Washington State Rules and Regulations
And
Utility Distribution System Efficiency Measures

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Washington State voters passed Initiative 937 on Nov. 7, 2006. This initiative imposes targets for energy conservation and use of eligible renewable resources on the state's electric utilities that serve more than 25,000 customers. Specifically, these utilities, both public and investor owned, must secure 15 percent of their power supply from renewable resources by 2020. Initiative 937, also called the Washington Energy Independence Act (WEIA) was codified at RCW Title 19 Chapter 285.

Beginning Jan. 1, 2010, the WEIA requires utilities with 25,000 customers or more to acquire all conservation that is cost-effective, reliable and feasible as stated in the Energy Financing Voter Approval Act, RCW 80.52.030. Each utility is required to set an annual target which may be based on their integrated resource plan or a proportion of their regional share of achievable cost-effective conservation potential. Conservation can include increases in the efficiency of energy use, production, or distribution. Each utility must pursue all available cost-effective, reliable, and feasible conservation consistent with methodologies used by the Pacific Northwest Electric Power and Conservation Planning Council in its most recently published regional power plan.

Investor Owned Electric companies in Washington State are regulated in accordance with Washington Administrative Code, WAC, Title 480 Chapter 109 regarding acquisition of minimum quantities of conservation and renewable energy and describes implementation requirements to comply with RCW 19.285. There is no mention of "distribution system efficiency" conservation measures, however, RCW 480.109.007 does provide definitions for the "Conservation Council" which is defined as the Northwest Electric Power and Conservation Council which implies Council approved measures are acceptable. The WAC Title 194 Chapter 37 was created for Public Owned electric utilities and describes implementation requirements for energy independence and can be used as a guide for Investor Owned Electric companies as well.

WAC 194.37.090 provides additional documentation of efficiency from distribution system loss reduction improvements, including peak demand management and voltage regulation not specific address in RCW 480.109. For example, WAC 194.37.060-090 defines acceptable conservation measures or programs if they meet NWPCC (Council) measures or programs in its power plan which is based on methodologies and protocols established by the Regional Technical Forum. In Section 194.37.090 (2)(a)(i…iv) documentation requirements for distribution system improvements are as follows

(i) For distribution system upgrades, the utility will prepare a distribution flow analysis to compare the annual energy losses of the system being replaced or upgraded to the final system as installed.

(ii) For conservation voltage regulation, the utility will prepare a distribution flow analysis to compare the annual energy losses of the system before and after the implementation of a voltage regulation program. The difference in annual kilowatt-hour requirement at the utility point(s) of

receipt (for distribution utilities) or net energy for load for generating utilities may be counted as conservation savings.

(iii) For peak demand management, the utility will prepare a distribution flow analysis to compare the annual energy losses of the system before and after implementation of the peak demand management program. The change in net energy losses may be counted as conservation savings. Any net reduction in energy sales (economic curtailment) shall not be included in conservation savings.

(iv) The distribution flow analysis conducted for (b)(i), (ii), or (iii) of this subsection shall be prepared under the direction of, and carry the stamp of a registered professional electrical engineer licensed by the Washington department of licensing.

The Pacific Northwest Electric Power Planning and Conservation Act, P.L. 96-501, 16 U.S.C. 839 et seq. in Section 4 authorizes the Pacific Northwest Electric Power and Conservation Planning Council to ". . . establish such other voluntary advisory committees as it determines are necessary or appropriate to assist it in carrying out its functions and responsibilities . . .". The Regional Technical Forum committee (RTF) was created in 1999 in this regard.

The four goals adopted by the Council for the Regional Technical Forum committee (RTF) corresponding to its original charge from Congress and the Comprehensive Review are to:

1. Develop standardized protocols for verification and evaluation of energy savings and the performance of renewable resources.
2. Track regional progress toward the achievement of the region's conservation and renewable resource goals.
3. Provide feedback and suggestions for improving the effectiveness of the conservation and renewable resource development programs and activities in the region.
4. Conduct periodic reviews of the region's progress toward meeting its conservation and renewable resource goals at least every 5 years, acknowledging changes in the market for energy services and the potential availability of cost-effective conservation opportunities.

The distribution system conservation savings assessment used in the NWPCC 6th Power Plan was based on the estimates from measured data on 33 utility feeders, and analytical methods developed in a NEEA Distribution Efficiency Initiative study initiated in 2001 and completed in December 2007. The study was prepared by R.W. Beck, Inc. in association with five subcontractors and guided by the NEEA Technical Advisory Committee made up of NW electric utilities. The Council's 6th Power Plan estimate potential of distribution efficiency savings is 400 MWa by 2029 (7% of the total regional sector savings) as reported in Table E-1 "Estimated Cost-Effective Conservation Potential in Average Megawatts 2010-2014 and 2010 – 2029" of NWPCC 6th Power Plan Appendix E.

Costs and savings for four major distribution system measures in the 6th Power Plan were identified and applied to a descriptive data set of the region's distribution system. The measures are: Reduced System Voltage (LDC, Light System Improvements (capacitors and load balancing), Major System Improvements (reconductor, rephrasing, and regulators), and Enhanced Voltage Control (end-of-line feedback). The dataset contains system loads by customer class and load patterns, substation counts, feeder counts, customer counts, and climate zones for 137 regional utilities used to generate the units estimates.

