

# Briefing on Flexible Ramping Product

## Flexible Ramping Products

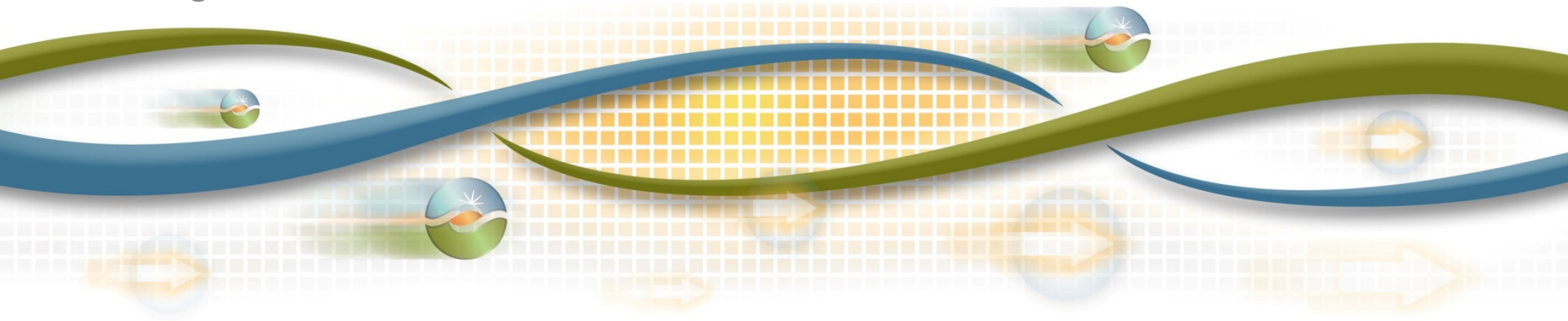
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Market Surveillance Committee Meeting

General Session

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# Topics for MSC discussion

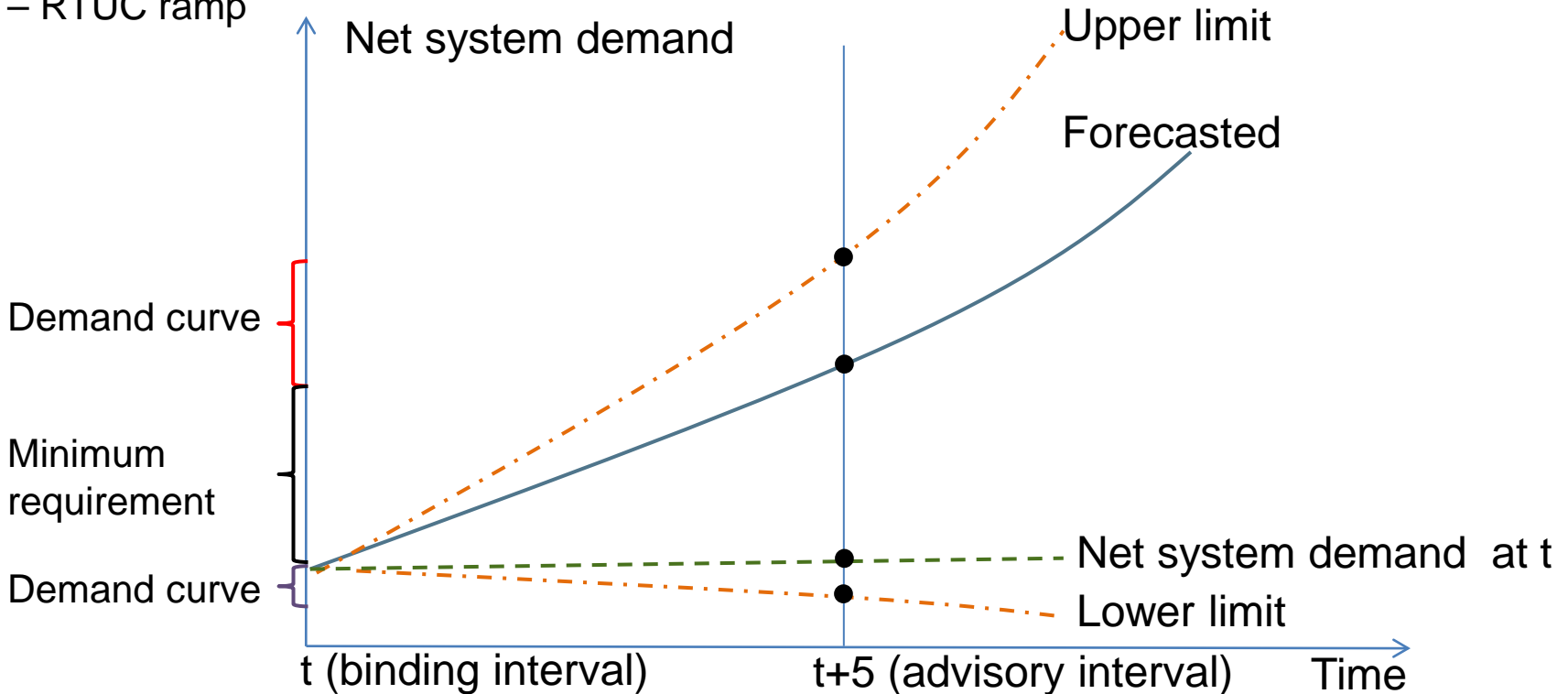
- Day Ahead Bidding Rules
- FRP requirement in RTD, FMM, and IFM
- Demand Curve

