



# Multiple Ramp Rate Study in ERCOT Balancing Energy Market

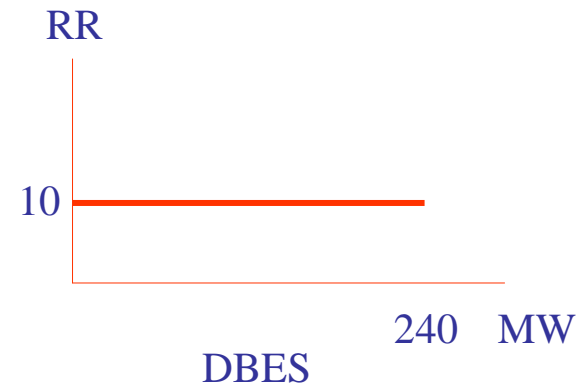
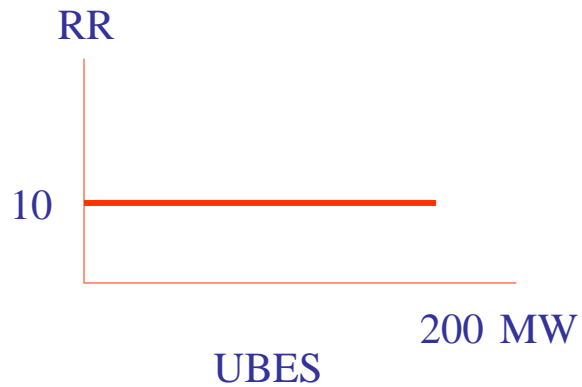
Young Li

ERCOT Market Operations Support

05/10/2006

# Single Ramp Rate

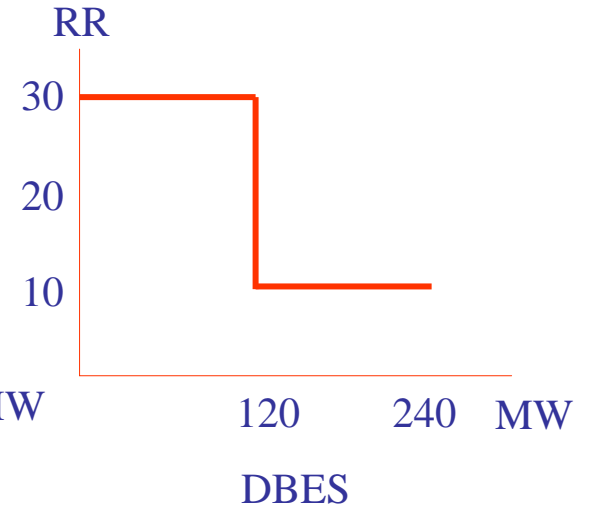
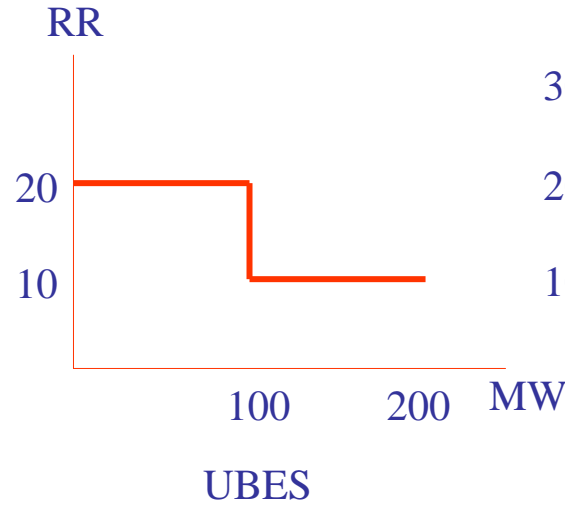
QSE	Type	Bid MW	Ramp Rate
A	UBES	100	10
A	UBES	200	
A	DBES	120	10
A	DBES	240	