To simplify the determination of distribution efficiency savings from voltage reduction and to encourage acceptance and adoption of distribution system efficiency, BPA worked with a newly form Energy Smart Utility Efficiency Technical Workgroup in 2009 and 2010 to develop a simplified measurement and verification protocol. The NWPCC and RTF adopted this new voltage reduction and distribution system efficiency methodology titled "Simplified Voltage Optimization (VO) Measurement and Verification Protocol" approved on May 4th, 2010. http://www.nwcouncil.org/energy/rtf/measures/protocols/ut/VoltageOptimization_Protocol_v1.pdf

The Simplified Voltage Optimization (VO) Measurement and Verification (M&V) Protocol provides a basic approach to determine end-use energy savings when operating the electric distribution system more efficiently and within the lower band of the ANSI Standard voltage level and is consistent with WAC 194.37.090 reporting requirements. The protocol covers utility electric distribution systems serving mostly residential and light commercial load as defined by the utility. System loads do not need to be uniformly distributed throughout the distribution system.

The VO Protocol identifies the procedure to determine the average annual voltage for a distribution primary system with source voltage regulation. Minimum system stability thresholds (e.g., max voltage drops, min power factors, max phase unbalance, etc.), system data requirements, and measurement and verification formulations are included as part of this Protocol. To meet the minimum thresholds, utilities generally achieve distribution efficiency and the ability to lower the customer's average voltage. The Protocol defines a VO factor that is used to estimate the end-use energy savings from reduced voltage and is based on the NEEA DEI Study. BPA has successfully applied this protocol to many NW electric utilities.

The CVR factor was used for the past 30 years to define the relationship between either annual demand or energy at the source of a distribution feeder and the average change in voltage at the source. The CVR factor includes the savings from system no load loss savings and end use savings and was derived via length field tests. Based on the NEEA DEI Study work and the "Simplified Voltage Optimization (VO) Measurement and Verification Protocol" approved on May 4th, 2010 by the RTF, a new industry voltage and energy savings factor has been developed to better represent the change in energy use at the end-use customer. The end-use VO Factor is a ratio of expected % change in energy delivered for each 1% change in average voltage supplied at the end-use service entrance.

The end-use VO Factor is given as a p.u. ratio for a given system and is determined from VO Factor Tables in Appendix A of the Protocol. The VO factor does not include savings from line or no-load loss savings. The no-load loss savings can be easily determined knowing the distribution transformer total connected kVA. The line loss savings can be determined using accurate distribution load flow models to simulate line losses before and after system improvements. The CVR factor has been replaced with the VO factor.

To determine the VO factor, you must enter the table identified for the Heating and cooling climate zone associated for each substation and select the appropriate VO Factor using the percent customers with Non-Electric Heating (and Heat Pumps) and percent of customers with Air-conditioning. The protocol further discusses the formulation to calculate the average voltage change on the feeder and is used with the VO factor to yield the total change in energy at the

end-use customer. The line loss savings and no-load (core) distribution transformer loss savings are calculated separately from the VO savings.

Background Information Regarding the NWPCC 6th Power Plan

The Council uses its portfolio model to determine how much conservation is cost-effective to develop. The Pacific Northwest Electric Power Planning and Conservation Act defines regional cost-effectiveness as follows: "Cost-effective", when applied to any measure or resource referred to in this chapter, means that such measure or resource must be forecast to be reliable and available within the time it is needed, and to meet or reduce the electric power demand, as determined by the Council or the Administrator, as appropriate, of the consumers of the customers at an estimated incremental system cost no greater than that of the least-cost similarly reliable and available alternative measure or resource, or any combination thereof.

Under the Act the term "system cost" means an estimate of all direct costs of a measure or resource over its effective life, including, if applicable, the cost of distribution and transmission to the consumer and such quantifiable environmental costs and benefits as are directly attributable to such measure or resource. The Council has interpreted the Act's provisions to mean that in order for a conservation measure to be cost-effective the discounted present value of all of the measure's benefits should be compared to the present value of all of its costs. The NWPCC 6th Power Plan describes the conservation supply curves development in Appendix E of the 6th Power Plan. The NW annual distribution efficiency savings load factor is 0.558. http://www.nwcouncil.org/energy/powerplan/6/final/SixthPowerPlan_Appendices.pdf

The estimated savings potential for distribution system efficiency in the northwest is given in Table E-1 "Estimated Cost-Effective Conservation Potential in Average Megawatts 2010-2014 and 2010 – 2029" of NWPCC 6th Power Plan Appendix E as follows:

Distribution Sector	MWa by 2014	MWa by 2029	
Reduced system voltage	47	160	Reduce system voltage w/LDC voltage control method
Light system improvements	8	80	VAR management, phase load balancing, and feeder load balancing
Major system improvements	9	90	Voltage regulators on 1 of 4 substations
Voltage control	4	40	End of Line (EOL) voltage control method
Unique system improvements	5	30	Seattle City Light system implements EOL w/ major system improvements
All Distribution Efficiency Measures	72	400	
Total for All Sectors	**1308**	**5740**	
	5.5%	7.0%	