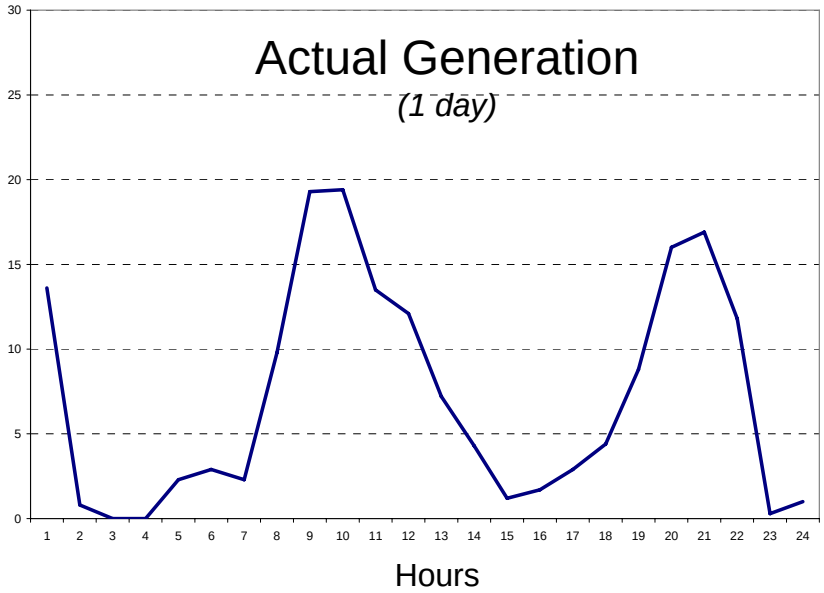
Resource Support Services

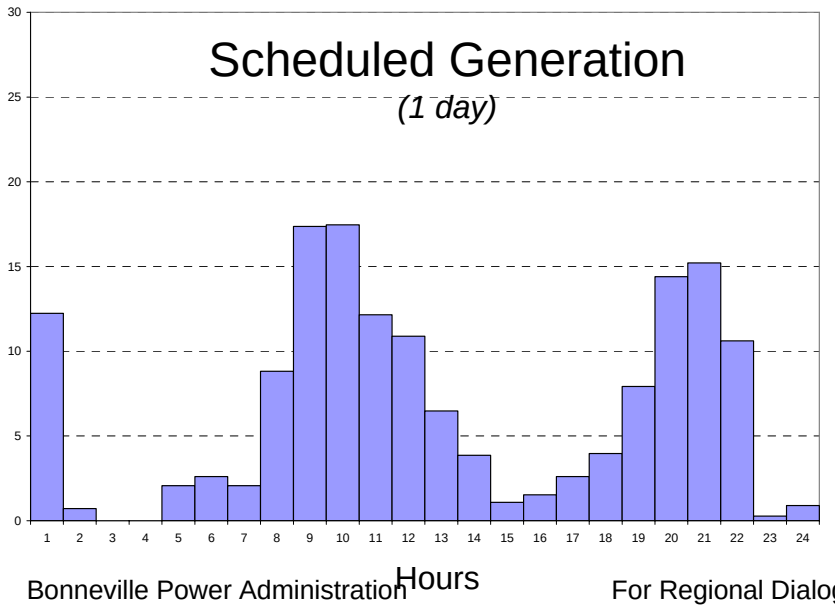
- The Regional Dialogue Policy states that resources serving load above high water mark will be benchmarked off a flat annual block. Since most resources have a portion of variable/intermittent output, a flattening service is needed to comport with this decision.
- BPA made the decision to offer the same service used for flattening its resources that serve its above high water mark obligation to non-federal resources that are dedicated to serve load above high water mark.

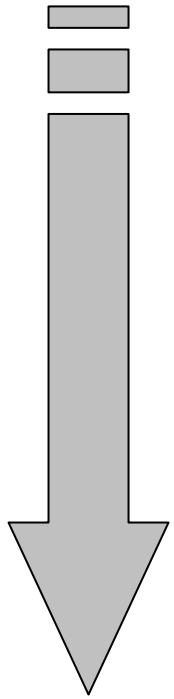
- Why did BPA determine that resources serving above high water mark load be benchmarked against the shape of a flat annual block?
  - BPA incurs a cost or benefit when resource are provided in different shapes since BPA serves the net Tier 1 load.
- What are Resource Support Services?
  - Resource Support Services includes a suite of services that can be purchased by utilities to help them meet the obligations of owning a resource in BPA's tiered rates environment.
- Do you have to take the entire suite of Resources Support Services, or can you pick and choose?
  - There will be some allowance for picking and choosing, but some of the services inherently include other RSS services.
- Which service takes your variable/intermittent resource and financially converts it to a flat annual block so that BPA remains financially indifferent between your resource shape and a flat annual block?
  - The Diurnal Flattening Service (DFS) in conjunction with an energy adjustment will provide this.

- How will the DFS be priced?
  - The DFS is attempting to capture the value difference between a resource that generates flat within the 24 HLH and LLH periods of the year and the variable/intermittent portion of your resource. The DFS will consist of a capacity charge as well as an energy charge.
    - The capacity charge compares the amount of capacity provided by variable/intermittent portion of your resource to the capacity provided by a flat annual block. A capacity rate is then applied to the amount of capacity your resource is short of a flat annual block.
    - The energy charge attempts to capture the value difference in shape between the variable/intermittent portion of your resource and a flat annual block. The charge will be developed using efficiency losses associated with a support resource capable of smoothing the variable/intermittent portion of your resource into the 24 HLH and LLH of the year.