# Multiple Ramp Rate

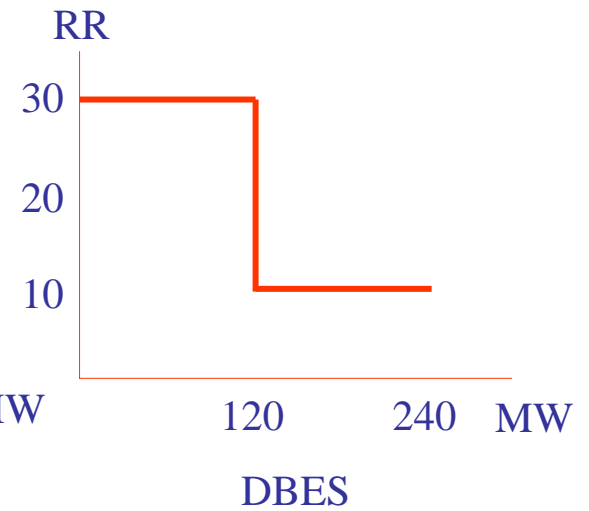
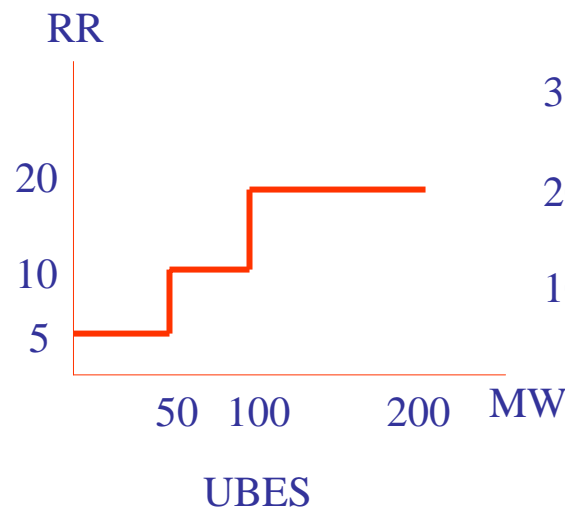
## Multiple Ramp-Rate Bid-1

QSE	Type	Bid MW	Ramp Rate
A	UBES	100	20
A	UBES	200	10
A	DBES	120	30
A	DBES	240	10



## Multiple Ramp-Rate Bid-2

QSE	Type	Bid MW	Ramp Rate
A	UBES	50	5
A	UBES	100	10
A	UBES	200	20
A	DBES	120	30
A	DBES	240	10



