

# Calculating Scarcity Rents

EPFSTF

January 11, 2019

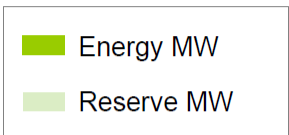
Joe Bowring  
Catherine Tyler



Monitoring Analytics

# Calculation of Energy Market Scarcity Rents

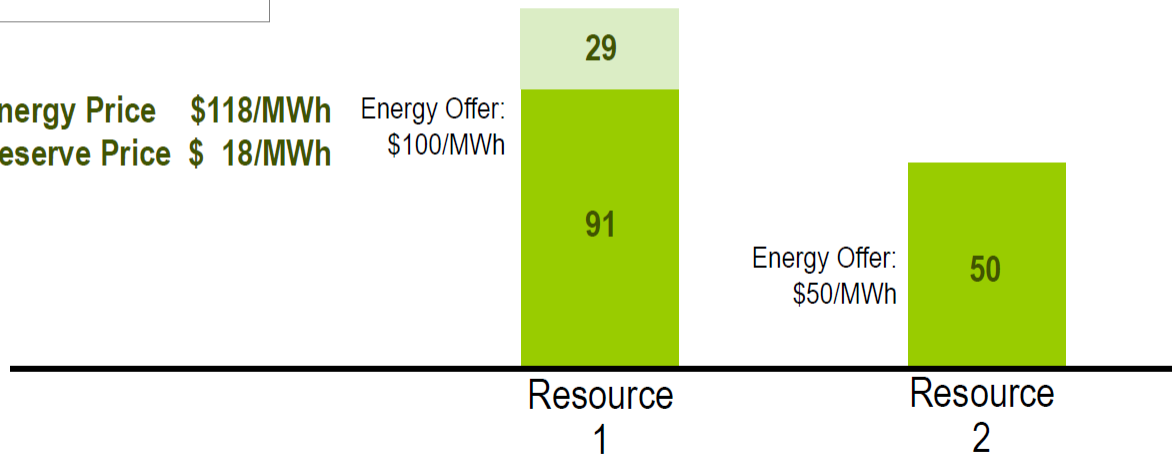
- **Scarcity rents in energy and reserve markets are the portion of revenues directly attributable to the scarcity price adder to LMP.**
- **The scarcity adder to LMP is the difference between the LMP and the marginal cost of the marginal unit.**
- **The scarcity adder to the reserve price is the amount of the LMP scarcity when it enters the reserve price through the lost opportunity cost of the marginal reserve resource.**



Demand 141 MW

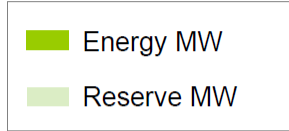
Energy Price \$118/MWh  
Reserve Price \$ 18/MWh

Energy Offer:  
\$100/MWh



Energy Offer:  
\$50/MWh





Demand 141 MW

Energy Price \$118/MWh  
Reserve Price \$ 18/MWh

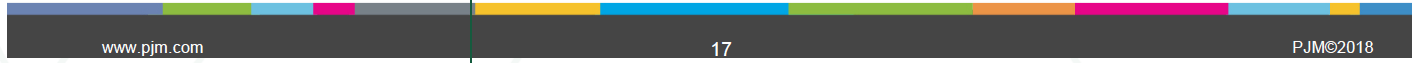
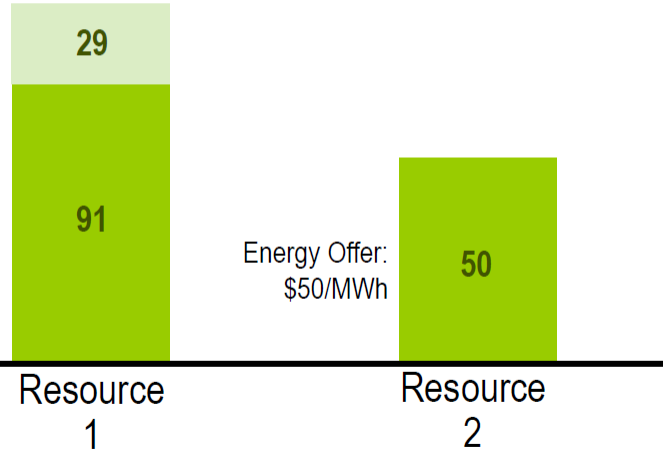
Energy Offer:  
\$100/MWh

