WAPA Rocky Mountain Customer Service Region Proposed Rates

Comments Offered by
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We applaud WAPA's efforts to develop a transmission tariff that recognizes the costs associated with providing regulation and energy imbalance and that attempts to allocate these costs to transmission customers that are responsible for their being incurred. DOE's Oak Ridge National Laboratory and National Renewable Energy Laboratory are interested in WAPA's proposed tariff because this is a pioneering effort that may influence how ancillary services are addressed for renewable generators and loads throughout the country. This is important work that WAPA is doing. It is important to do it correctly and it is worth the effort that it will take.

WAPA has correctly identified the regulation and energy imbalance services and their purposes. The tariff description recognizes that:

- FERC established the regulation service to compensate for the uncontrolled, short term, minute to minute fluctuations of loads and generators
- Regulation is provided on a control area basis (rather than on an individual basis)
- Regulation service requirements are based upon NERC statistical Control Area Performance Criteria (CPS) 1 and 2
- The need for regulation results from the aggregated effect of the behavior of individuals[1]
- Individuals differ in their behavior
- Charges for individuals should be based upon their behavior and the impact that behavior has on the control area costs.
- Energy Imbalance service balances any net mismatch over an hour between the scheduled or actual delivery of energy

The tariff further states that intermittent renewable resources should only pay for their energy imbalance impact on the system and will not be penalized for out-of-bandwidth excursions.

Charging customers for the costs they impose on the power system provides the correct signal to maximize economic efficiency. In the case of the transmission system "customers" refers to both generators and loads since both use the transmission system to facilitate their business. Much of the benefit we expect to obtain from restructuring the

[1] "Aggregation" means "physical aggregation" and is the way that power systems are always operated. We ignore the impacts of business aggregation because a cost-based tariff should be blind to whether or not intermittent resources' businesses are combined or not.

electric power industry comes from increasing economic efficiency by having customers see the true costs of their operations. They then have incentives to modify their behavior to reduce those costs *if* it is cheaper for them to modify their behavior than to buy the service from willing suppliers. The intent behind WAPA's proposed tariff, to have customer charges reflect the ancillary service costs they impose, is a logical extension of restructuring from the energy markets into the ancillary services. We have been advocating this type of change for several years and are glad to see it starting to take place (Kirby and Hirst 2000-1, Hirst and Kirby 2000, and Hirst and Kirby 1996 for example).

Unfortunately, there are a number of flaws in how WAPA has designed the actual tariff:

- The proposed tariff assesses individuals' regulation burden based upon their energy or demand consumption. Neither energy nor demand has anything to do with regulation burden, as shown in Figure 1. Regulation burden arises, instead, from minute-to-minute variability.
- The proposed regulation tariff for intermittent renewable generators is really a short-term scheduling-error penalty, not an assessment for the resource's impact on the control area's regulation needs. It does not recognize the benefits of physical aggregation or reflect how the system is physically operated.
- It does not recognize the statistical nature of NERC's CPS 1&2 requirements.
- The regulation tariff and the WAPA's July 14 presentation encourage individuals to literally self provide regulation. This is extremely wasteful of regulation resources, bad for the power system, and bad for society.
- The regulation tariff would assess costs in cases that no costs to WAPA are incurred. This tariff is therefore not cost based but is instead penalty based.

