

ENABLING SYSTEM FLEXIBILITY

Meeting #4

August 1, 2017

Agenda

- Engagement update
- Pricing outcomes and flexibility
- Proposed interim solution
- Next steps

Stakeholder Engagement Update

Engagement Recap

- The objective of the Enabling Flexibility Stakeholder Engagement is to determine potential solutions that can enable and achieve flexibility to meet evolving system needs
- Meetings held to discuss
 - The nature of the flexibility need
 - Brief survey of solutions from other ISOs
 - Characteristics of flexible resources
 - Relationship of near term solutions bridging Market Renewal elements enabling flexibility

Market Renewal and Near Term Solutions

Market Renewal will put in place necessary features for an enduring flex solution through the Energy, Capacity and Operability workstreams and guided by principles of

- **Competition:** Facilitates participation from more and diverse resources
- **Transparency:** Sends new and improved signals to value evolving system needs
- **Efficiency:** Reduces system costs

Near term solutions identified through the Flexibility Stakeholder Engagement will be coordinated with the Market Renewal workstreams

Recent Pricing Outcomes & Flexibility

Recent Price Spikes

Initial analysis presented at the Market Operations Awareness meeting on May 1st

- No reliability issues during recent price spikes

Price spike contributors include

- Energy and Operating Reserve (OR) offer curves
- Forecast uncertainty
- Intertie failures and forced outages

Many price spikes were related to flexibility need

Energy and OR Offer Curves

The supply curve varies depending on the time-frame allowed to address imbalances

- Non-quick start resources typically require several hours to be on-line
- Imports/exports are scheduled 1-hour ahead
- Flexible supply can be dispatched intra-hour

The quantity of dispatchable offers reduces closer to the hour of dispatch and results in steeper intra-hour energy and OR supply curves

Forecast Uncertainty

The magnitude and timing of VG output is less predictable than that of conventional generators

