence Act, Chapter 19.285 RCW.

Approve an incremental generation percentage of 5.42 percent for each of the generating units.

**Background**

The Energy Independence Act ("EIA," also known as I-937) requires that qualifying electric utilities use renewable resources to meet a specified portion of customers' energy requirements and establishes eligibility standards for renewable resources used to meet this requirement.

The EIA defines hydropower as a renewable resource, but it limits the eligibility of this resource to the incremental electricity produced as a result of efficiency improvements completed after March 31, 1999. Further, the generation project must be owned by a qualifying utility and must be located in the Pacific Northwest, and the additional generation must not result in new water diversions or impoundments.[1]

RCW 19.285.045 allows utilities and project owners to obtain an advisory opinion from Commerce regarding the eligibility of resources to meet a target under RCW 19.285.040. In this case, the advisory opinion from Commerce provides a basis to register the hydroelectric projects in the Western Renewable Energy Generation Information System, identifying the portion of each project's output that is eligible in Washington.

[1] RCW 19.285.030(12)(b).

**Procedural History**

Chelan County Public Utility District, a qualifying utility under the EIA, requested an advisory opinion concerning the eligibility of incremental generation from efficiency improvements to the Projects. The applications included a report describing the Projects, the timing and nature of the efficiency improvements to the Projects, and a summary of the engineering analysis used to determine the amount of additional generation resulting from the improvements.[2] Commerce determined on July 16, 2018, that the applications were complete and posted them for public comment on the web page[3] that it maintains for advisory opinions. Commerce received no public comments on the applications.

**Analysis – Eligibility of the Incremental Generation**

The Engineering Report describes the improvements made that resulted in increased generation. Chelan PUD installed new generators and turbines in 2009 and 2010. As discussed below, the Projects' efficiency improvements meet each of the elements of the eligibility requirements in RCW 19.285.030(12)(b):

- *The incremental generation must result from efficiency improvements.* The turbine and generator replacements result in greater hydroelectric output for any given quantity of water passing directly through the turbines.

- *The efficiency improvements must be completed after March 31, 1999.* Chelan PUD's application shows that it completed the turbine and generation upgrades after the statutory date. The Engineering Report identifies turbine improvements occurring after this date.[4]

- *A qualifying utility must own the hydroelectric generation project.* Chelan PUD is a qualifying utility and owns the Projects.

- *The hydroelectric generation projects must be located in the Pacific Northwest.* The Projects are located in the state of Washington, which is within the Pacific Northwest as defined by the EIA.

- *The additional generation must not result in new water diversions or impoundments.* Chelan PUD has made no changes to the amount of water available to or impounded by

[2] *Renewable Incremental Hydro Engineering Report, Lake Chelan Hydroelectric Project* (the "Engineering Report"), Chelan PUD, March 2018. The report is stamped by Brett M. Bickford, Professional Engineer.
[3] http://www.commerce.wa.gov/growing-the-economy/energy/energy-independence-act/eia-advisory-opinions/
[4] Engineering Report, p. 5.

the Projects, so the additional generation did not result in new water diversions or impoundments.

**Analysis – Amount of Incremental Generation**

The second question presented by Chelan PUD's applications is how much of the generation from the Projects is an eligible renewable resource.[5] The incremental generation is not directly measured and must be calculated by modeling the amount of generation that would occur with and without the efficiency improvements.

The Engineering Report concludes that 5.421 percent of total generation for each of the Projects results from the equipment upgrades.[6] Chelan PUD used "Method 2" in determining the amount of eligible generation.[7] This method determines the average incremental generation, as a percentage of total generation, over representative historical stream flow conditions.

The incremental hydro rule, WAC 194-37-130, requires that incremental generation be quantified using a historical study period reasonably representative of the stream flows that would have been available to the hydroelectric project over the period of time for which stream flow records are readily available. Chelan PUD satisfied this requirement by estimating incremental generation over a five-year historical period from 2012 to 2016. Chelan PUD prepared the estimate using its CHEOPS model, which it uses for other operational and planning purposes concerning the project. An earlier version of the model provided support for Chelan PUD's application to the Federal Energy Regulatory Commission to install the new equipment.[8]

We conclude that the hydro optimization model and the stream flow data used in Chelan PUD's analysis support the proposed calculation of the additional generation that results from the improvements to the Projects.

**Conclusion**

Incremental generation from the Project is an eligible renewable resource under the Energy Independence Act. Chelan PUD's engineering analysis supports the specific percentage amount of 5.42 percent of generation identified by the utility, and it is therefore reasonable to use this percentage amount in registering the generating units in WREGIS.

---

[5] The quantity or percentage question is one not typically addressed in an advisory opinion. The advisory opinion provides advice regarding whether a resource is eligible, not how much energy from a project is eligible. However, in the case of incremental hydro projects, the procedures of the regional tracking system, the Western Renewable Energy Generation Information System (WREGIS) require the identification by the state of the eligible portion of a resource being registered.

[6] Engineering Report, p. 6.

[7] WAC 194-37-130(3)(c)(ii).

[8] Order Amending License, Project 637-051, Federal Energy Regulatory Commission, 126 FERC ¶ 62,137, February 20, 2009.