# Ramp Rate Constrained Balancing Deployment Range

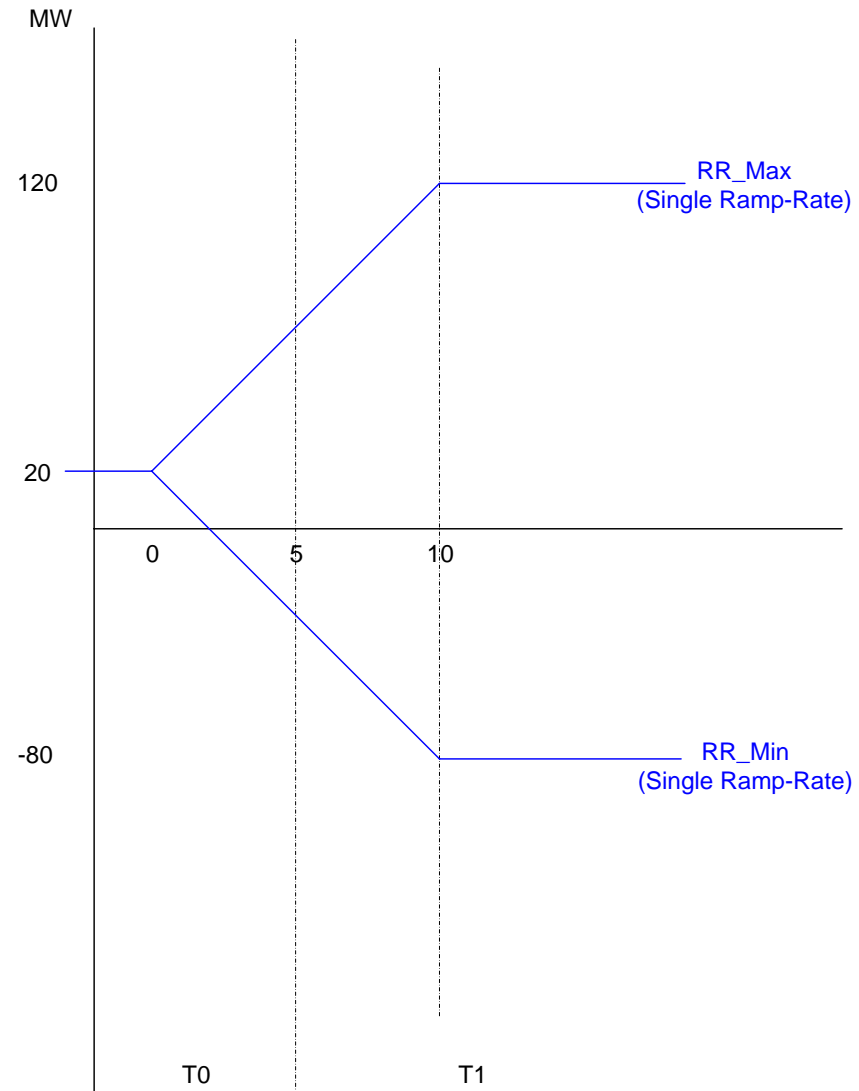
## RR\_Max:

The maximum amount of net Balancing Energy that can be deployed from the portfolio in the target interval