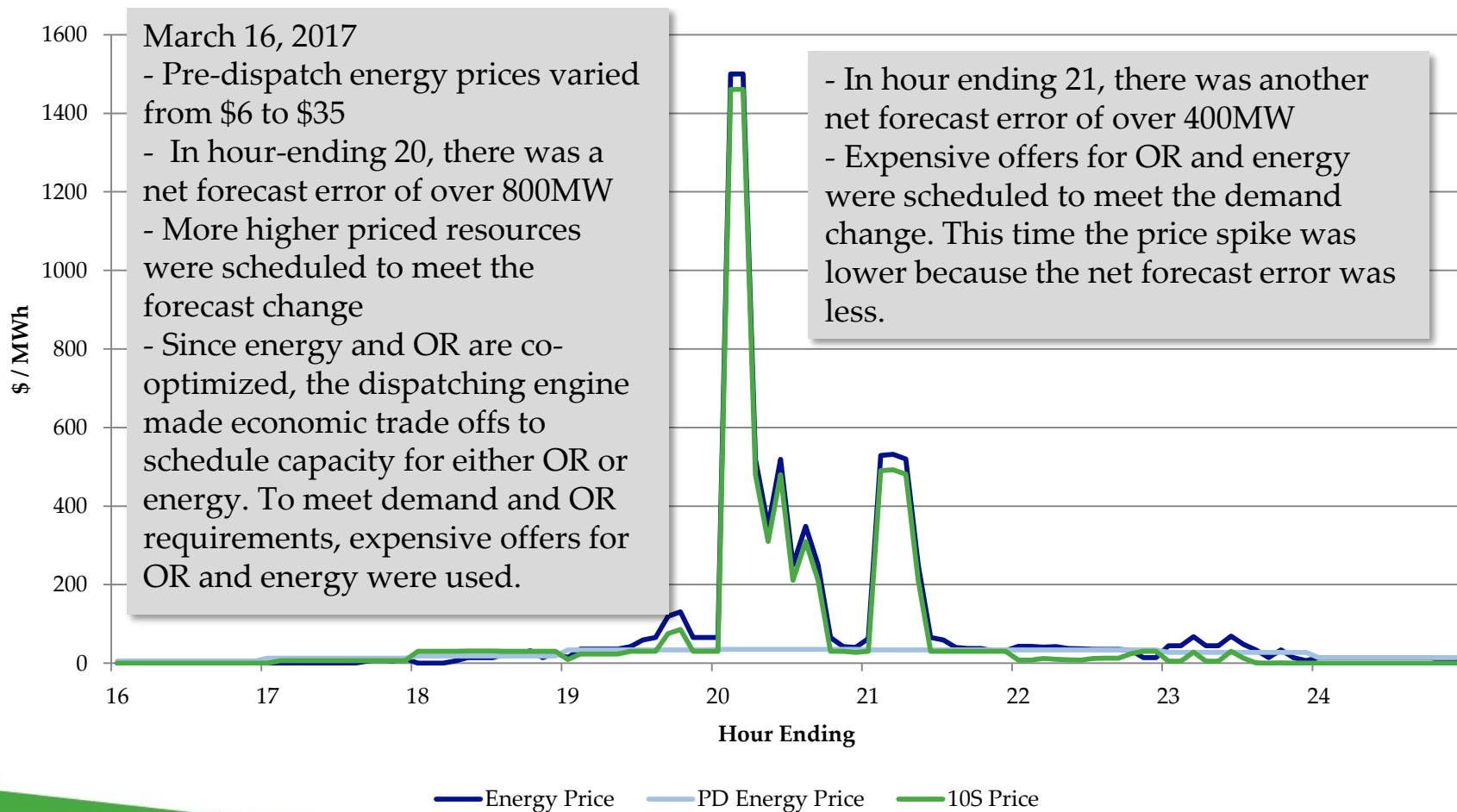
- Forecasts do not significantly improve until the hour of dispatch
- When VG is over-forecast, the supply offer curve to dispatch from is steeper and a price spike may occur
- Since energy and OR are co-optimized, offers scheduled for OR may be dispatched for energy and the OR price may simultaneously spike

Intertie Failures and Forced Outages

Import failures and forced outages may also cause price spikes

- Extra supply is needed suddenly
- If the supply offer curve is steep, price spikes occur

