

Calculating Scarcity Rents

EPFSTF

January 11, 2019

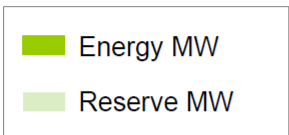
Joe Bowring
Catherine Tyler



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.**

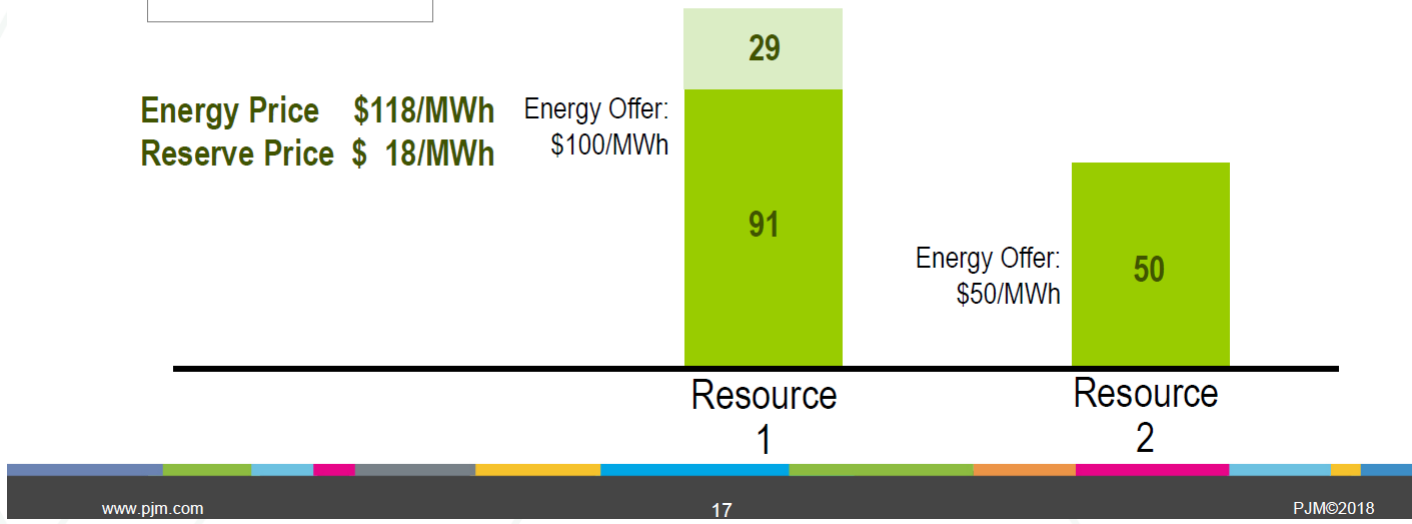


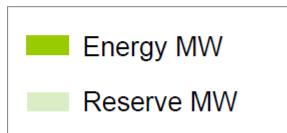
Demand 141 MW

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

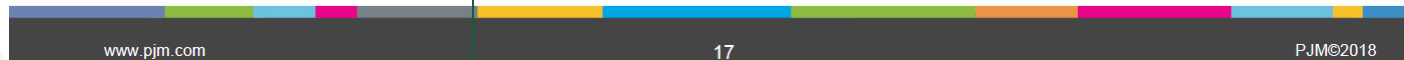
Scarcity adder = \$18/MWh