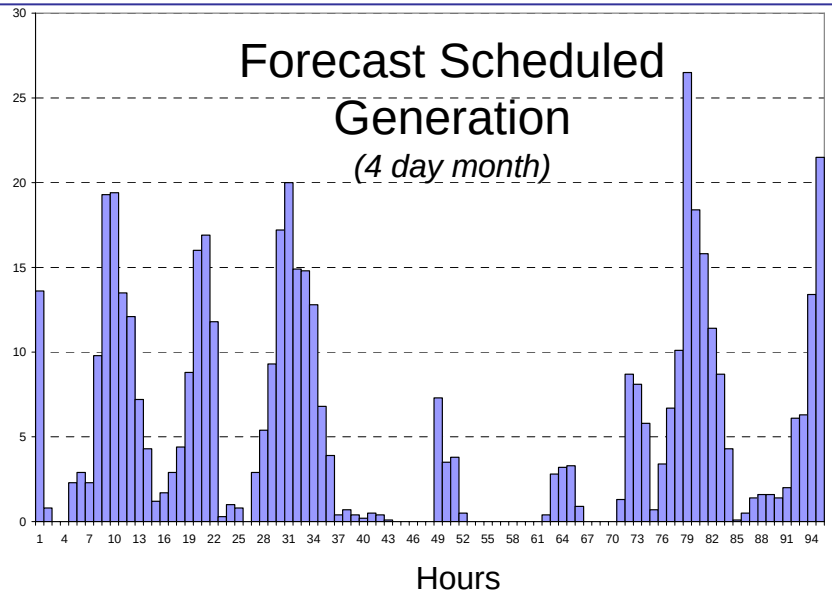
- The resource is not yet a flat block, is there another pricing adjustment made to financially convert the 24 flat HLH and LLH blocks into a flat annual block?
  - Yes, there will also be an energy value adjustment (Resource Shaping Charge) that accounts for the fact that your resource will generate more or less energy in the diurnal periods than the amount of energy provided by a flat annual block. BPA will value the purchase of power at forecast market prices when the flat diurnal block is smaller than the energy provided in that same period by flat annual block. BPA will also value the sale of energy at forecast market prices when the flat diurnal block is greater than the amount of energy provided by a flat annual block. The net results is an additional charge or credit based on the projected energy value of your resource.