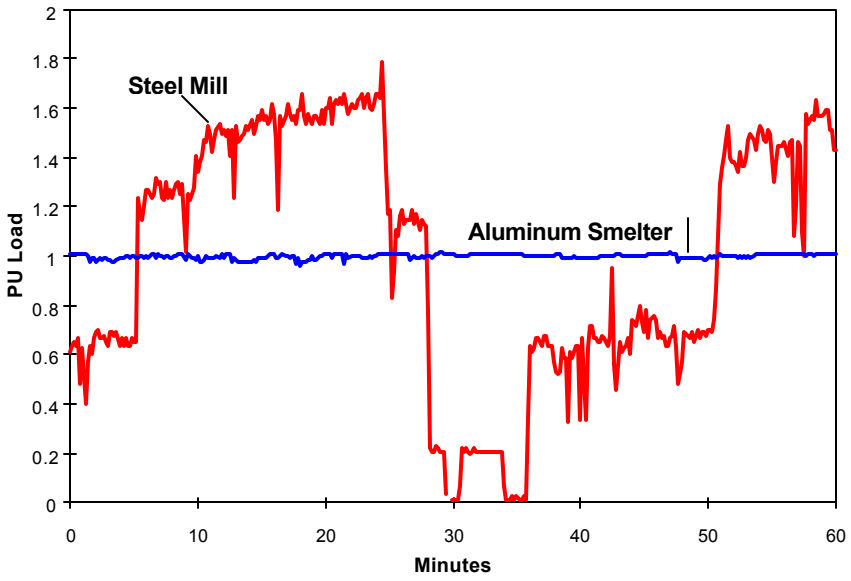

Figure 1 An aluminum mill and a steel mill with identical energy consumption impose very different regulation burdens

The Importance of Physical Aggregation

Much of our concern with the proposed WAPA tariff centers on the treatment, or lack of treatment, of the physical aggregation benefits that are important in many aspects of all power system operation. This aggregation benefit is the reason that the CPS 1 and 2 requirements are based on system balance, not on individual resource (or load) balance. Although WAPA has recognized the CPS 1 & 2 requirements, they have been ignored in the development of the tariff. We offer four examples that demonstrate the importance of physical aggregation.

Aggregation of Two Unique Plants

If two entities were consistently moving exactly opposite to each other, as shown in Figure 2, their regulation burdens would cancel each other out and have no adverse impact or cost on the control area. This proposed WAPA tariff would charge both entities a regulation fee, however.

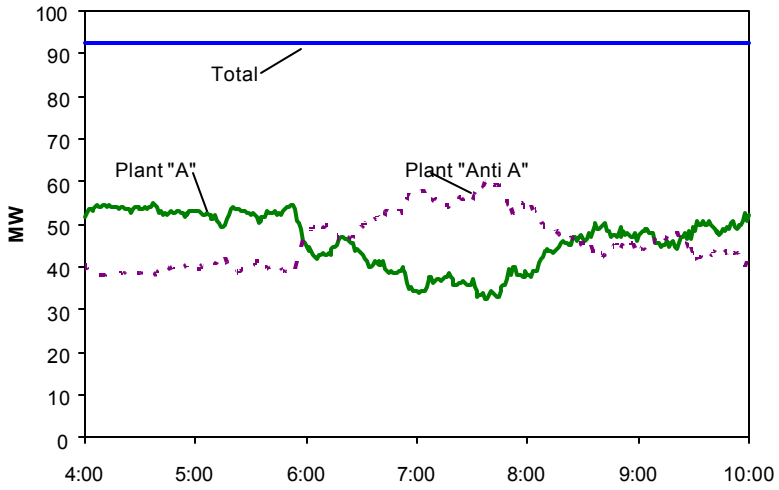

Figure 2 Two plants, moving in opposite directions, present no regulation requirement to the power system.

Aggregation of Multiple Real Plants

We are not suggesting that two entities are likely to consistently move opposite to each other and zero their regulation burden but they are also not likely to consistently move together in the regulation time frame, as this proposed tariff assumes. Instead, in the regulation time frame, entities movements tend to be uncorrelated. This does not need to be assumed, it can be easily measured. (Kirby and Hirst 2000-2) Figure 3 presents three plants that are moving largely independently. This represents a more realistic example. Unlike the Figure 2 example, the aggregation of these three plants has more fluctuation than any single plant alone. There is still significant aggregation benefit, however. Plant A spans a range of 22.6 MW, plant B spans a range of 13.5 MW, and plant C spans a range of 39.4 MW. Combining these ranges would yield an expected range of 75.4 MW

but the aggregation's range is only 53.3 MW. Charging each plant for its regulation range would result in over charging by 42% when compared with the aggregation. As we will show shortly, this discrepancy is greater still when you consider aggregating with the rest of the control area and not simply aggregating the three plants.