# Flexible ramping product bidding

- If resource provides flexible RA, must bid MW quantity for flexible ramping up and flexible ramping down in IFM
  - Minimum MW = flexible RA award that is dispatchable in RTD
  - Price is \$0.00
  - FRP is limited to the MW bid, which can be less than the bid range
- No bidding in FMM and RTD
  - Entire bid range is available for FRP
- No self-provision of flexible ramping products

# Flexible Ramping Product to meet Real Ramping Need

Net system demand = load + export – import – internal self-schedules - supply deviations – RTUC ramp



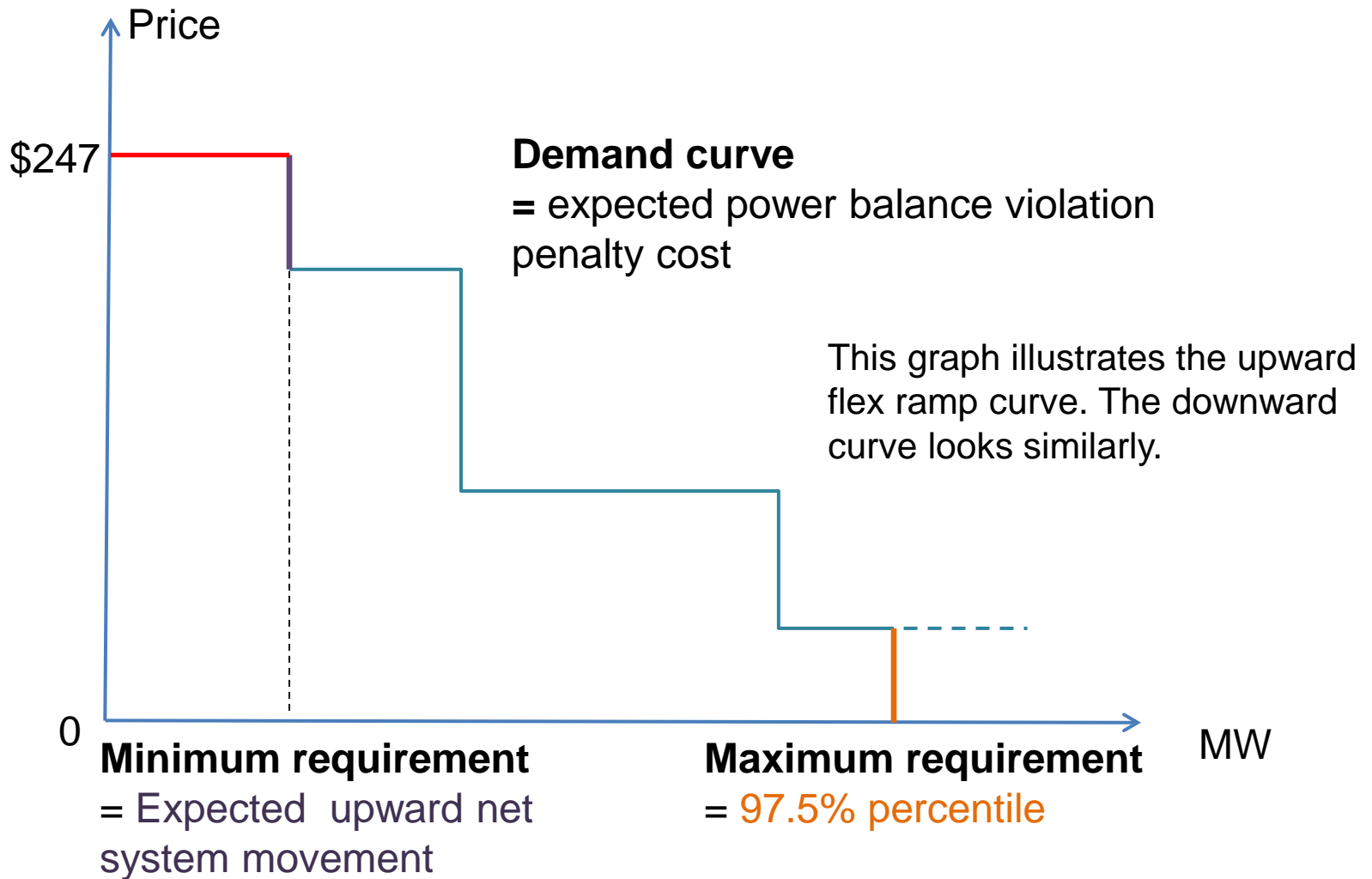
## Real ramping need:

Potential net load change from interval t to interval t+5  
(net system demand t+5 – net system demand t)

# Requirement calculation

- **RTD**
  - Compare T+5 advisory to binding interval
  - Develop historical distribution of 5-minute movement
  - Split between minimum requirement and demand curve
- **FMM**
  - Maximum movement that occurs in 15-minute interval
  - Split between minimum requirement and demand curve