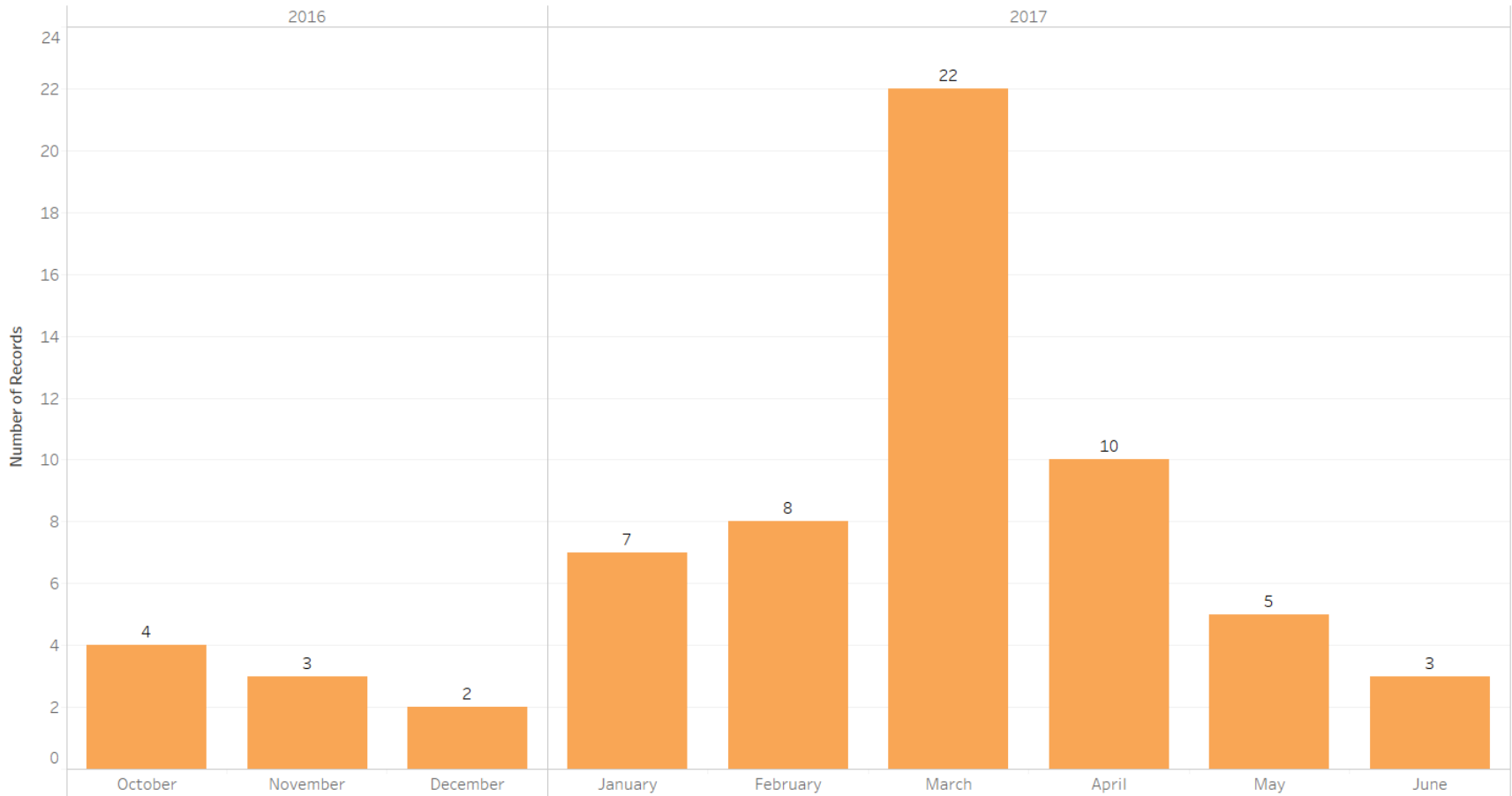
Price Spike Example



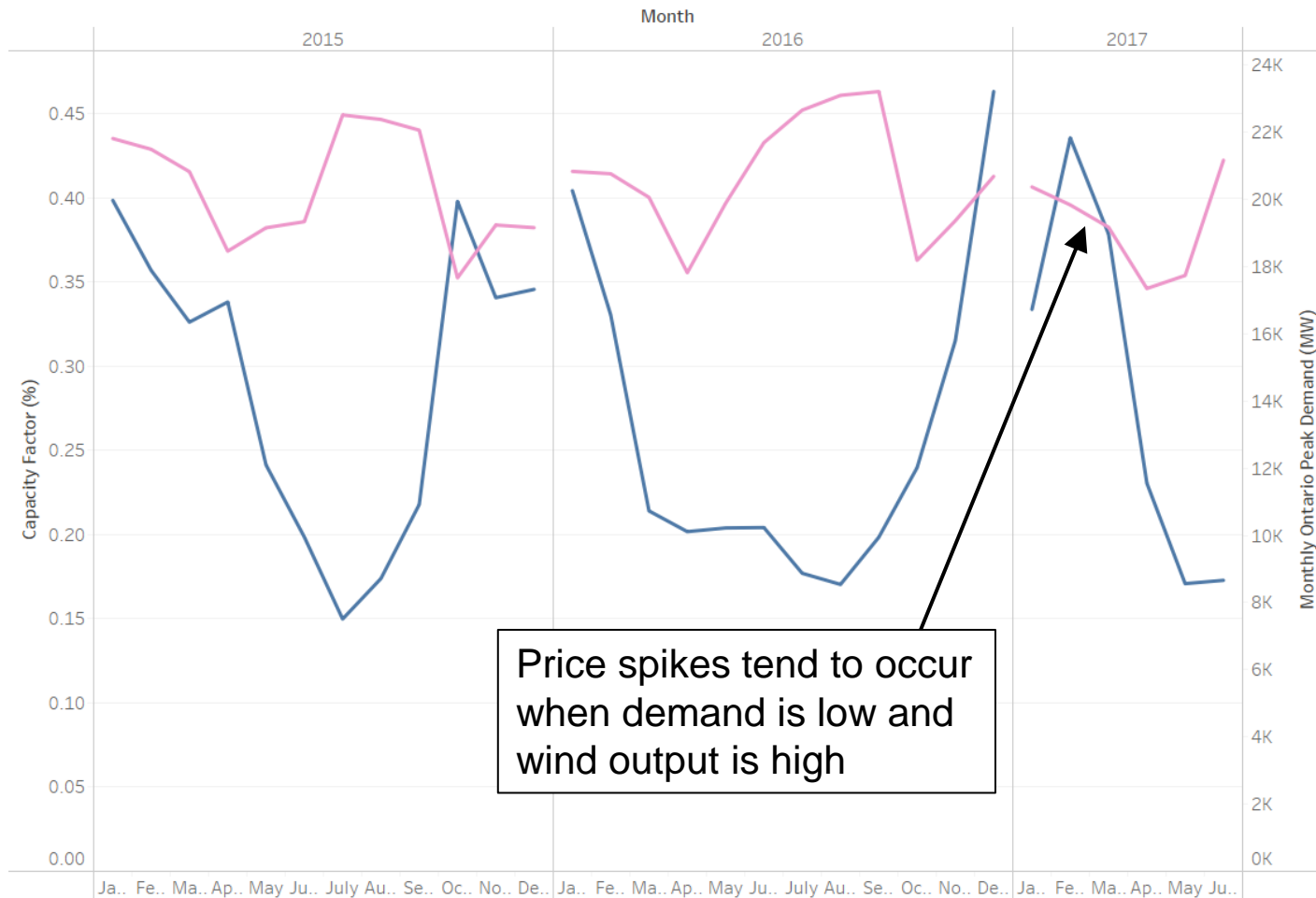
Value of Flexibility

- Price spikes indicate the value of flexibility when additional supply is suddenly needed
- There is a seasonal pattern – for now
 - Price spikes occur during the ‘shoulder seasons’ when there is lower demand and higher wind output
 - Little or no resource commitments
- The value of flexibility can be reflected in both energy and OR prices
- No advance price signaling of flexibility need