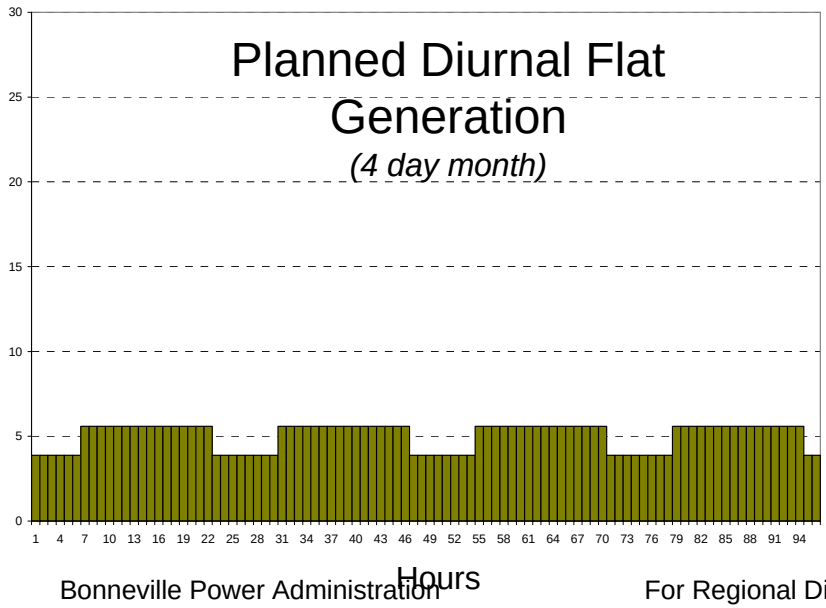




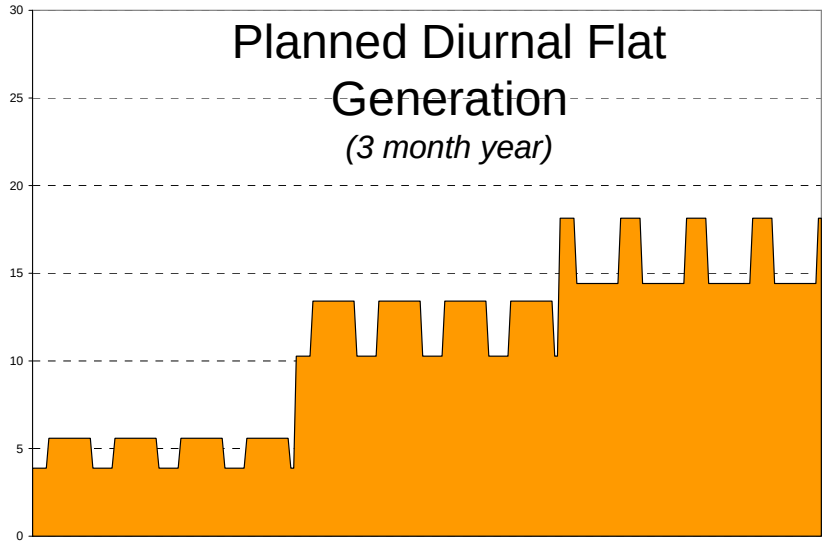


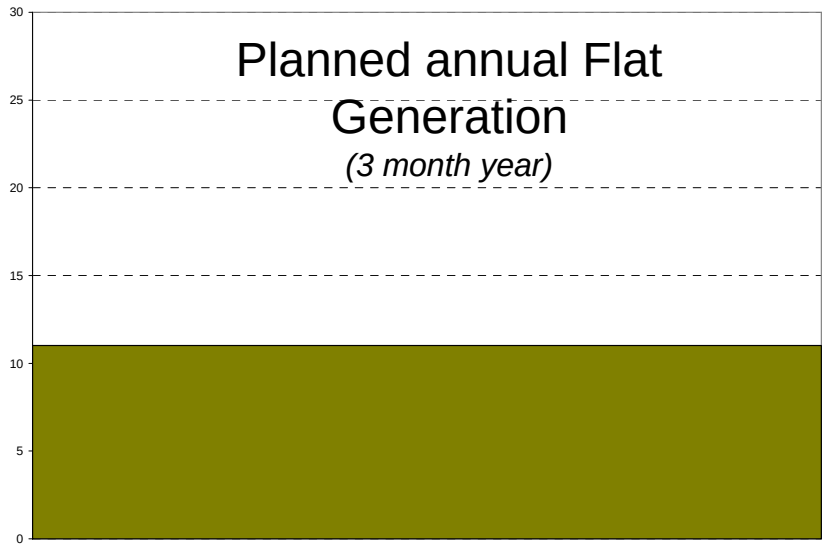
Balancing Authority where resource is located provides the within hour flattening through integration charges and generation imbalance charges.





The Diurnal Flattening Service provided by Power will financially flatten the resource in the 24 HLH and LLH periods of the year.

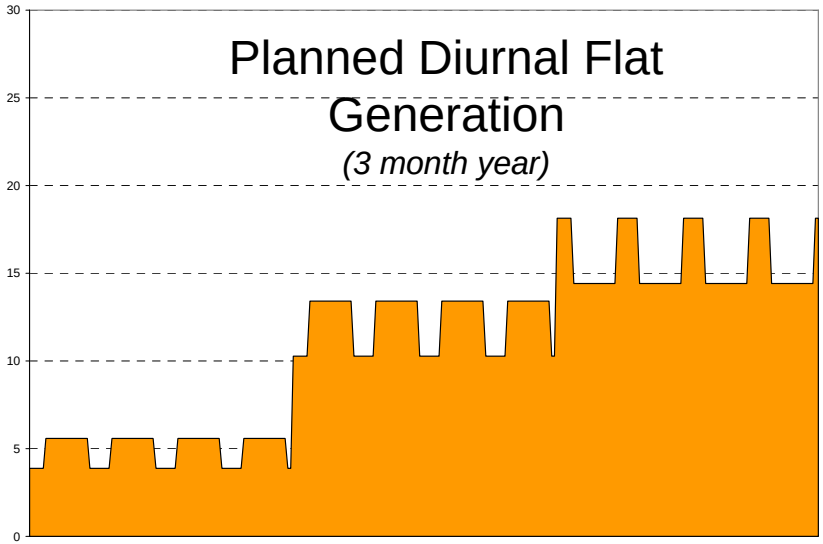


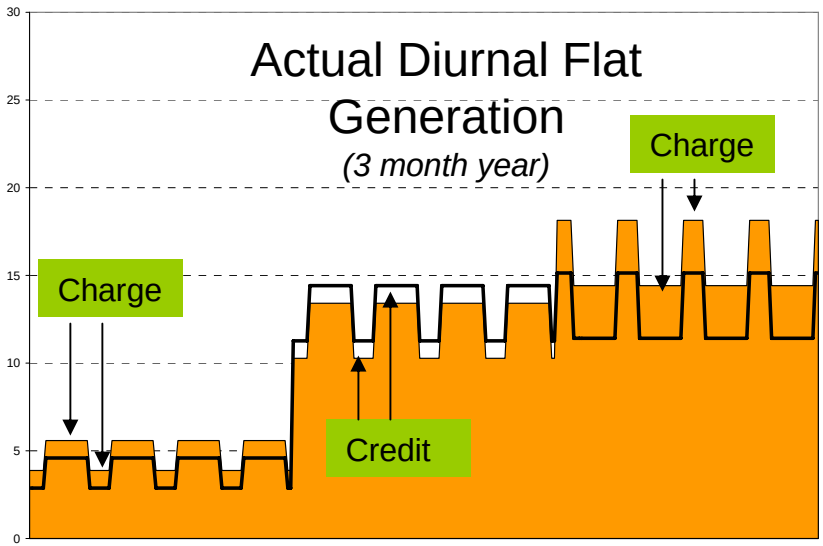


The Resource Shaping Charge calculated off planned generation will financially flatten a resource that is flat within the 24 HLH and LLH periods of the year to a resource that is annually flat.

Resource Shaping Charge Adjustment

- The Diurnal Flattening Service is designed to be an energy neutral service.
- When expected diurnal monthly energy is greater or less than actual, an adjustment will apply (24 adjustments each year billed monthly).
- Energy in excess of expected amount will be credited at the forecast market prices used for the Resource Shaping Charge.
- Energy amounts below expected generation will be charged at the forecast market prices used for the Resource Shaping Charge.