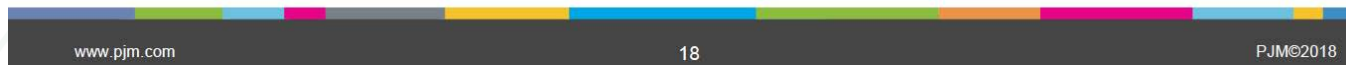
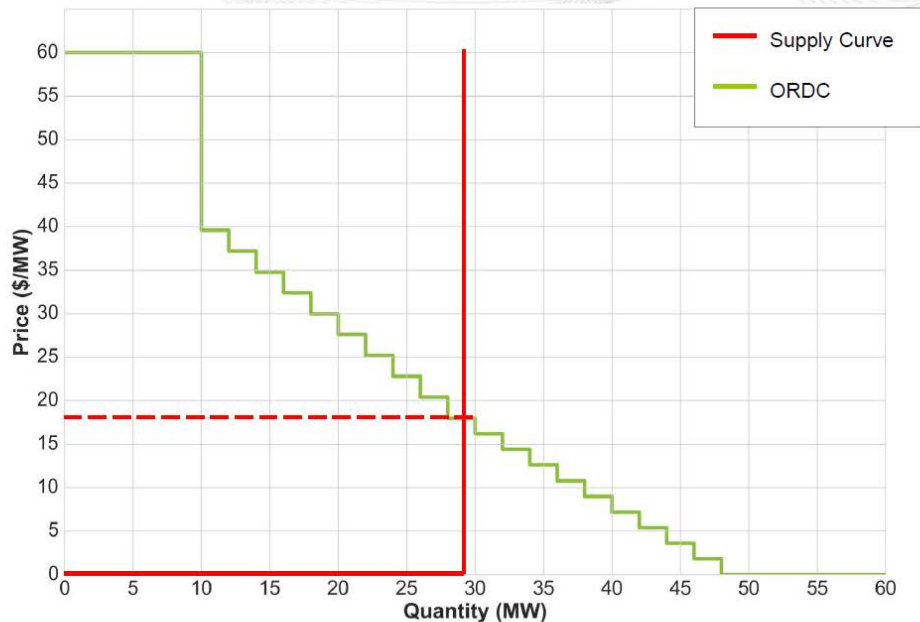
Resource 1 scarcity rent:

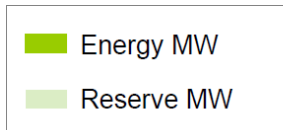
$$\begin{aligned} & \$18/\text{MWh} \times 91 \text{ MWh} \\ & + \$18/\text{MWh} \times 29 \text{ MWh} = \$2160 \end{aligned}$$

Resource 2 scarcity rent:

$$\$18/\text{MWh} \times 50 \text{ MWh} = \$900$$



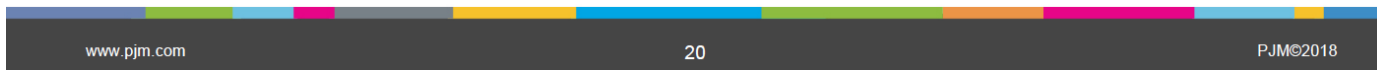
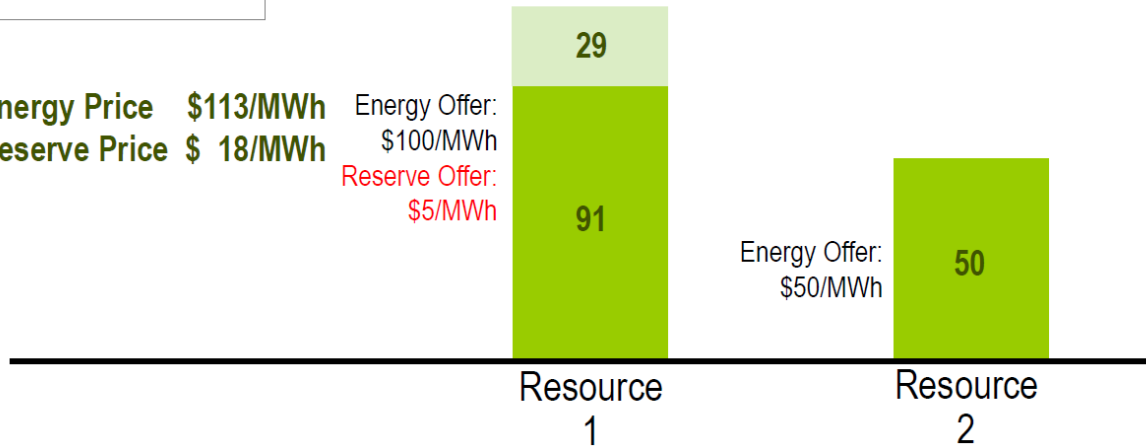