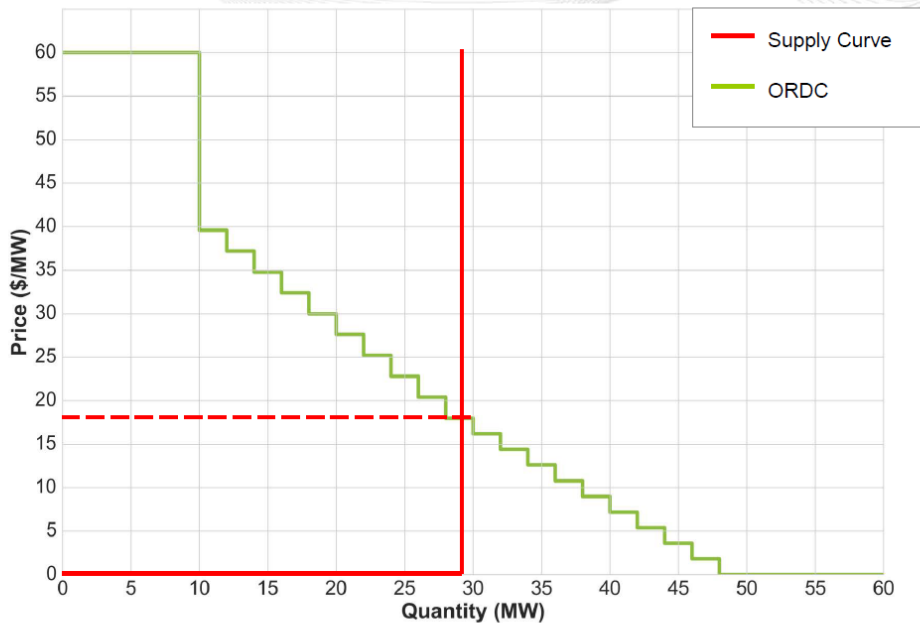
Energy Offer:  
\$50/MWh

Scarcity adder = \$18/MWh  
Resource 1 scarcity rent:  
\$18/MWh x 91 MWh  
+ \$18/MWh x 29 MWh = \$2160

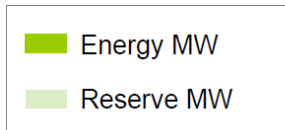
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Resource 2 scarcity rent:  
\$18/MWh x 50 MWh = \$900





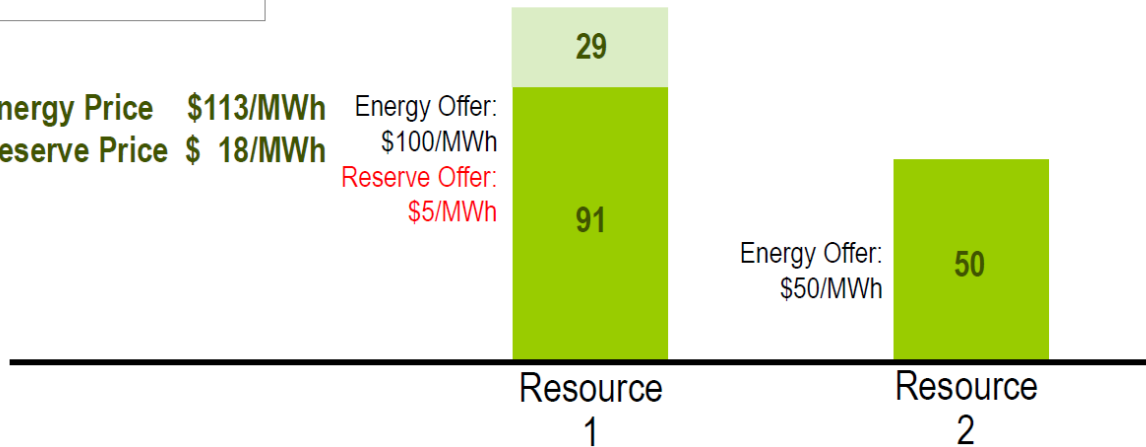
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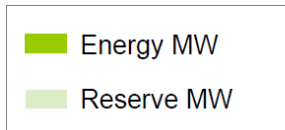