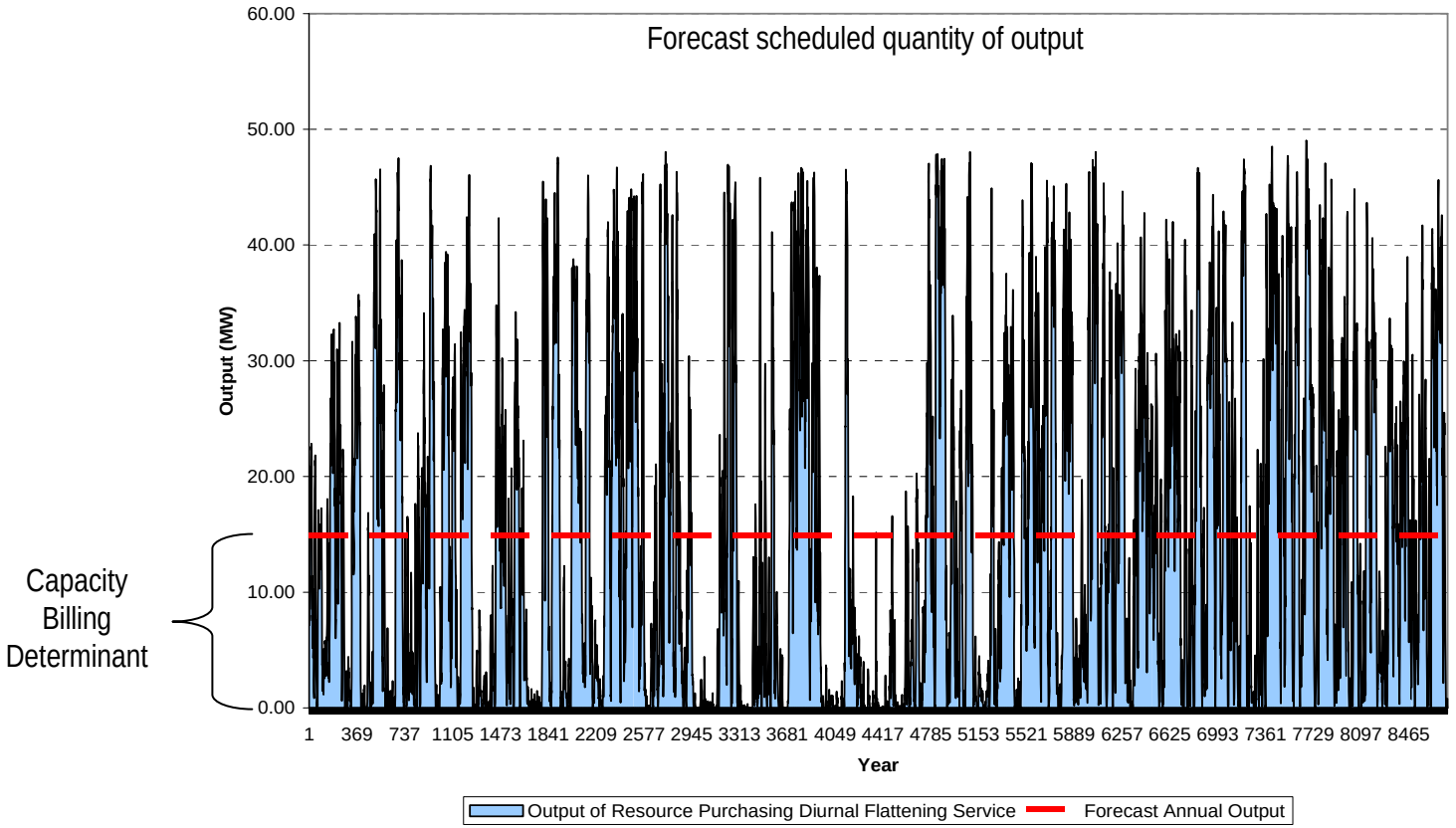


The Resource Shaping Charge Adjustment will compare the planned diurnal flat generation to the actual diurnal average generation of the resource. Generation above will be credited and generation below will be charged.

Pricing the Diurnal Flattening Service
Gas Turbine or Pump Storage

Resource Capacity Charge

- The Resource Capacity Charge uses the same methodology in both the Gas Turbine and Pumped Storage approach.
- Based on the fixed capital costs of the rate case defined capacity machine – same that is used for the Tier 1 demand charge.
- Billing determinant will be the resource's expected annual generation minus the amount of capacity provided by the resource.



Resource Energy Charge

- The method for pricing the resource energy charge is different between the gas turbine and the pumped hydro storage methods.
- The gas turbine approach uses the efficiency curve of the GE LMS 100 and builds a charge based on increased heat rate when the gas turbine is running below its most efficient level.

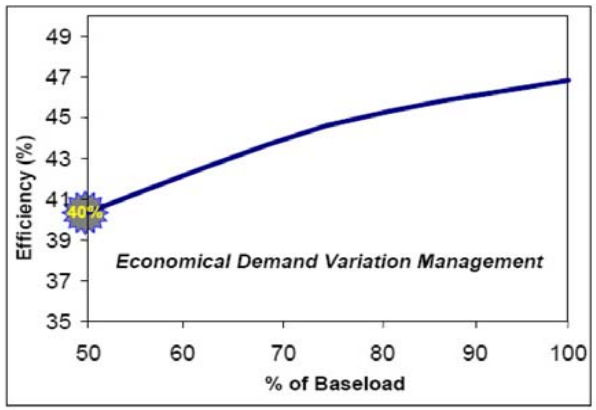


Fig. 10. LMS100™ System Part-Power Efficiency

- The pumped storage approach applies the lost efficiency of a pump (~25%) to the energy generated above the expected output of the supported resource (i.e., for every 10 MWh that is being stored, only 7.5 MWh will be returned when the water is released to meet load).