## RR\_Min:

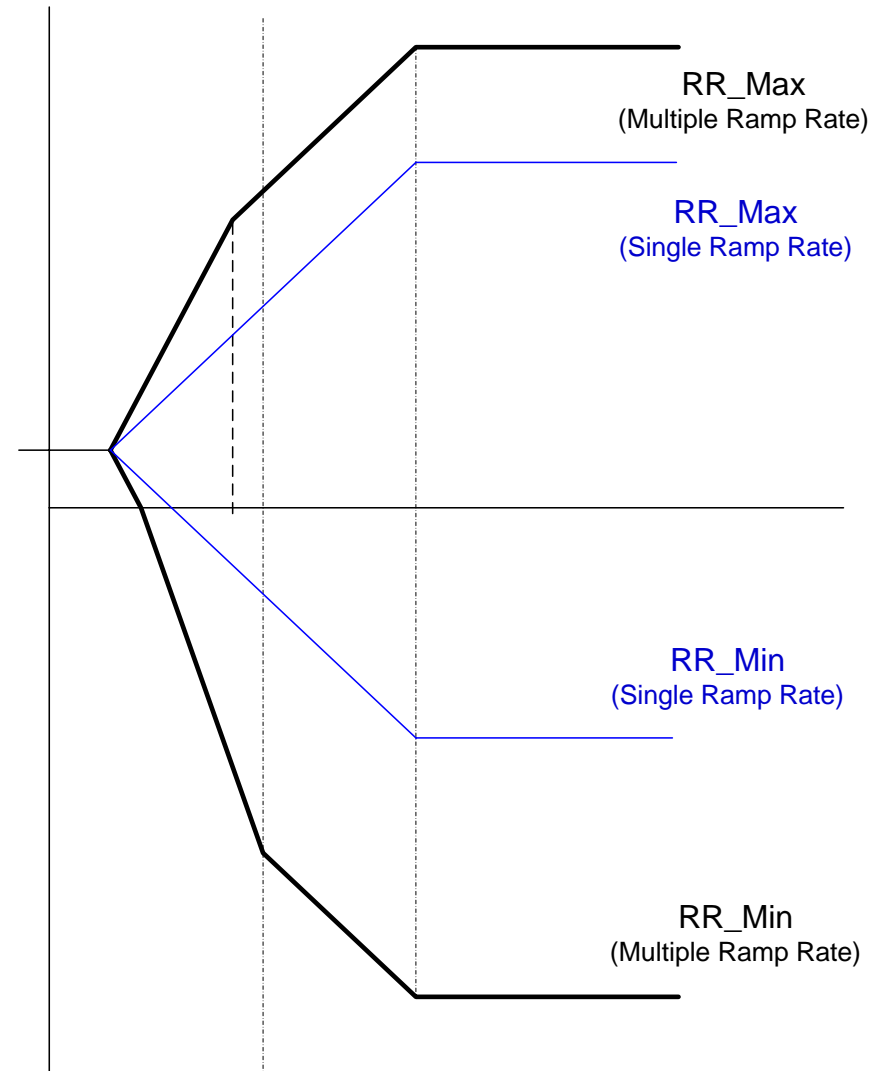
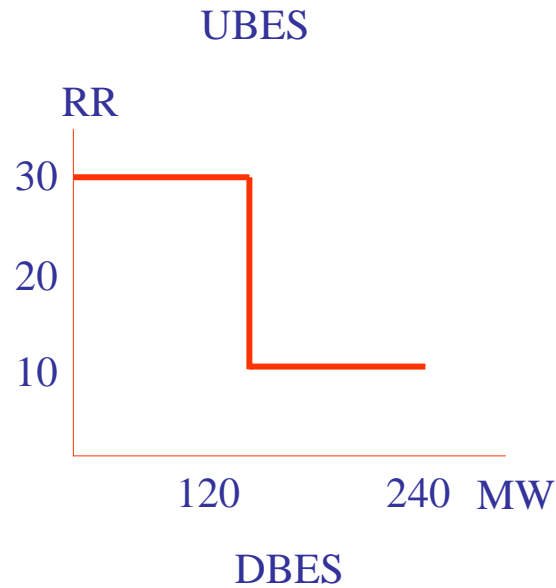
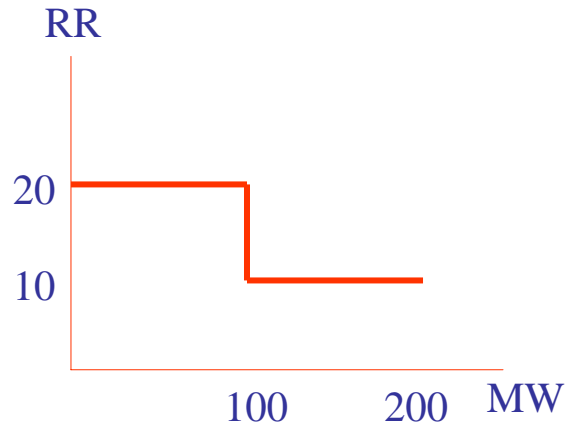
The minimum amount of net Balancing Energy that can be deployed from the portfolio in the target interval

RR\_Max & RR\_Min are calculated in ERCOT SPD (Scheduling, Pricing and Dispatching) engine to clear real time balancing energy market