**Demand 141 MW**

**Energy Price \$113/MWh**  
**Reserve Price \$ 18/MWh**

Energy Offer:  
 \$100/MWh  
 Reserve Offer:  
 \$5/MWh



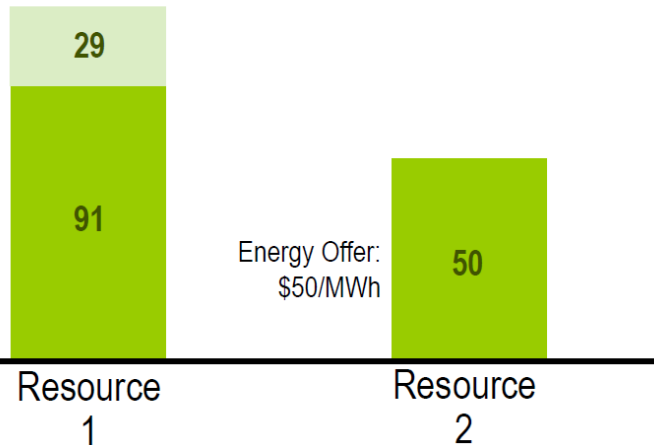


Demand 141 MW

Energy Price \$113/MWh  
Reserve Price \$ 18/MWh

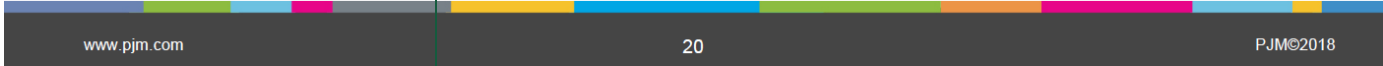
Energy Offer: \$100/MWh  
Reserve Offer: \$5/MWh

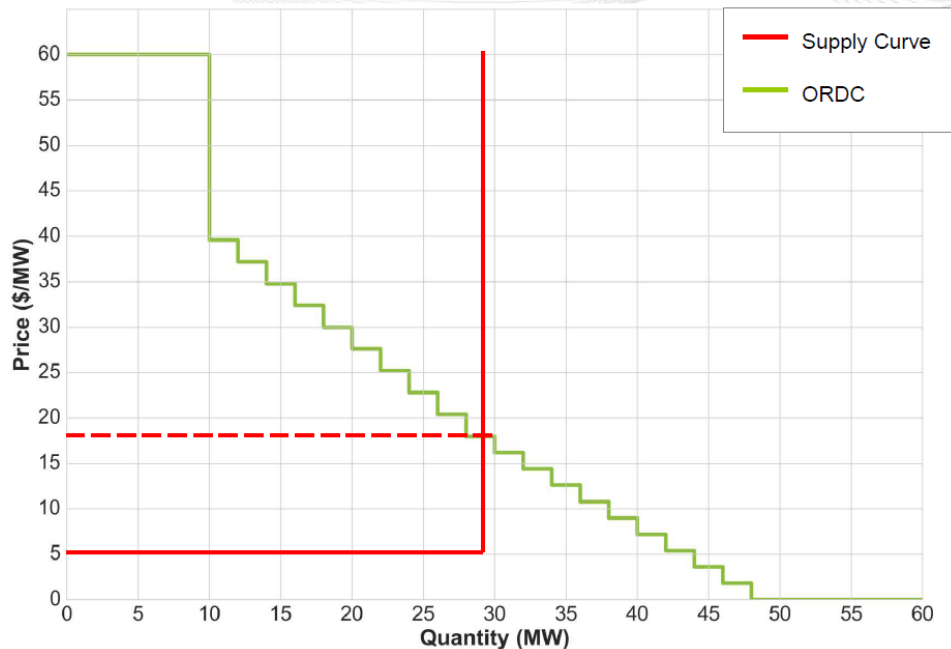
Energy Offer: \$50/MWh



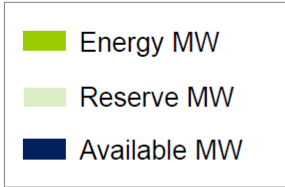
Scarcity adder = \$13/MWh  
 Resource 1 scarcity rent:  
 $\$13/\text{MWh} \times 91 \text{ MWh}$   
 $+ \$13/\text{MWh} \times 29 \text{ MWh} = \$1560$