Resource Energy Charge – Gas Turbine

Example Hour

Supported Resource Output = 10 MW → Gas Turbine Output = 90 MW

October Gas Price = $4.429/mmBtu

Lost Gas Turbine Efficiency = 196 Btu/kWh = $0.87/MWh

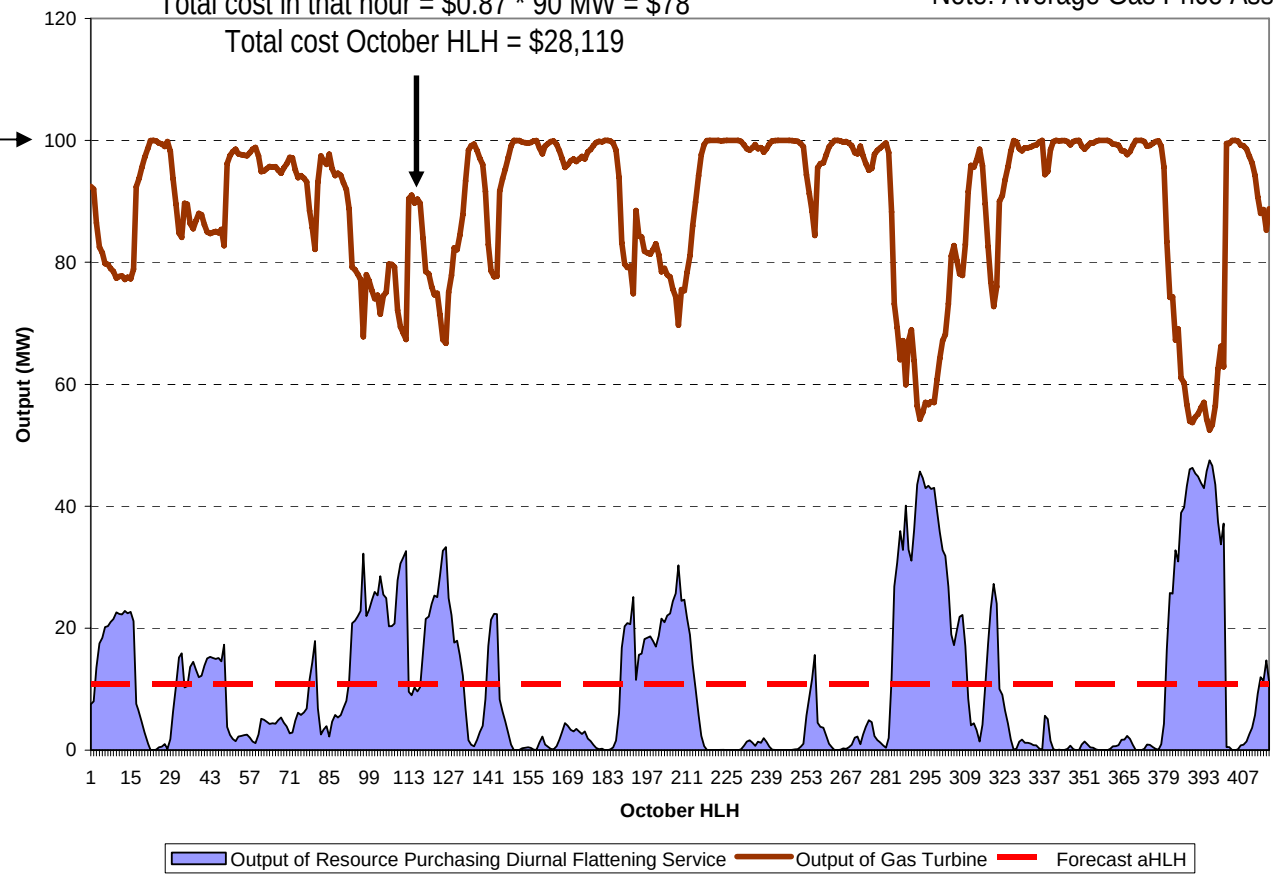
Total cost in that hour = $0.87 * 90 MW = $78

Total cost October HLH = $28,119

Note: Using a Gas Turbine to price this service may be a more realistic representation of what utilities would do in the future.

Note: Average Gas Price Assumed = $5.25/mmBtu

Gas Turbine is running most efficient (Heat Rate = 7,600 Btu/kWh) when the resource that is being supported is producing zero (i.e., no energy cost when gas turbine is running at 100%).