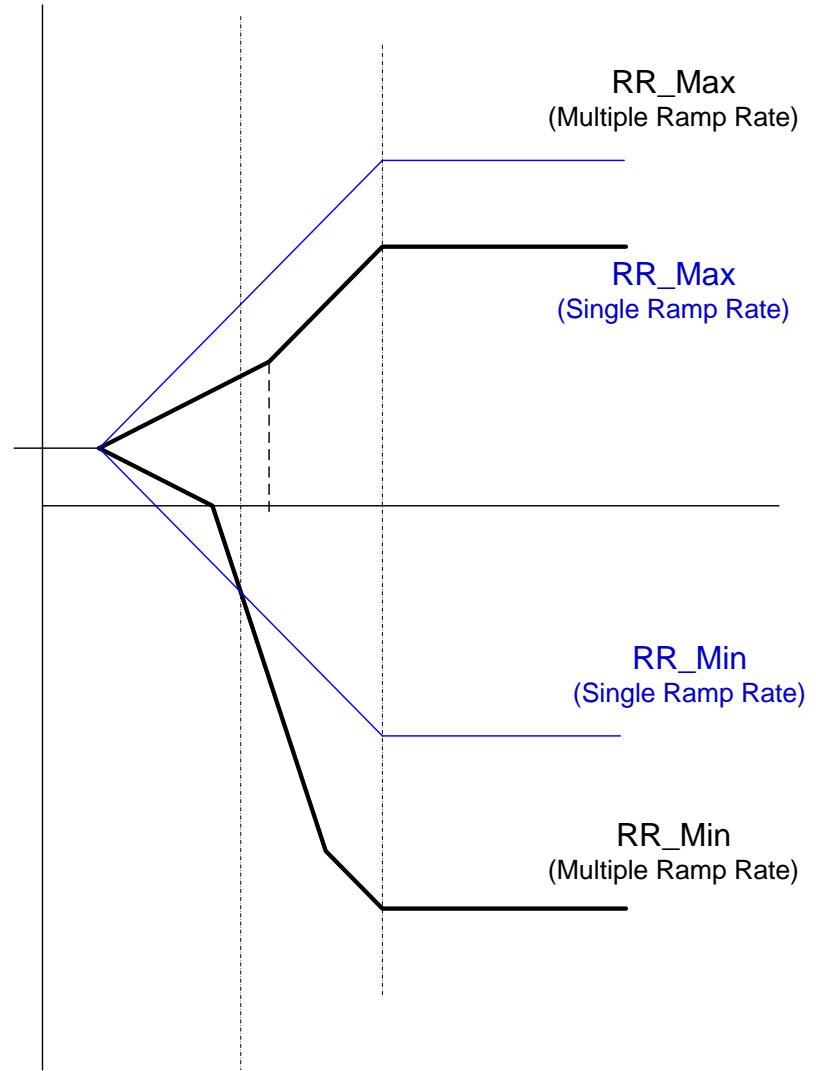
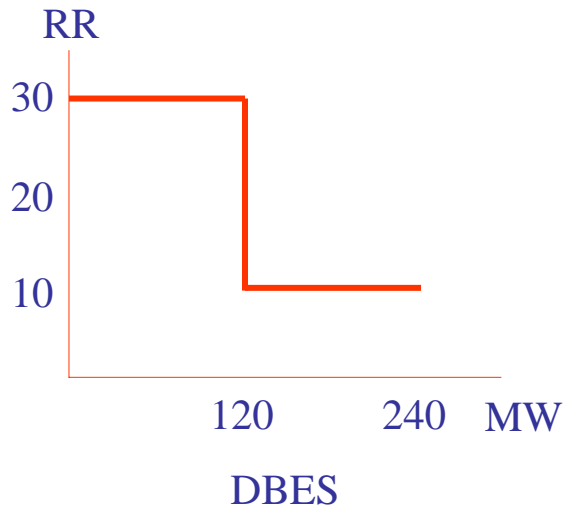
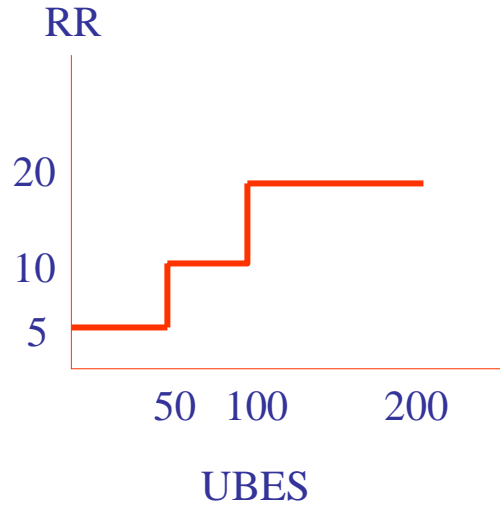
# Balancing Deployment Availability