Resource 2 scarcity rent:  
 $\$13/\text{MWh} \times 50 \text{ MWh} = \$650$





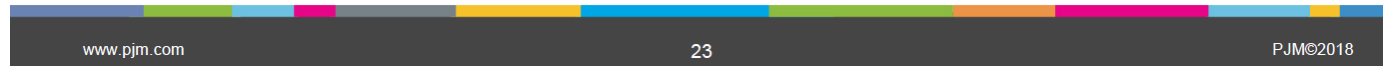
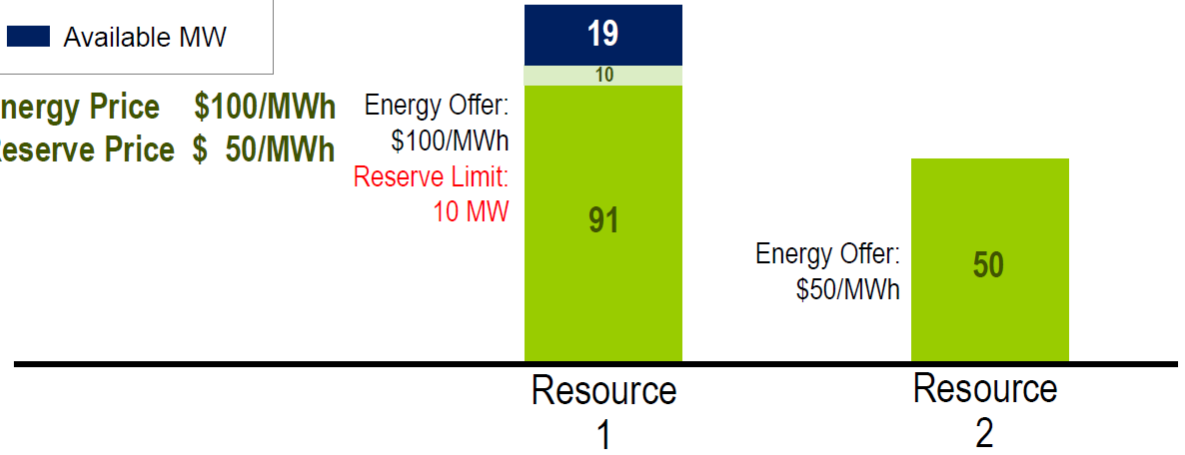


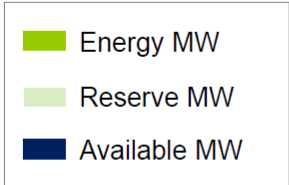


**Demand 141 MW**

**Energy Price \$100/MWh**  
**Reserve Price \$ 50/MWh**

Energy Offer: \$100/MWh  
 Reserve Limit: 10 MW



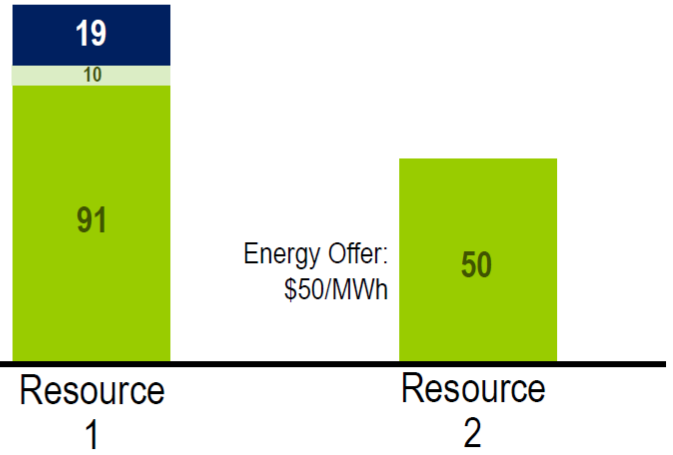


Demand 141 MW

Energy Price \$100/MWh  
Reserve Price \$ 50/MWh

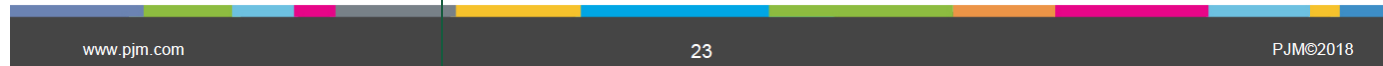
Energy Offer: \$100/MWh  
Reserve Limit: 10 MW

