

Grow Eastside Smart Transmission Project Local Economic Study Request

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Submitted to:

Puget Sound Energy Transmission

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1 Introduction

PSE is forecasting winter peak load to grow on their eastside system in the next 10 years. In order to support this forecast PSE is considering new capacity resources and several transmission level projects. One of the larger PSE proposed transmission projects is expected to cost \$300MM and includes: Sammamish-Lakeside-Talbot 115 kV to 230 kV line rebuild (Energize Eastside), and a new 230/115 kV transformer at Lakeside substation.

EQL Energy is requesting a Local Economic Study as described in section VII of Attachment K of PSE's Open Access Transmission Tariff to address the expected transmission congestion on PSE's Eastside transmission network as identified in the 2015 Supplemental Eastside Needs Assessment Report produced by PSE/Quanta.¹ We expect the Grow Eastside Smart Transmission ("GEST") study request will:

- a. address the performance criteria discussed in 2015 Supplemental Eastside Solutions Study Report² ("2015 PSE Solutions"),
- b. support eastside load growth,
- c. fully utilize the existing 115kV transmission system,
- d. provide automated thermal limit protection devices on 115kV system,
- e. eliminate Corrective Action Plans (CAPs),
- f. begin to invest in transmission level smart grid technology, and
- g. cost much less than current proposals by PSE.

EQL Energy is requesting that two transmission level projects be studied for Puget Sound Energy's 115kV Transmission system in addition to enhanced demand-side management. These elements are:

1. Flexible AC transmission system (FACTS) control devices on all 115kV transmission lines serving Eastside load that are affected by all CAPs that PSE implements during periods of high south to north power flows.
 - One capability of FACTS technologies is providing the utility with control over transmission parameters such as impedance, thereby allowing utility to increase or decrease power flows and current. This allows the lines to stay in service during conditions that currently cause PSE to utilize CAPs.
2. Installing 230/115kV transformer at Lake Tradition and/or Talbot Hill.
3. Invest in non-transmission mitigation options consisting of demand-side resources, focused on eastside, as identified in PSE consultant reports by Cadmus and E3.³

¹http://www.energizeeastside.com/Media/Default/Library/Reports/SupplementalNeedsAssessmentReport_Redacted_April2015.pdf

²http://www.energizeeastside.com/Media/Default/Library/Reports/SupplementalSolutionsReport_Redacted_May2015.pdf

³http://www.energizeeastside.org/uploads/4/7/3/1/47314045/attachment_5_-_screening_study.pdf

2 Economic Study Request Description

We are requesting two different studies. These two studies will address two proposed solutions using FACTS devices to control power flows and provide congestion relief for PSE's local load service 115 kV network.

All studies should use the following assumptions:

1. Use the same planning assumptions identified in the Supplemental Eastside Needs Assessment Report performed by Quanta Technology for PSE in April 2015.⁴ E.g., power flow cases, time periods, generation patterns, load forecasts, system topology, contingencies, etc.
2. For load forecast, use 100% conservation forecast in 2015 Eastside Solutions report, plus the 56MW of winter peak load reduction (by 2021) of energy efficiency, demand response and distributed generation identified by E3 in the Non-Wires Screening Study. The non-wire peak reduction yearly forecast through 2027 is on page 9 in the report. The E3 estimates are conservative because a) they used only a 4-year deferral value of the \$220MM Energize Eastside project, and b) they did not consider several technologies and programs that can provide winter and emergency capacity.
3. Install new 230/115 kV transformers at Lake Tradition (connecting to adjacent BPA 230kV line) and/or at Talbot Hill as needed. One of these may not be needed for several years, but both should be included in the Local Economic Study.

Study Request #1: Install Smart Wires PowerLine Guardian devices on 115kV conductors

Objective: Provide power flow control and thermal limit protection for transmission lines and eliminate CAPs that remove transmission lines from service under PSE Specified conditions.

Vendor: Smart Wires Inc.

Product: <http://www.smartwires.com/powerline-guardian/>

What to study:

Install and operate multiple PowerLine Guardians directly on all 115kV transmission lines serving Eastside load⁵ that are affected by all CAPs that PSE implements during periods of high south to north power flows. The number and configuration of Powerline Guardians will need to be decided through meetings with PSE, interested stakeholders, EQL, and vendor. In general, these devices will be installed in sufficient numbers and locations to control the effective inductive reactance and/or capacitive reactance of these lines such that their thermal facility limits are not exceeded.

⁴http://www.energizeeastside.com/Media/Default/Library/Reports/SupplementalNeedsAssessmentReport_Redacted_April2015.pdf

⁵Eastside load is defined in the E3 Non-Wires Screening Study.

Study Request #2: FACTS Flow-Based Compensation at Substations

Objective: Provide power flow control and thermal limit protection for transmission lines and eliminate CAPs that remove transmission lines from service under PSE specified conditions.

Multiple Vendors: ABB, GE, Siemens.