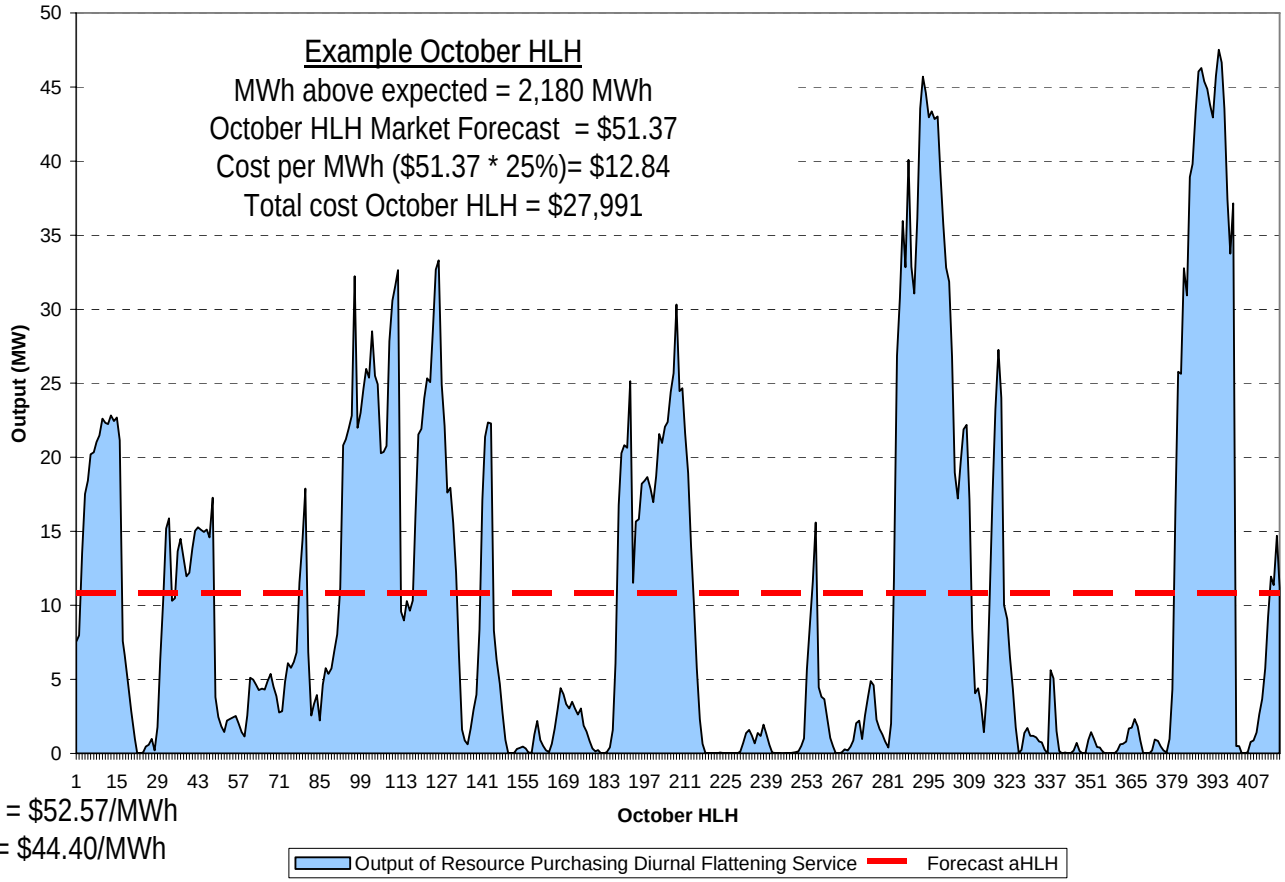


The LMS 100 can run as low as 50% nameplate. Heat rate at this level is approximately 8,500 Btu/kWh

Resource Energy Charge – Pumped Storage

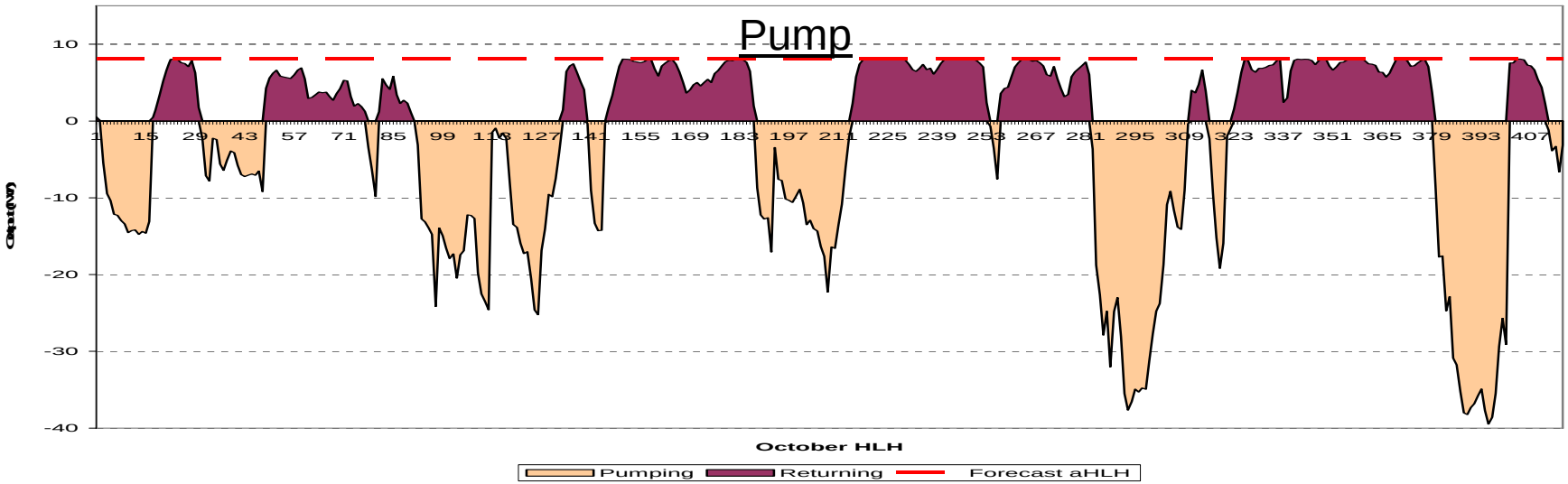
- Based on generation above the supported resources expected output in each monthly diurnal period of the year (24 each year).
- Billing Determinant will be the sum of MWhs that are generated above the resource's expected monthly diurnal generation (forecast October aHLH in the below graph).