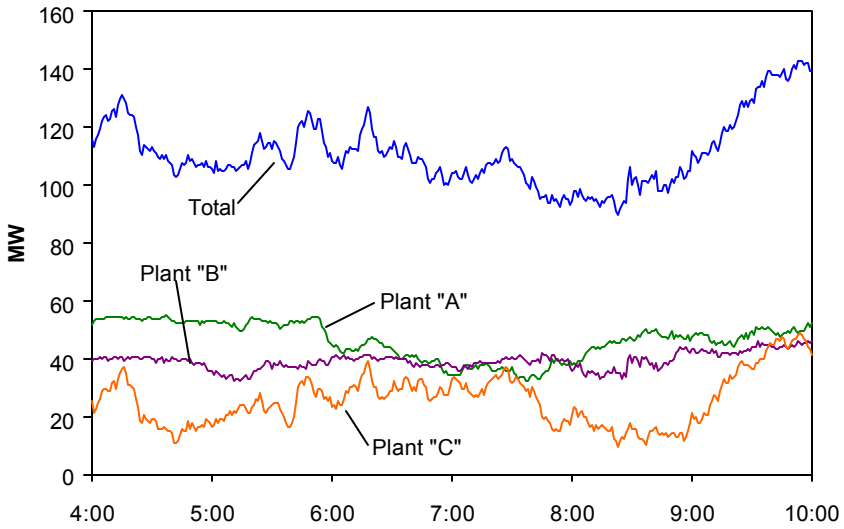

Figure 3 Aggregating 3 greatly plants reduces the fluctuation burden presented to the power system.

Aggregating to Form a Control Area

The practical importance of aggregation is even greater when the entire control area is considered. This example utilizes loads rather than intermittent renewable generators in order to keep the example simple; the same principles apply to both.

Assume a 2000 MW control area that is composed of 40 individual 50 MW municipal power systems. For simplicity, assume each has a similar mix of residential, commercial, and industrial loads and consequently has similar regulation requirements. Each individual municipal power system might require 11 MW of regulating capacity if it were to meet NERC's CPS1&2 requirements on its own. The collective regulation requirement for the overall collection of 40 municipals (each independently regulating) would then be 440 MW.

Alternatively, if the control area performs the regulation function for the aggregation of the 40 municipals the regulation requirement drops to 70 MW, or 1.7 MW per municipality. This savings of 9.3 MW per individual municipality or 370 MW for the control area is real. It is physically based. It is the benefit of aggregation and has been recognized for decades. It is a major reason why the control area concept has been so successful.

Extending the example, what happens if another similar load is added to the control area? If the load must compensate for its regulation burden on its own, and present an essentially flat regulation profile to the control area, the new load must dedicate another 11 MW to regulation. Alternatively, if the new load can join the control area aggregation the total regulation burden of the new aggregation is only 0.86 MW greater (70.43 vs 69.47).

System Size	Energy MW	Regulation MW	
1 Muni	50	11	22%
40 Muni	2000	440	22%
Control Area	2000	70	3%
1 Muni share of Control Area	50	1.7	3%
Individual Muni Savings	0	9.3	
Total Savings	0	370	

Table 1 Aggregation greatly reduces regulation requirements but does not impact energy requirements.

Aggregating a Plant with a Control Area

Suggesting the multiple loads or renewable generators should form sub-aggregations on their own is not a good solution. As we saw in the last two examples there is benefit in aggregating three plants (the regulation requirement was dropped by 29%). There was greater benefit when 40 municipals combined to form a control area (the regulation requirement dropped by 84%).