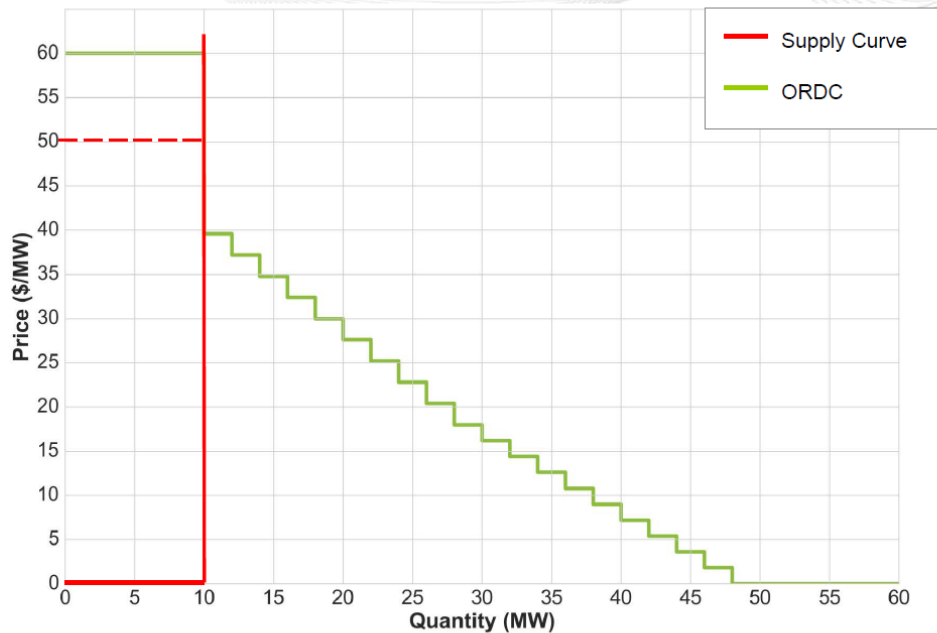
Energy Offer: \$50/MWh

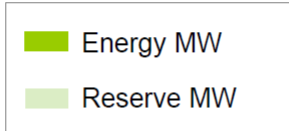


Scarcity adder = \$0/MWh  
Resource 1 scarcity rent:  
\$0/MWh x 91 MWh  
+ \$0/MWh x 10 MWh = \$0

Resource 2 scarcity rent:  
\$0/MWh x 50 MWh = \$0



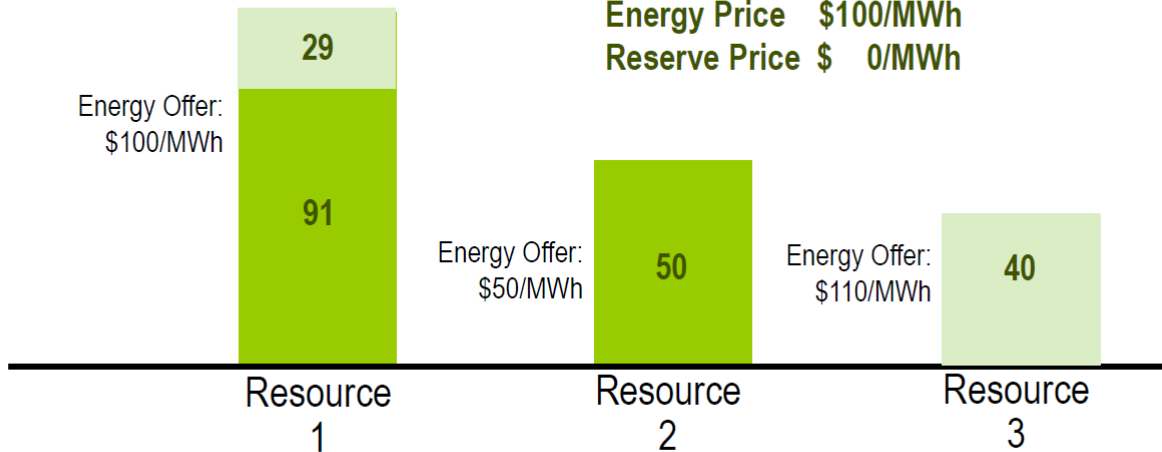


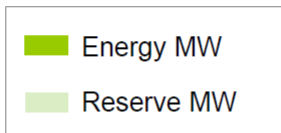


**Demand 141 MW**

**Energy Price \$100/MWh**

**Reserve Price \$ 0/MWh**



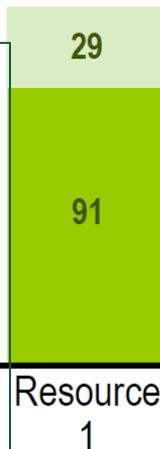


**Demand 141 MW**

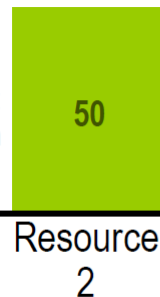
**Energy Price \$100/MWh**  
**Reserve Price \$ 0/MWh**

Scarcity adder = \$0/MWh  
 Resource 1 scarcity rent:  
 $\$0/\text{MWh} \times 91 \text{ MWh}$   
 $+ \$0/\text{MWh} \times 29 \text{ MWh} = \$0$   
 Resource 2 scarcity rent:  
 $\$0/\text{MWh} \times 50 \text{ MWh} = \$0$   
 Resource 3 scarcity rent:  
 $\$0/\text{MWh} \times 40 \text{ MWh} = \$0$