Recent Price Spikes



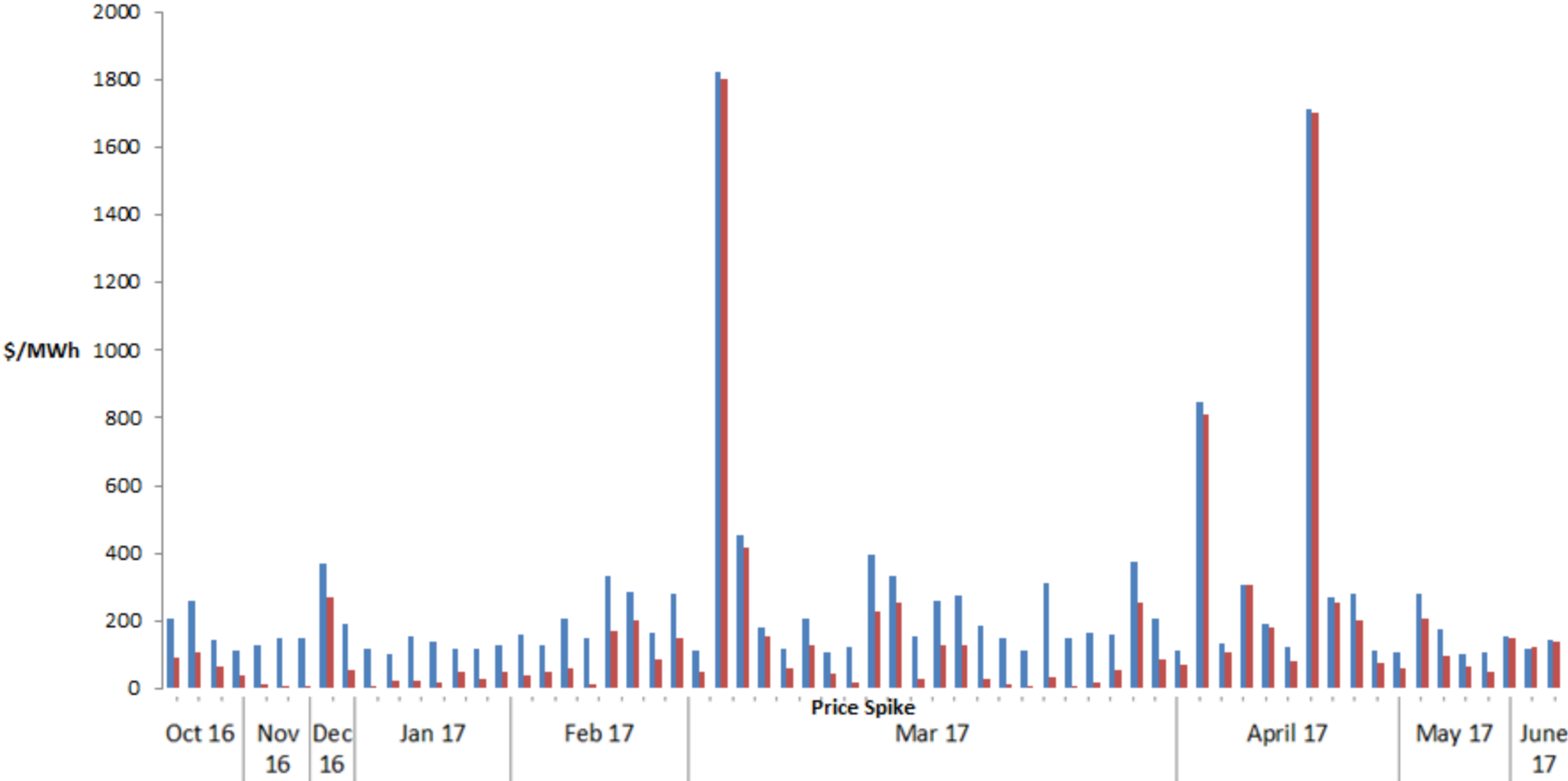
"Shoulder Seasons"



■ Capacity Factor
■ Monthly Ontario Peak Demand (MW)

