PJM Manual 15:

Cost Development Guidelines

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Prepared by

Cost Development Subcommittee

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Glen Boyle, Chairman

Cost Development Subcommittee

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- **FERC Order 841 Implementation**

Section 11: Batteries and Flywheels

This section contains information for the development of battery and flywheelsEnergy Storage Resource cost offers. .Regulation only resources should see Section 11.8

Battery – device to store electrical energy via chemicals

Flywheel- mechanical device for storing rotational energy.

11.1 Heat RatesEfficiency factor

Efficiency factor is a battery or flywheel version of a heat rate. Energy Storage Resources do not burn fuel so heat rates are not applicable. Efficiency factors measure the ratio of generation produced to the amount of electricity used to charge.

$$Efficiency\ factor = \frac{MWh\ Discharged}{MWh\ Charged}$$

Efficiency factors can be calculated over the time period specified by the Market Seller in the Fuel Cost Policy. A Market Seller must make the choice of method in their fuel cost policy and cannot change to another method for a period specified in Section 2.1.

11.2 Performance Factors

Note:
The information in Section 2.2 contains basic Performance Factor information relevant for all unit types. The following additional information only pertains to Energy Storage Resources.batteries and flywheels.

Energy Storage ResourcesBattery and flywheel do not burn fuel so Performance Factors are equal to 1.0.

11.3 Fuel Cost

For a battery/flywheel to be consistent with other PJM units within this manual the term fuel cost is used to account for the energy necessary to charge the resource.

Note:
The information in Section 2.3 contains basic Fuel Cost information relevant for all unit types. The following additional information only pertains to Energy Storage Resources:batteries/flywheel

Energy Storage Resource's fuel costs are equal to zero.

11.3.1 Total Fuel Cost

Market Sellers for batteries and flywheels must identify in their Fuel Cost Policies the methodology they are using to calculate fuel cost (charging cost).

Total Energy Input Related Costs for Battery/Flywheel

$$Total\ Fuel\ Cost\left(\frac{\$}{MWh}\right) = \left(average\ charging\ cost\left(\frac{\$}{MWh}\right) * efficiency\ factor\right) + maintenance\ adder$$

11.3.2 Operating Costs

Operating Costs may include, but are not limited to: acids and lithium ion replacement.

11.4 Start-up Cost

~~Energy Storage Resource's~~Battery/flyhweel's Start Fuel and Total Fuel Related Costs are equal to zero.

11.5 No-Load Cost

~~Energy Storage Resources~~Batteries and flywheels no-load cost shall be equal to zero.~~do not have No-load costs.~~

11.6 Maintenance

Note:
The information in Section 2.6 contains basic Maintenance Cost information relevant for all unit types. The following additional information only pertains to Energy Storage Resources.

Batteries and flywheels cannot include costs that can be include in their capacity offer such as straight time labor. Maintenance costs for batteries and flywheels may include, but are not limited to: cell repairs/replacements, inverter maintenance, and generation owned GSU/ Interconnection Transmission maintenance.

11.7 Synchronized Reserve Cost

Note:
The information in Section 2.7 contains basic Synchronized Reserve Cost information relevant for all unit types. The following additional information only pertains to Energy Storage Resources if applicable.

The cost to provide synchronous reserves from battery or flywheel resources shall be equal to the margin up of $7.50 per MWh of reserves offered plus the maintenance adder.

11.8 Regulation Cost

Note:
The information in Section 2.8 contains basic Regulation Cost information relevant for all unit types. The following additional information only pertains to Energy Storage Resources.

Energy Storage Resources shall calculate Energy Storage Unit Losses in accordance with the equation below. The “Cost Increase due to Heat Rate Increase during non-steady state operation” and the “Fuel Cost Increase and Unit Specific Heat Rate Degradation due to Operating at lower loads” shall be equal to zero.

If a Market Seller wishes to change its method of calculating these losses, the Market Seller shall submit a request to change its Fuel Cost Policy to PJM and the MMU pursuant to Section 2.3.1. The approved method of calculation may be implemented upon approval and may be updated no more frequently than once every 12 months. If any action by a government or regulatory agency that results in a need for the Market Seller to change its method of cost calculation, the affected Market Seller may submit a request, or notification as appropriate, to PJM and the MMU for evaluation, pursuant to Section 2.3.1.

Energy Storage Unit Losses ($/MW) – shall be the calculated average of seven (7) days of rolling hourly periods where the real time bus LMP ($/MWh) at the plant node is multiplied by the net energy consumed (MWh) when regulating divided by the regulation offer (MW). The seven (7) days of rolling hourly periods shall consist of the unit’s last 168 hour periods with accepted regulation offers. The following equation governs energy storage unit’s fuel cost increase:

$$Energy\ Storage\ Unit\ Losses\ (\$/MW)$$
$$= Average\ of\ 7\ Days\{\frac{\left(Hourly\ LMP\left(\frac{\$}{MWh}\right)*Hourly\ Net\ Energy\ Consumed\ (MWh)\right)}{Hourly\ Accepted\ Regulation\ Offers\ (MW)}\}$$

11.9 Opportunity Cost fpr Energy Storage Resources Operating in the Energy Market

- TBD