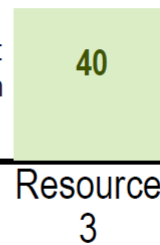
Energy Offer:  
\$100/MWh

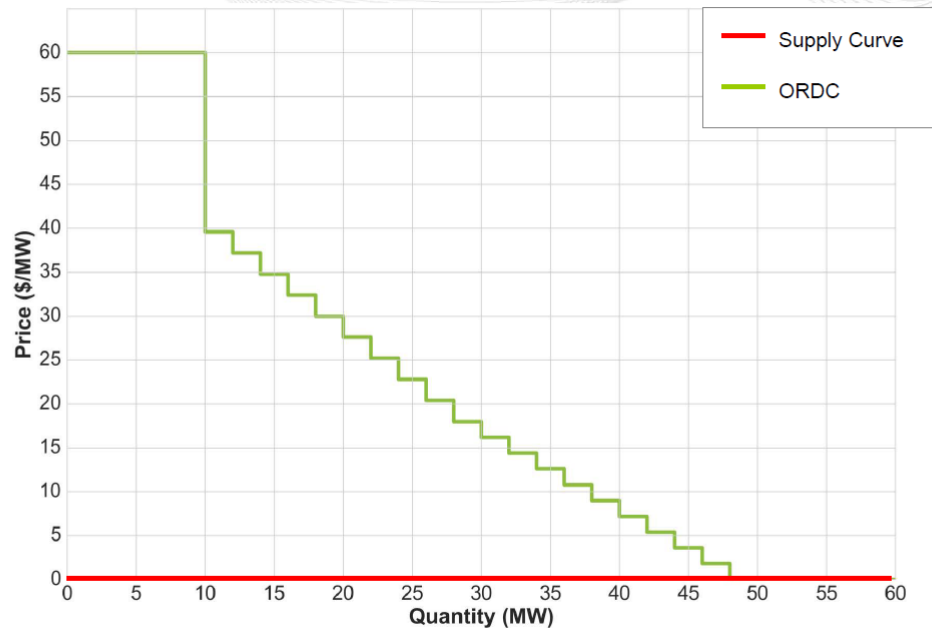


Energy Offer:  
\$50/MWh

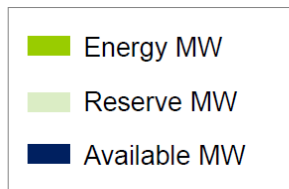


Energy Offer:  
\$110/MWh





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**Demand 141 MW**

**Energy Price \$105/MWh**

**Reserve Price \$ 5/MWh**

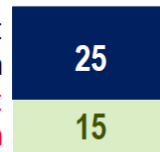
Energy Offer:  
\$100/MWh



Energy Offer:  
\$50/MWh



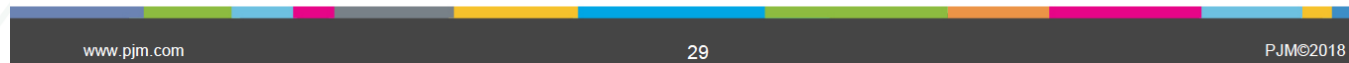
Energy Offer:  
\$110/MWh  
Reserve Offer:  
\$5/MWh

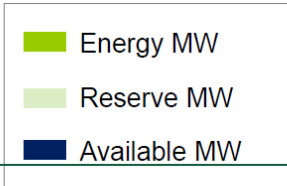


Resource  
1

Resource  
2

Resource  
3





Demand 141 MW

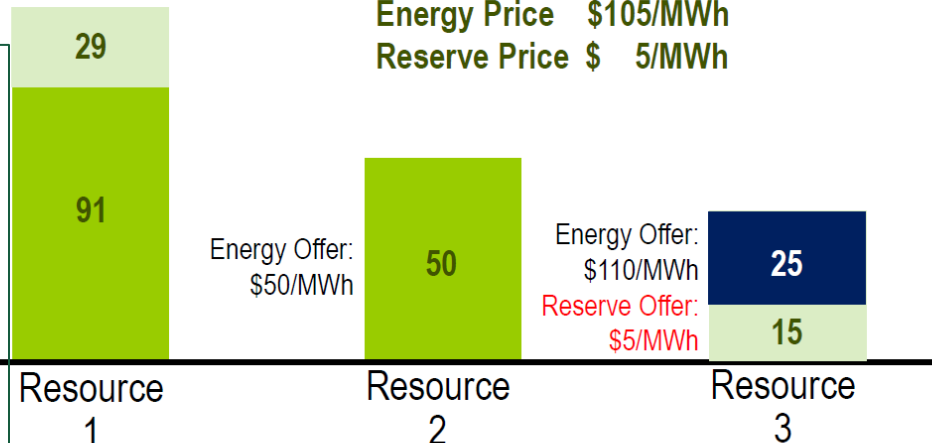
Energy Price \$105/MWh  
Reserve Price \$ 5/MWh