- **IFM**
  - Maximum movement that occurs in hourly interval
  - Entire requirement uses a demand curve

# Flexible ramping product demand curve



# Determine the demand curve

- Inputs
  - The distribution of net load  $NL$  at  $t+5$
  - The power balance violation penalties
- Expected power balance violation penalty conditional on flex ramp procurement
  - $E(\text{PPBC\_penalty\_cost}|\text{FRU}=0) = \sum_y [\text{prob}(NL=y) * \max(y - NL^{\text{forecast}}, 0) * \text{PPBC\_penalty}(y - NL^{\text{forecast}})]$ .
  - Assuming  $x$  MW of flex ramp would reduce  $x$  MW of power balance violation, then
    - $E(\text{PPBC\_penalty\_cost}|\text{FRU}=x) = \sum_y [\text{prob}(NL=y) * \max(y - NL^{\text{forecast}} - x, 0) * \text{PPBC\_penalty}(y - NL^{\text{forecast}} - x)]$ .
- Marginal value (in reducing power balance violations) of flex ramp
  - from  $x$  to  $x + \Delta x$ , the flex ramp marginal value is
    - $[E(\text{PPBC\_penalty\_cost}|\text{FRU}=x) - E(\text{PPBC\_penalty\_cost}|\text{FRU}=x + \Delta x)] / \Delta x$