## Multiple Ramp-Rate Bid-1



# Balancing Deployment Availability-Bid 2

## Multiple Ramp-Rate Bid-2



# Two Alternatives

- I: Market System Changes, No SPD change



- II: Market System Changes and SPD change.



# Alternative I

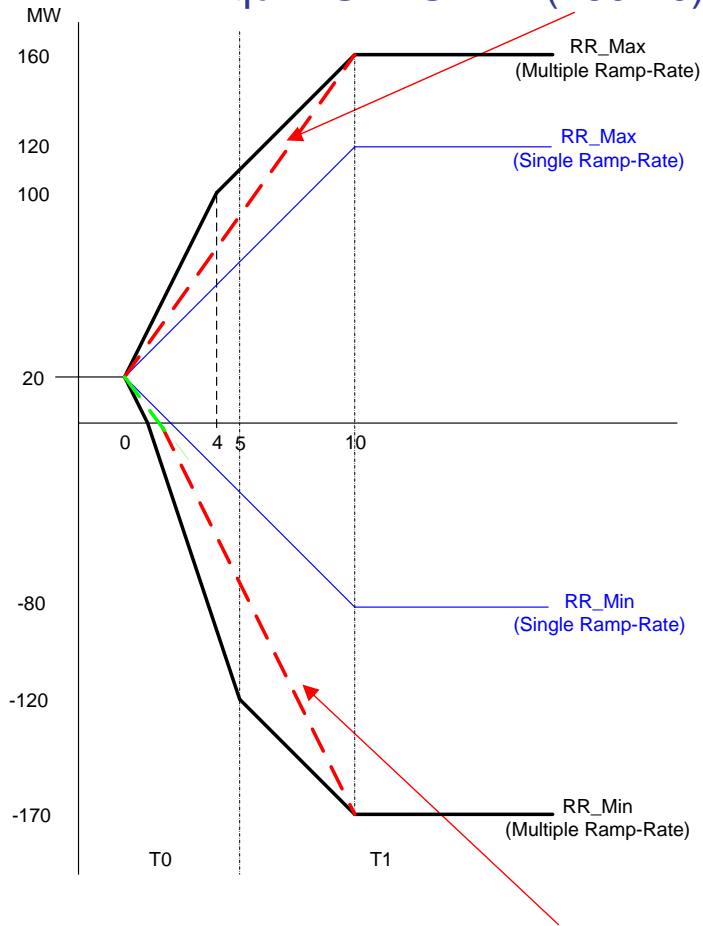
- **No SPD changes, but market system changes**
  - QSEs submit the multiple ramp rate curve together with the balancing bids,
  - Both XML/Portal and market database will be changed,
  - A specific ramp rate will be used before clearing the balancing market.
- **Major Task**
  - Calculate some equivalent ramp-rates using a stored procedure in MDB,
  - Pass the calculated ramp-rates to SPD.
- **Limitation**
  - How to Handle Ramp Rate Recall?