Energy Offer: \$100/MWh

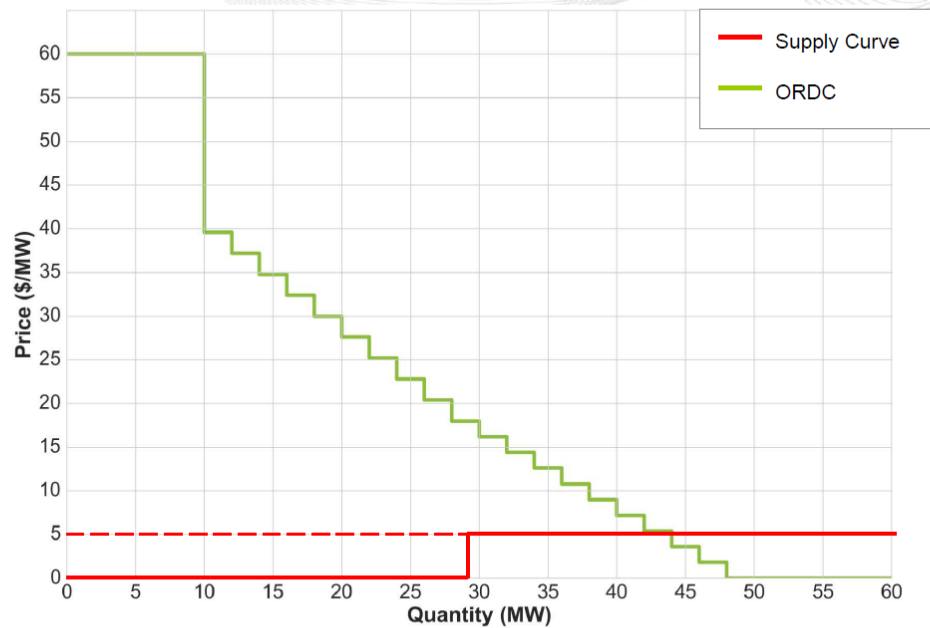
Resource 1 scarcity rent:  
\$5/MWh x 91 MWh  
+ \$0/MWh x 29 MWh = \$455

Resource 2 scarcity rent:  
\$5/MWh x 50 MWh = \$0

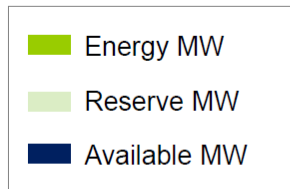
Resource 3 scarcity rent:  
\$0/MWh x 15 MWh = \$0





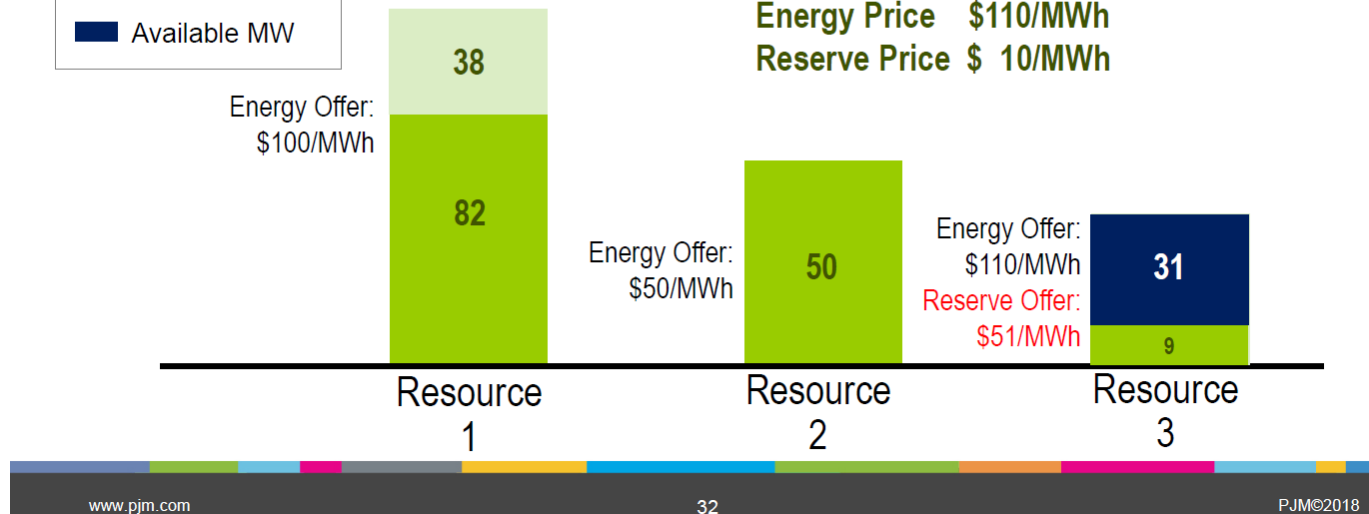


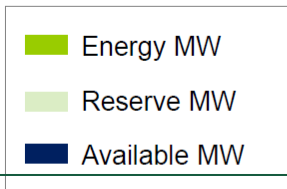
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**Demand 141 MW**