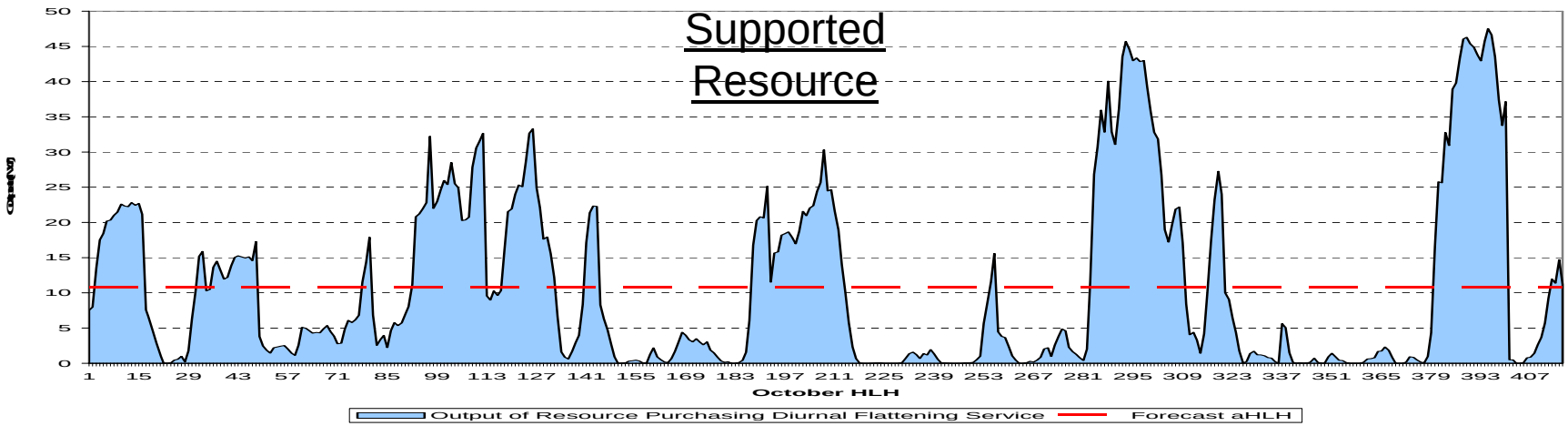
MWh above expected output in a diurnal period = Energy Billing Determinant



Note:
Average HLH price assumed = $52.57/MWh
Average LLH price assumed= $44.40/MWh