# Preprocess out of Market Clearing Engine

## Bid-1

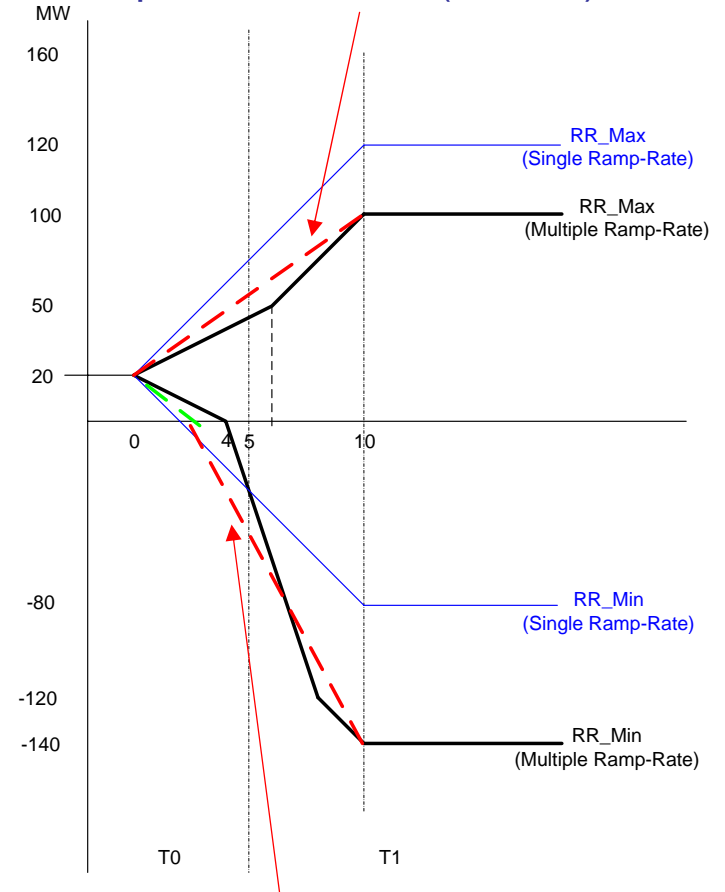
Equiv. UBES RR= $(160-20)/10=14$



Equiv. DBES RR= $(170-0)/(10-1.43)=19.8$

## Bid-2

Equiv. UBES RR= $(100-20)/10=8$



Equiv. DBES RR= $(140-0)/(10-2.5)=18.7$

- **With both SPD and market system changes**
  - **QSEs submit the multiple ramp rate curve together with the balancing bids,**
  - **Both XML/Portal and market database will be changed,**
  - **Modify SPD to accommodate the multiple ramp rate.**

- **Modify SPD to accommodate the multiple ramp-rates**
  - **Modify bid data structure and the associated preprocess procedures,**
  - **Modify the ramp-rate recall constraint model,**
  - **Modify UBES/DBES directional ramp-rate constrain model in Step 2,**
  - **Modify the logic to determine the impact of OOME ID and Step2 ID,**
  - **Modify the logic to determine the “price taker” MW for a QSE bid,**
  - **Review the entire SPD code to make sure the things are consistent**
  - **Perform significant unit and regression testing, including all the scenarios for ramp-rate recall and OOME/Step2 ID model,**
  - **Modify SPD display/output to support this new function.**

# Summary

Alternative	I	II
Resource	ERCOT Internal	AREVA
Technical Feasibility	Yes	Yes
Known Cost (Approx.)	Pre-Processing for deriving equivalent ramp-rate: \$15,000	SPD Modification: \$200,000
Unknown Cost	XML, Portal, MDB, and Participant-related cost, etc.	XML, Portal, MDB, and Participant-related cost, etc.
Benefit	??	??
Limits	<ol style="list-style-type: none"> <li>1. Approximate ramp-rates still,</li> <li>2. Inaccurate ramp-rate when RR_recall exists,</li> <li>3. Possible performance impact due to this additional pre-processing step,</li> </ol>	<ol style="list-style-type: none"> <li>1. Huge and complicated task since almost everything done in R3 will need to be either redesigned/re-implemented/retested or reviewed/retested,</li> <li>2. SPD performance issue due to additional logics in a variety of models,</li> <li>3. Prototype engine needs to be built to give accurate assessment</li> </ol>

# Questions