**Energy Price \$110/MWh**  
**Reserve Price \$ 10/MWh**

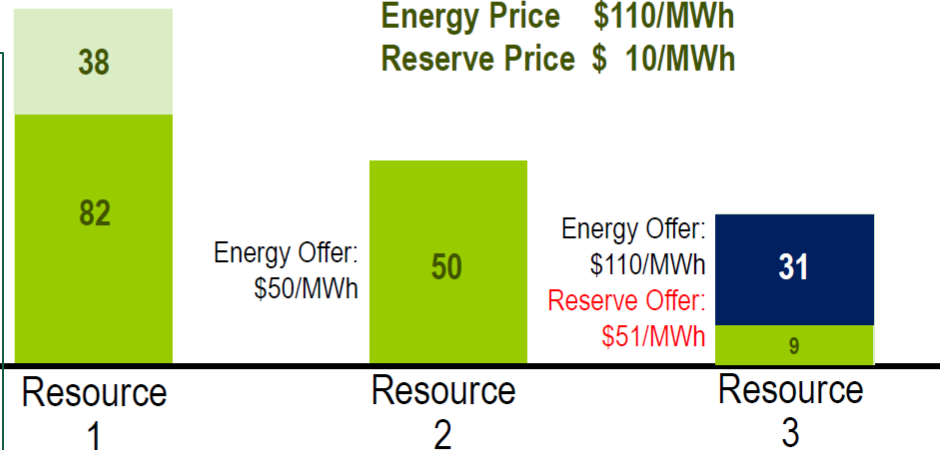




**Demand 141 MW**

**Energy Price \$110/MWh**

**Reserve Price \$ 10/MWh**



Energy Offer: \$100/MWh

Energy Offer: \$50/MWh

Energy Offer: \$110/MWh  
Reserve Offer: \$51/MWh

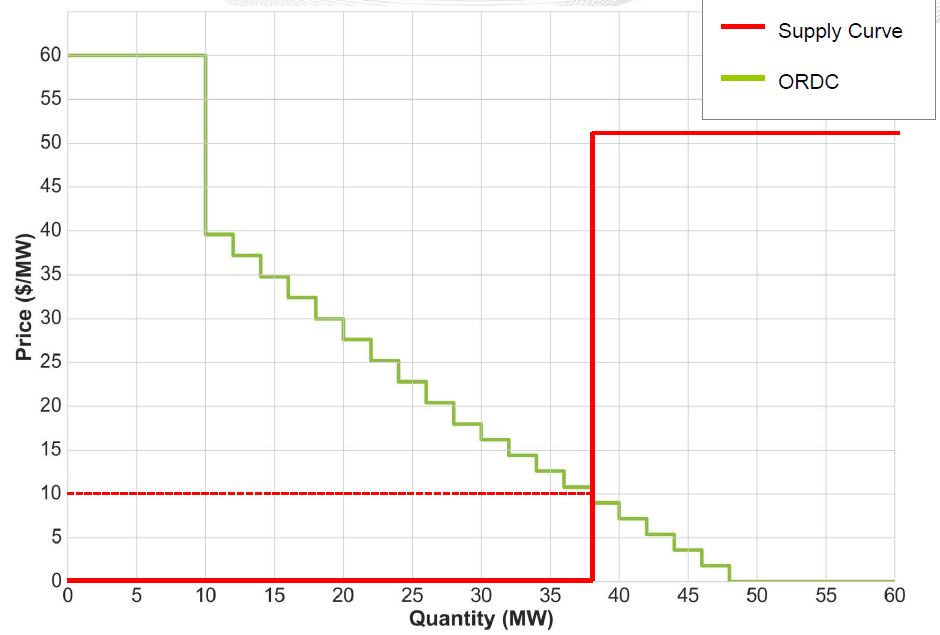
Scarcity adder: \$10/MWh

Resource 1 scarcity rent:  
 $\$10/\text{MWh} \times 82 \text{ MWh}$   
 $+ \$10/\text{MWh} \times 38 \text{ MWh} = \$1200$

Resource 2 scarcity rent:  
 $\$10/\text{MWh} \times 50 \text{ MWh} = \$500$

Resource 3 scarcity rent:  
 $\$10/\text{MWh} \times 9 \text{ MWh} = \$90$





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