What happens if a 41st municipal joins the 40 that have formed a control area? If the municipal must compensate for its regulation burden on its own, and present an essentially flat regulation profile to the control area, the new municipal must dedicate another 11 MW to regulation. Alternatively, if the new municipal can join the control area aggregation the total regulation burden of the new aggregation is only 0.86 MW greater (70.43 MW vs 69.47 MW).

What should the new municipal be charged? We would argue that it should *not* be charged for the 0.86 MW of incremental regulation requirement. All of the municipals are identical in this example; they should share equally in paying for the regulation requirements. The new total regulation burden should be allocated to each of the loads based upon its contribution to the total regulation burden. Each should be charged for 1.72 MW of regulation (down from the previous 1.74) since they all present the same regulation burden to the control area. In this case, every individual's regulation burden is reduced by 0.02 MW when the new individual joins the aggregation.

These principals of encouraging individuals to join the control area, providing regulation for the physical aggregation, and allocating the regulation burden based upon consumption applies equally well to a wind plant that is located within a control area as it does to a municipal located within the control area. If a 16 MW average energy wind

plant with a stand alone regulation requirement of 5 MW is built in a 2000 MW control area with a 70 MW regulation requirement the control area regulation requirement will rise to 70.4 MW. Physical aggregation reduces the increased regulation requirement by 92%.

We would *not* argue that the incremental load or generator be charged only for the 0.4 MW incremental increase in control area regulation. As shown above, this would not result in a fair allocation. Instead the new total regulation burden should be allocated to each individual upon its contribution to the total regulation burden. In this case the control area's regulation share should be reduced from 70 MW to 69.6 MW and the new plant's share should be 0.8 MW (instead of 0.4 MW) based on the "fair" allocation method discussed below.

Refunding Excess Revenue Collections

WAPA has stated that any excess revenue collected through the regulation tariff will be refunded to all customers through future rate adjustments. This is good but also deeply flawed. It is good in that it removes any economic incentive WAPA might have for wanting to profit from excessively high tariffs of any kind. It is flawed because, first, the regulation requirements calculation does not reflect the system regulation requirements or the system regulation costs. Second, refunding excess revenues collected from one customer class (intermittent renewables in this case) to all customers forces the penalized customers to subsidize the rest of the system.

Conclusions

In summary, the proposed WAPA tariff does not pass the test of a cost-based tariff because revenues collected from the tariff are not related to costs incurred. The tariff does not recognize the requirement to balance system loads and resources, and ignores the impact of wind on system variability. The proposed tariff is a scheduling error penalty, masquerading as a regulation tariff.

Clearly it makes no sense to require or encourage individuals to literally provide their own regulation. The above examples demonstrate that the regulation burden is greatly reduced for everyone when regulation is provided on a control area basis. Even if an individual wishes to provide the regulating resources those resources should be dispatched by the control area operator to serve the aggregation's regulation requirement. It is not in the power system's interest to waste regulation resources in this manner. It drives the cost of regulation up for all users, including the control area.

It is not very helpful to point out shortcomings without offering solutions. Here we can help. We have developed a regulation analysis and allocation method that determines the actual regulation burden imposed on the control area by each individual load and non-regulating generator. (Kirby and Hirst 2000-2) The method allocates that total control area regulation requirement based upon the individual's behavior. It predicts the increased control area regulation requirements that will result if another individual is added to the aggregation. WAPA is already collecting all of the data required to utilize this method. The method has been used to analyze loads and renewable generators. It has

been successfully applied in other regions including AEP, BPA, Alberta, CSW, NIPSCO, CAISO, New Brunswick, Ontario Hydro, and Xcel and it has been peer-reviewed.

WAPA is in an ideal position to analyze the impact additional wind plants will have on its system. Two wind plants are currently physically located within the WAPA service territory but are dynamically scheduled out of the control area. WAPA has SCADA data available to perform a detailed impact study without the need to invoke hypothetical models. DOE, NREL and ORNL would like to work with WAPA to perform a wind integration analysis and provide the basis for a technically sound tariff.

References

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