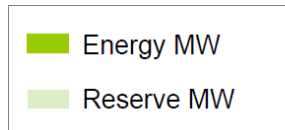


Demand 141 MW

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

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





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

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

Demand 141 MW

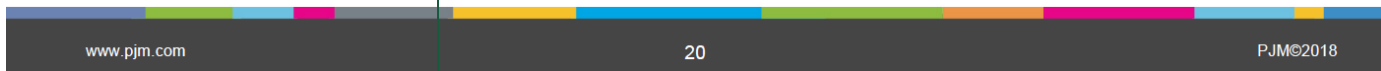


Resource 1



Energy Offer: \$50/MWh

Resource 2



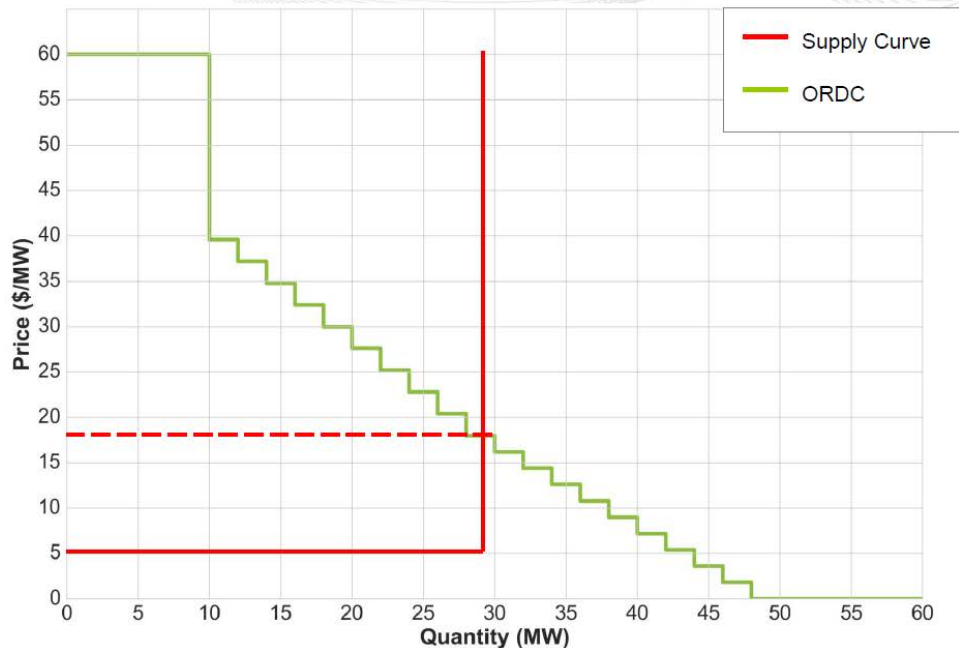
Scarcity adder = \$13/MWh

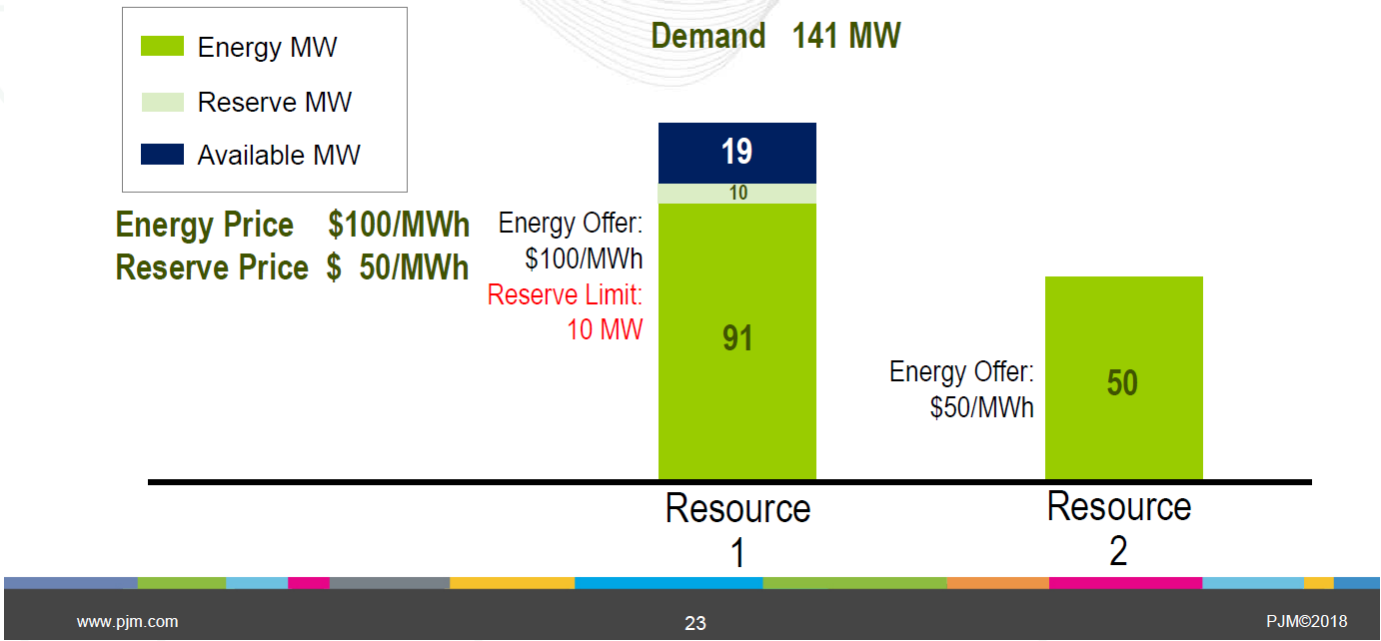
Resource 1 scarcity rent:

$$\begin{aligned} & \$13/\text{MWh} \times 91 \text{ MWh} \\ & + \$13/\text{MWh} \times 29 \text{ MWh} = \$1560 \end{aligned}$$

Resource 2 scarcity rent:

$$\$13/\text{MWh} \times 50 \text{ MWh} = \$650$$

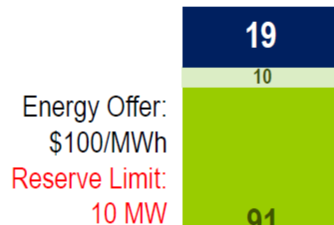




Energy MW
Reserve MW
Available MW

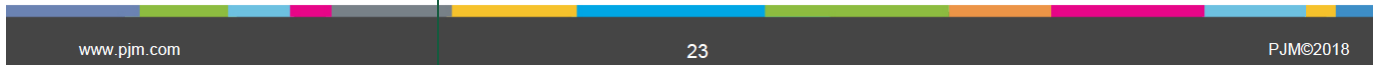
Energy Price \$100/MWh
Reserve Price \$ 50/MWh

Demand 141 MW



Resource 1

Resource 2



www.pjm.com

PJM©2018

Scarcity adder = \$0/MWh

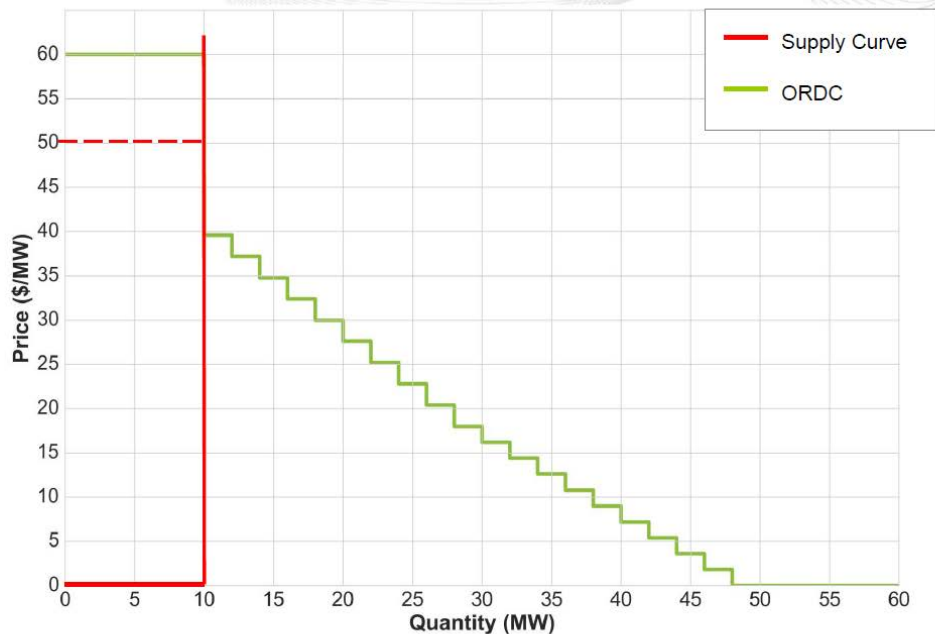
Resource 1 scarcity rent:

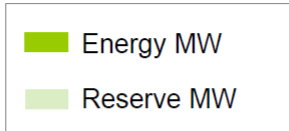
\$0/MWh x 91 MWh

+ \$0/MWh x 10 MWh = \$0

Resource 2 scarcity rent:

\$0/MWh x 50 MWh = \$0

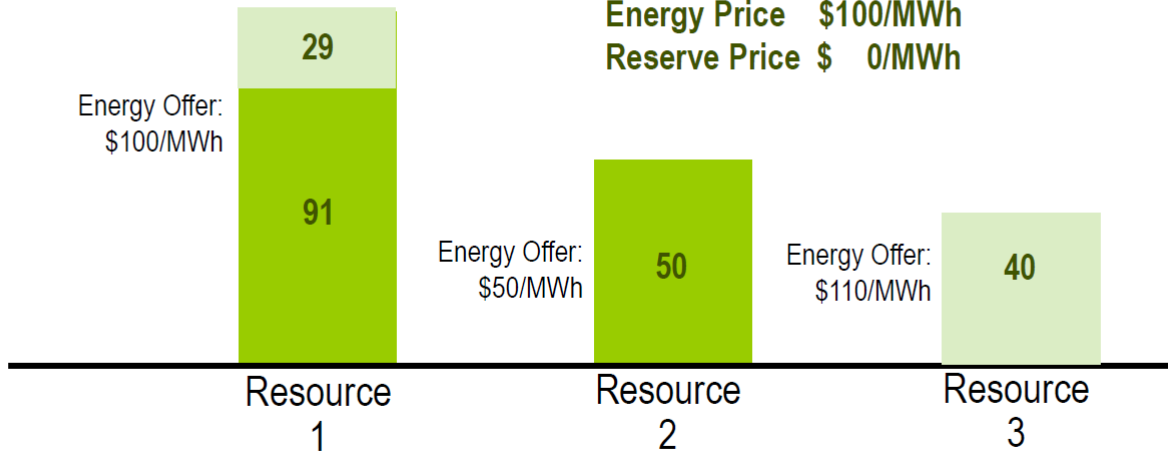


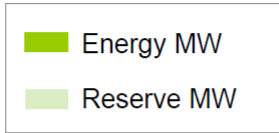


Demand 141 MW

Energy Price \$100/MWh

Reserve Price \$ 0/MWh





Demand 141 MW

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

Energy Offer:
\$100/MWh

Energy Offer:
\$50/MWh

Energy Offer:
\$110/MWh

Scarcity adder = \$0/MWh

Resource 1 scarcity rent:

\$0/MWh x 91 MWh

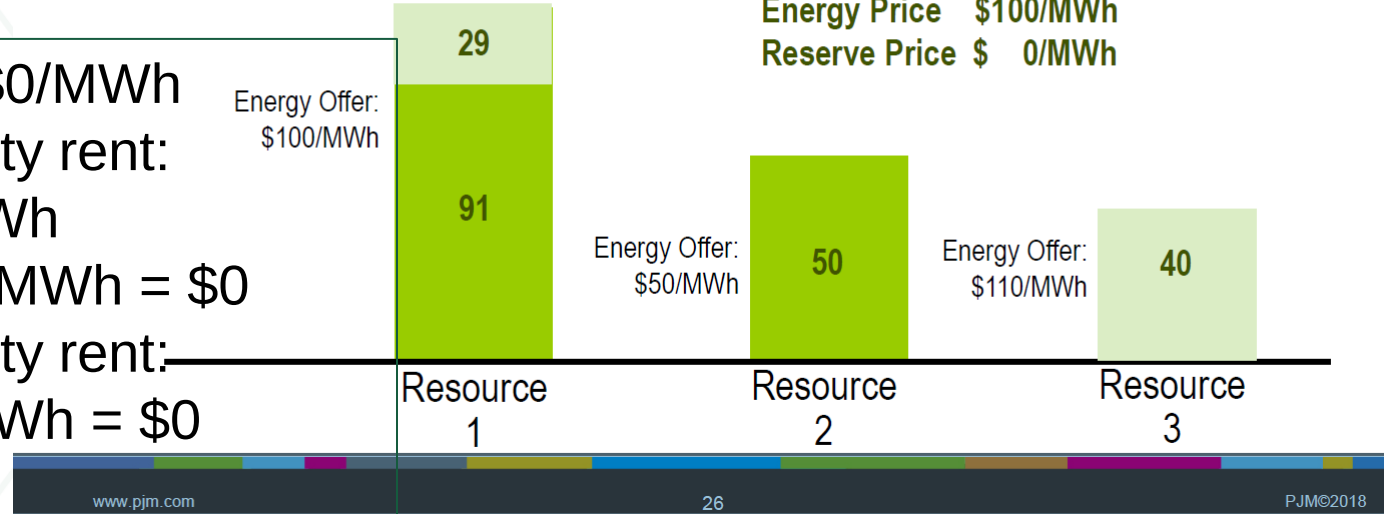
+ \$0/MWh x 29 MWh = \$0

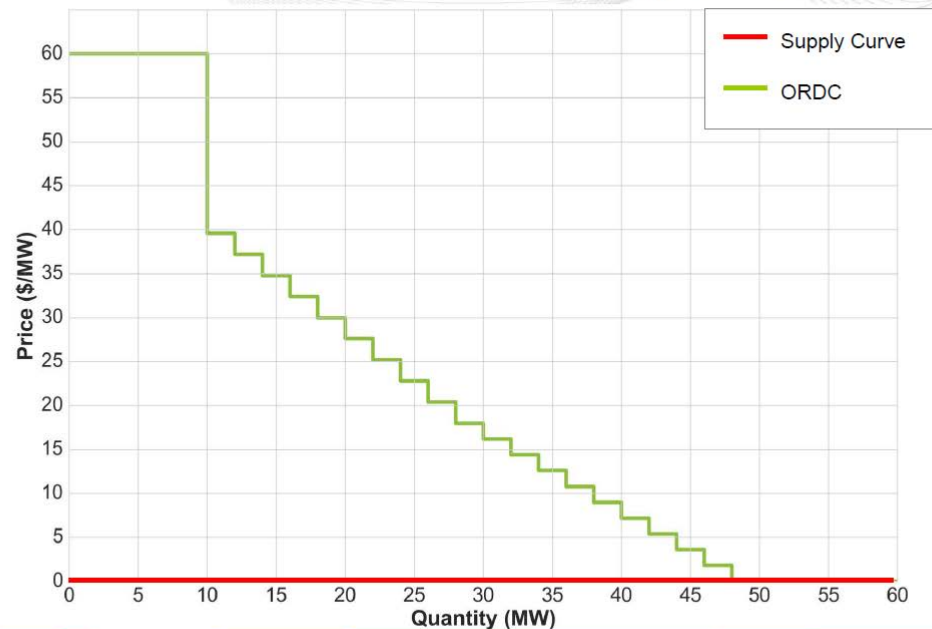
Resource 2 scarcity rent:

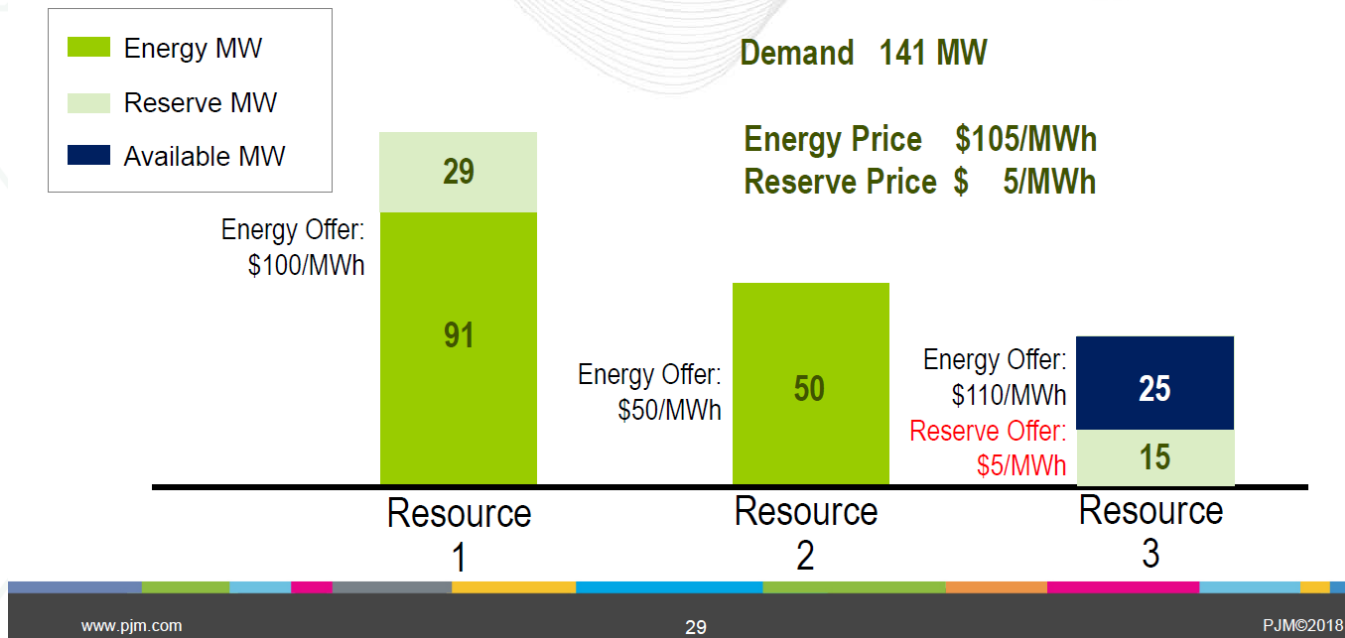
\$0/MWh x 50 MWh = \$0

Resource 3 scarcity rent:

\$0/MWh x 40 MWh = \$0







■ Energy MW
■ Reserve MW
■ Available MW

Demand 141 MW

Energy Price \$105/MWh

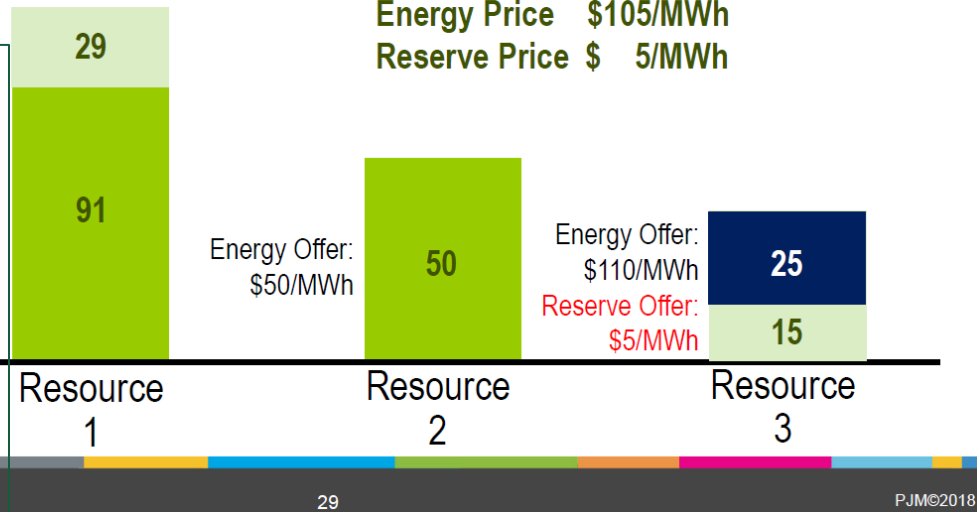
Reserve Price \$ 5/MWh

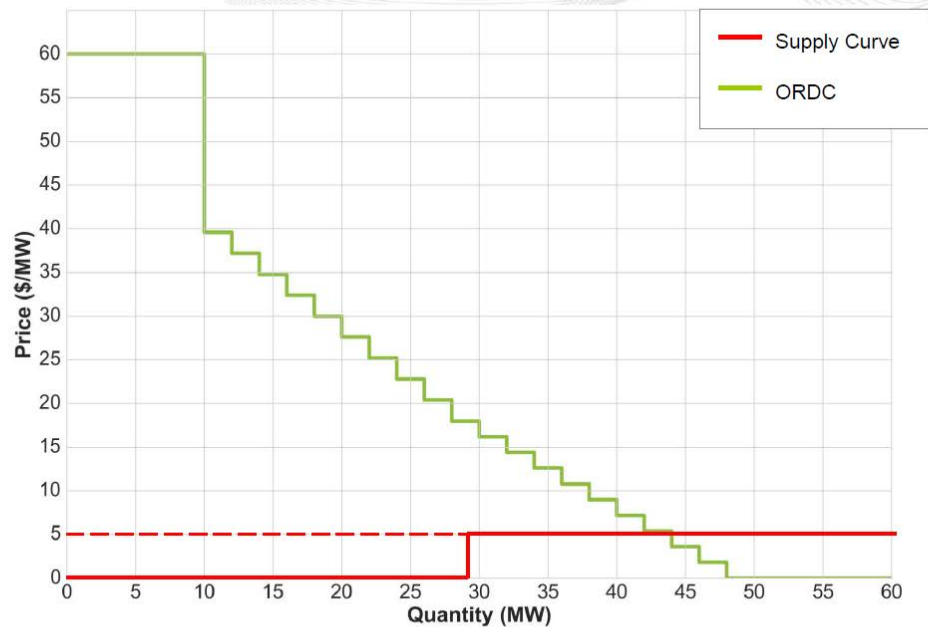
Energy Offer:
\$100/MWh

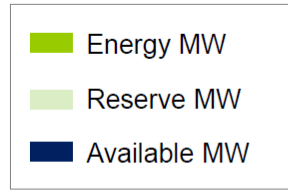
Resource 1 scarcity rent:
 $\$5/\text{MWh} \times 91 \text{ MWh}$
 $+ \$0/\text{MWh} \times 29 \text{ MWh} = \455

Resource 2 scarcity rent:
 $\$5/\text{MWh} \times 50 \text{ MWh} = \0

Resource 3 scarcity rent:
 $\$0/\text{MWh} \times 15 \text{ MWh} = \0







Demand 141 MW

Energy Price \$110/MWh

Reserve Price \$ 10/MWh

Energy Offer:
\$100/MWh

38

82

Resource
1

Energy Offer:
\$50/MWh

50

Resource
2

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

31

9

Resource
3

www.pjm.com

32

PJM©2018

■ Energy MW
■ Reserve MW
■ Available MW

Demand 141 MW

Energy Price \$110/MWh

Reserve Price \$ 10/MWh

Scarcity adder: \$10/MWh

Resource 1 scarcity rent:

\$10/MWh x 82 MWh

+ \$10/MWh x 38 MWh = \$1200

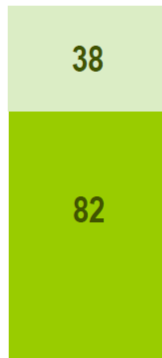
Resource 2 scarcity rent:

\$10/MWh x 50 MWh = \$500

Resource 3 scarcity rent:

\$10/MWh x 9 MWh = \$90

Energy Offer:
\$100/MWh



Resource
1

Energy Offer:
\$50/MWh



Resource
2

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

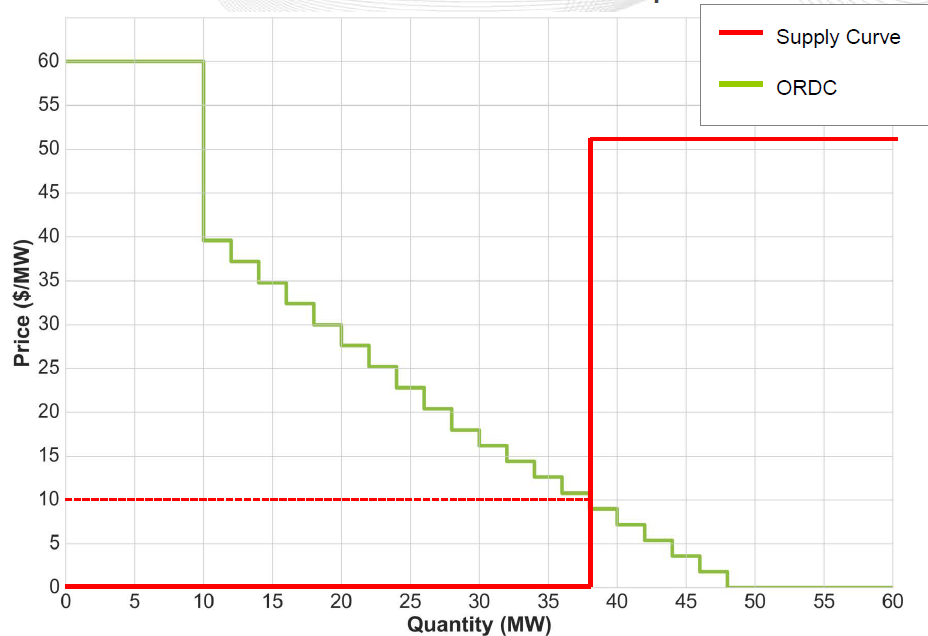


Resource
3

www.pjm.com

32

PJM©2018



Monitoring Analytics, LLC

2621 Van Buren Avenue

Suite 160

Eagleville, PA

19403

(610) 271-8050

MA@monitoringanalytics.com

www.MonitoringAnalytics.com