What to study:

Install and operate FACTS Flow-based compensation equipment at all substations supplying all 115 kV transmission lines serving Eastside load⁶ that are affected by all CAPs that PSE implements during periods of high south to north power flows. The equipment type and vendor will need to be specified through meetings with PSE, interested stakeholders, EQL, and selected vendor(s). In general, equipment will be installed at substation(s) and connected to the 115 kV lines described above that is capable of controlling the effective inductive reactance and/or capacitive reactance of these lines such that their thermal facility limits are not exceeded.

2.1 Equipment Discussion

FACTS Flow-Based Compensation Examples

FACTS flow control devices are available from multiple vendors in multiple configurations. One example sourced from ABB is a system of stepped, switched discrete air core reactors described as an Overload Line Controller.⁷ This system is more flexible than a single switched reactor because eight compensation level steps are available. Other FACTS devices are capable of continuously variable flow-based compensation and providing additional grid support functions if required.

Figure 1: Overload Line Controller. Source: ABB



⁶ Eastside load is defined in the E3 Non-Wires Screening Study.

⁷ <https://library.e.abb.com/public/635ffc7bc6ce9ddf83257cd100506742/1JNS016181.pdf>

Distributed FACTS Flow-Based Compensation Examples

TVA installed and tested Smart Wires devices on a 161 kV transmission line, reporting successful results and has experienced 21 months of continuous operation of the devices.⁸

Figure 2: Smart Wires PowerLine Guardian Distributed FACTS Device. Source: Smart Wires



3 Additional Study Request Items

To the extent any of these options triggers additional system reinforcement needs in order to maintain reliability on PSE or other utility systems, please describe these requirements and any mitigation requirements that result.

4 Local Economic Study in PSE Open Access Transmission Tariff

PSE's tariff states "interested stakeholders may submit requests for Economic Studies to Transmission Provider." An Economic Study is defined in Appendix A of PSE's tariff as:

A.18 "Economic Study" means a study of Transmission Provider's Transmission System, separately or in conjunction with study of other transmission systems, to evaluate (i) congestion, (ii) the integration on an aggregated or Western Interconnection (or Western Interconnection "sub-regional") wide basis of new resources or new loads, or (iii) Local Economic Study.

A Local Economic Study is defined as:

A.31 "Local Economic Study" means an Economic Study that (i) evaluates congestion (and possible remedies) only on Transmission Provider's Washington Area transmission facilities of its Transmission System, or (ii) evaluates a potential Enhanced Reliability Upgrade. A Local Economic Study will not encompass or entail a production cost model study.

⁸ http://www.smartwires.com/wp-content/uploads/2015/01/Smart-Wires-Tennessee-Valley-Authority-Report_FINAL.pdf

Stated in Part VII (2), PSE must determine if an Economic Study request should be considered a high priority and whether it constitutes a Local Economic Study. Because of the clear determination that Energize Eastside is exclusively a local load service project, this study request provides an alternative to Energize Eastside, this request is a Local Economic Study. Because PSE indicates Energize Eastside is needed as early as 2018, this request should also be considered high priority.

Stated in Part VII (2):

Within three (3) months of each October 31, commencing October 31, 2008, Transmission Provider will hold or cause to be held a public meeting to review each request that has been submitted pursuant to the preceding paragraph by such October 31 for an Economic Study and to provide and receive from interested stakeholders input on such requests.

All Economic Studies so requested after October 31, 2008, but during subsequent periods November 1 through October 31 will be considered for performance in the following calendar year.

Stated in Part VII (3):

PSE will: “endeavor to perform Local Economic Studies that it performs pursuant to this Attachment K in a manner that is open and coordinated with interested stakeholders and will include appropriate sensitivity analysis.”

For the reasons stated above, PSE must accept and thoroughly study this transmission alternative Economic Study Request. Because an Economic Study is one that addresses “congestion” and the Puget Sound area experiences congestion in the area of described by PSE as the Eastside, this study request is a valid Local Economic Study. The term “Congestion” is not defined in Appendix A of PSE’s tariff.

5 Study Discussion

A simple survey of 115 kV transmission lines serving the Eastside reveals that approximately 1,350 MW of transmission transfer capability is available to move electricity into the Eastside to serve load.⁹ While key assumptions behind this estimate are likely subject to minor adjustments, this 1,350 MW figure is substantially higher than PSE’s eastside load forecast of approximately 750 MW in 2022. This clearly shows that these lines are subject to overload by power flowing through the Eastside to the northern Puget Sound area, not by power flowing to the Eastside load area.

PSE activates CAPs during high south to north flows that open multiple transmission lines serving Eastside load and the Lakeside substation. If flow control equipment is installed at the relevant substations or along these lines, then the full transmission capacity of these lines will be available to serve Eastside load. Regional power flows on these lines serving loads farther north will then shift to other lines that have unused capacity.

⁹ EQL understands that five 115 kV lines serve Eastside load from the Sammamish substation, four 115 kV lines serve Eastside load from Talbot Hill, and one 115 kV line serves Eastside load from Lake Tradition.