Resource Energy Charge – Pumped Storage

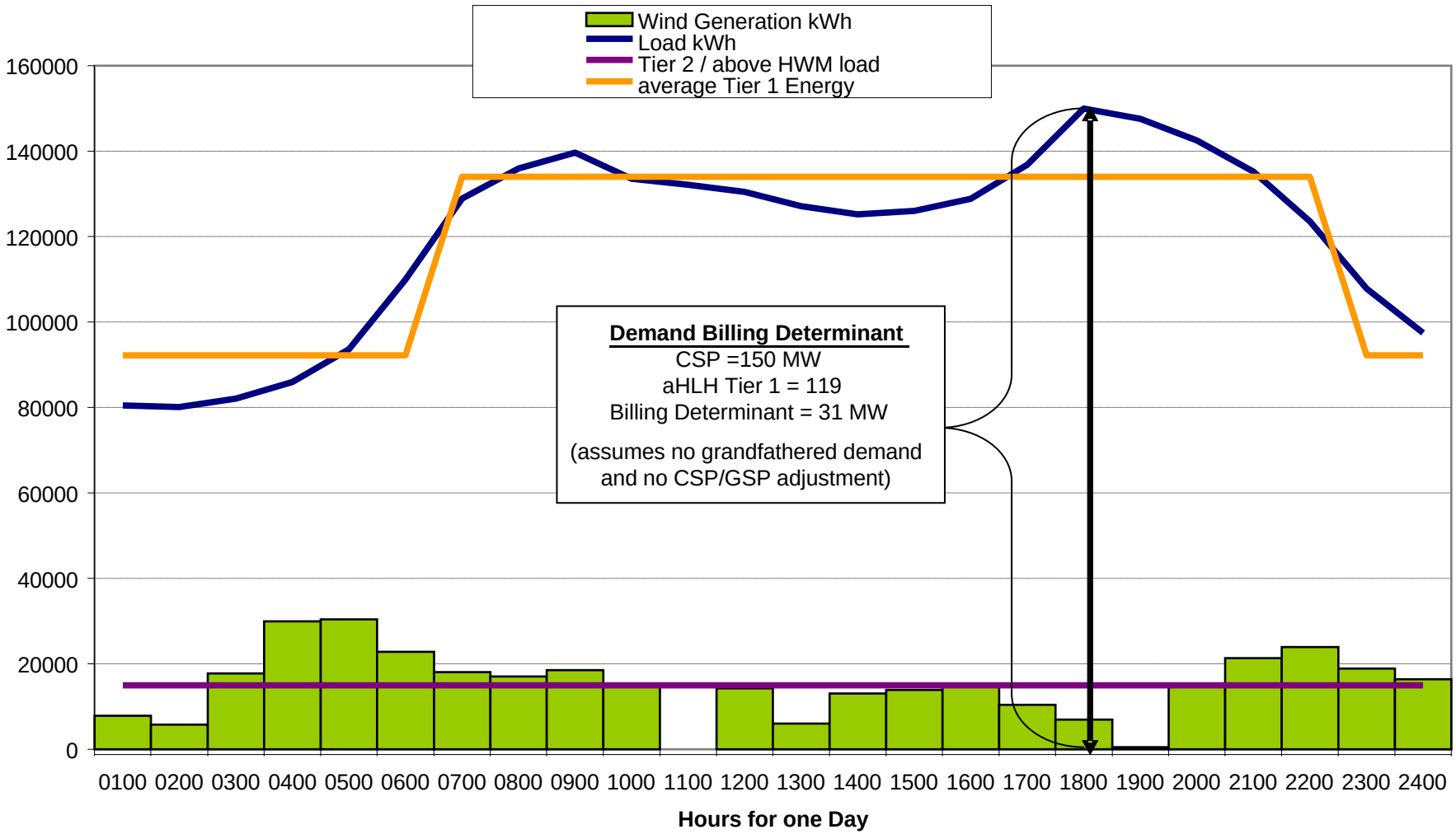




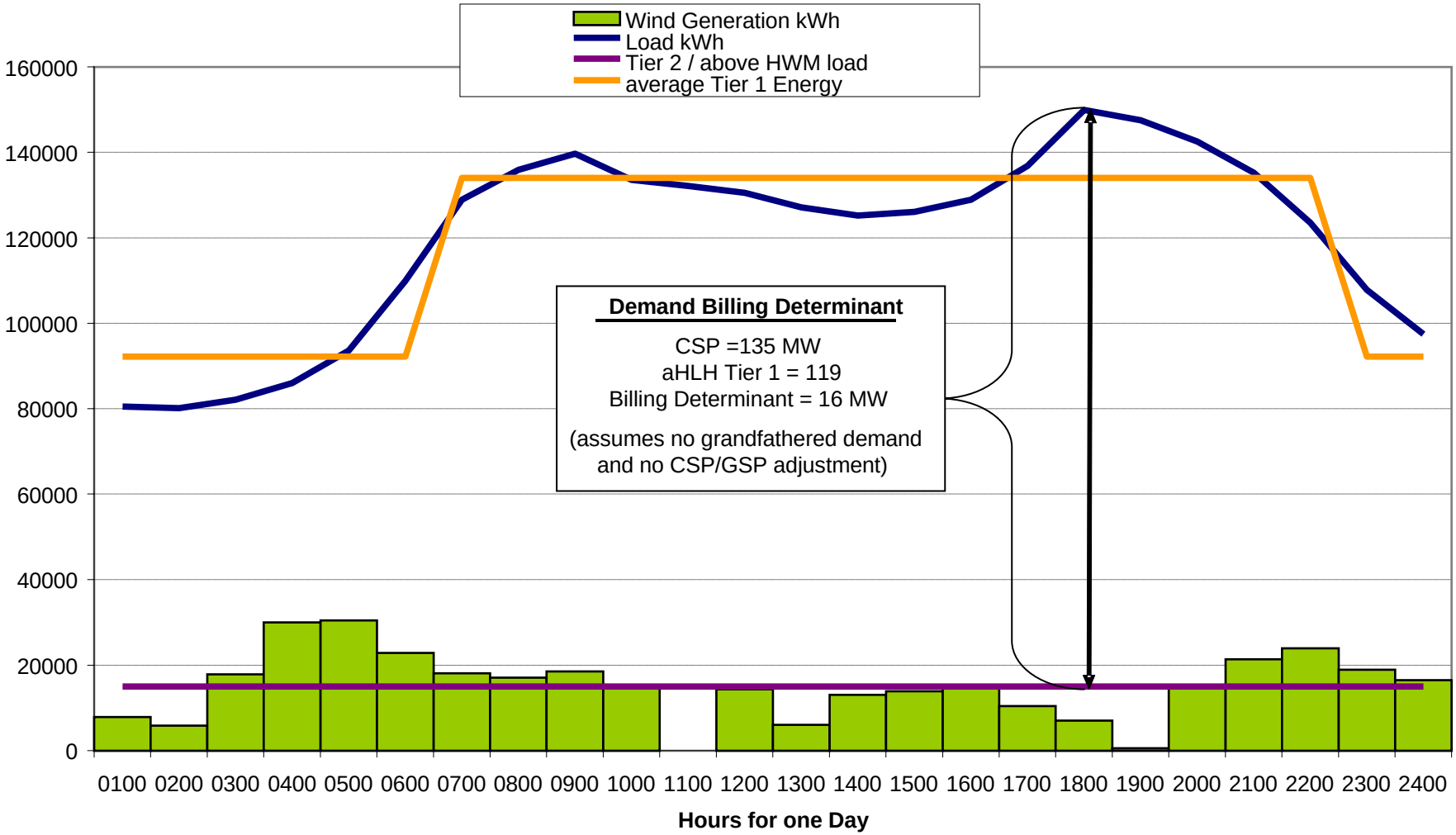
Firm Capacity created through the RSS

- BPA proposes to treat firm capacity purchased through the RSS the same as firm capacity brought by a customer resource.
  - Consistent treatment between self, third party, and BPA-provided RSS
- See following graph.

Current Treatment of Wind Showing the Hourly Load Profile and the Demand Billing Determinant



Proposed Treatment of Wind with RSS Showing the Hourly Load Profile and the Demand Billing Determinant



Price Comparison

Line		Capacity Charge $/MWh	Energy Charge $/MWh	Resource Shaping Charge	Amount Billed to Resource $/MWh	Avoided Tier 2 Load Demand $/MWh	Net Cost $/MWh
	Wind Farm "A" Capacity Factor = 32%						
1	Pumped Storage	11.62	5.23	0.71	17.56	11.62	**5.94**
2	Gas Turbine	11.62	6.30	0.71	18.63	11.62	**7.01**
	Wind Farm "B" Capacity Factor = 27%						
3	Pumped Storage	11.62	5.88	1.10	18.60	11.62	**6.98**
4	Gas Turbine	11.62	6.60	1.10	19.32	11.62	**7.70**
	Wind Farm "C" Capacity Factor = 29%						
5	Pumped Storage	11.62	5.40	1.04	18.06	11.62	**6.44**
6	Gas Turbine	11.62	6.59	1.04	19.25	11.62	**7.63**
	Wind Farm "P"ortfilio (A+B+C)/3 Capacity Factor = 30%						
7	Pumped Storage	11.62	4.80	0.94	17.36	11.62	**5.74**
8	Gas Turbine	11.62	7.00	0.94	19.56	11.62	**7.94**

Data used was based on actuals for three different wind farms. Both capacity factor and energy shape are different between the three farms.