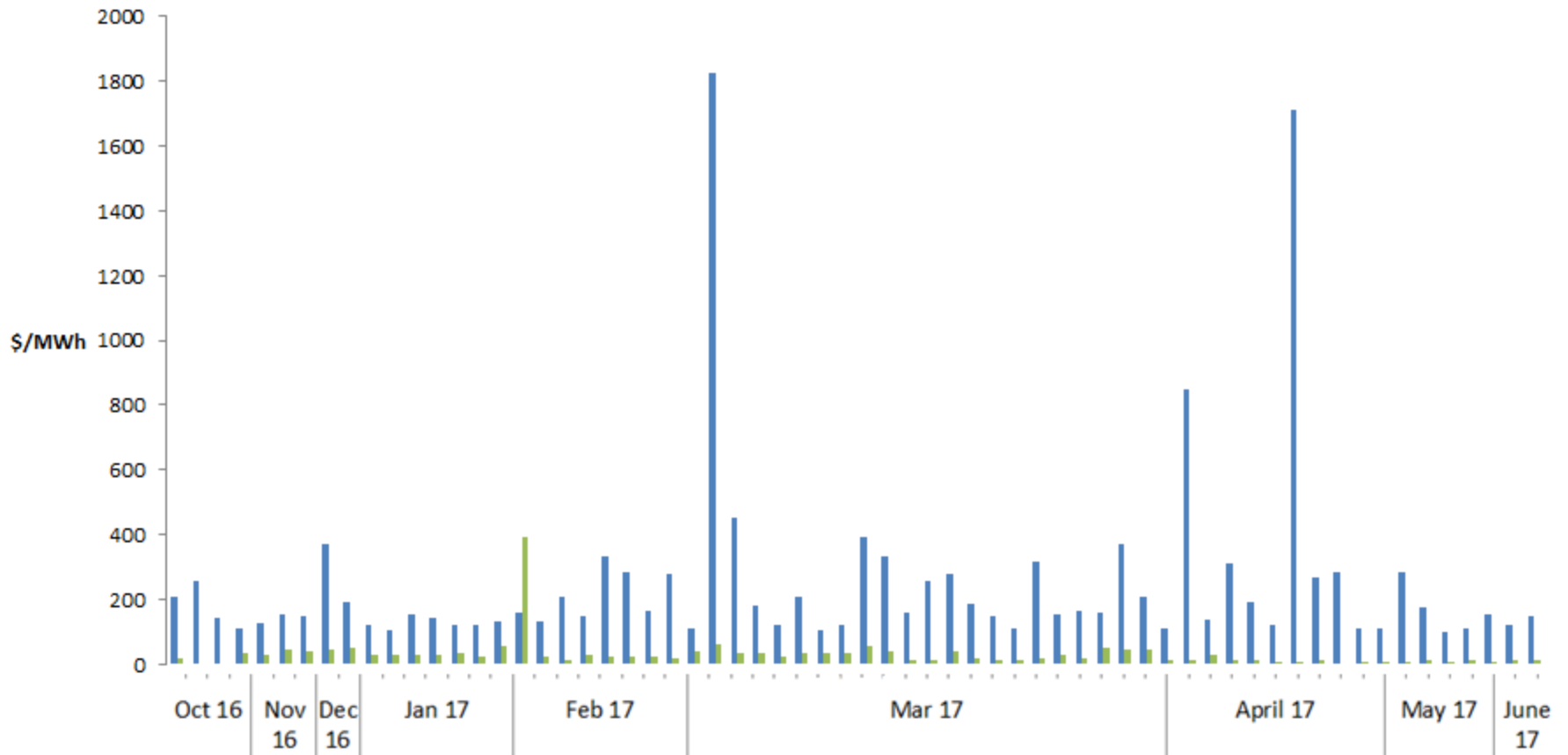
Energy and OR Price Spikes

HOEP & Avg OR Price



Price Spikes and Pre-dispatch Signalling

HOEP & PD Prices



Proposed Interim Solution

Near Term Flexibility Need

Up to 740 MW of flexible capability needed in 2017/18

- Can be provided by resources already on-line or that can synchronize and provide flexibility within 1/2-hour
- Revised given LRP II suspension, amended FIT targets and increase of flexible MW
- Re-evaluated periodically as forecast of system conditions and needs change

Near Term Solutions

Near term solutions bridging to Market Renewal implementation needed

- Engagement with stakeholders started without any solutions in mind
- Stakeholder feedback provided insights on
 - Incentives needed for flexible capability investment
 - Barriers against enabling more flexibility
 - Advanced signaling of flexibility need

Proposed Interim Solution

Near term solutions to be consistent with Market Renewal principles

- **Competition:** Enable more from existing resources
- **Transparency:** Signal early enough for market participants to respond
- **Efficiency:** Through leveraging current market processes

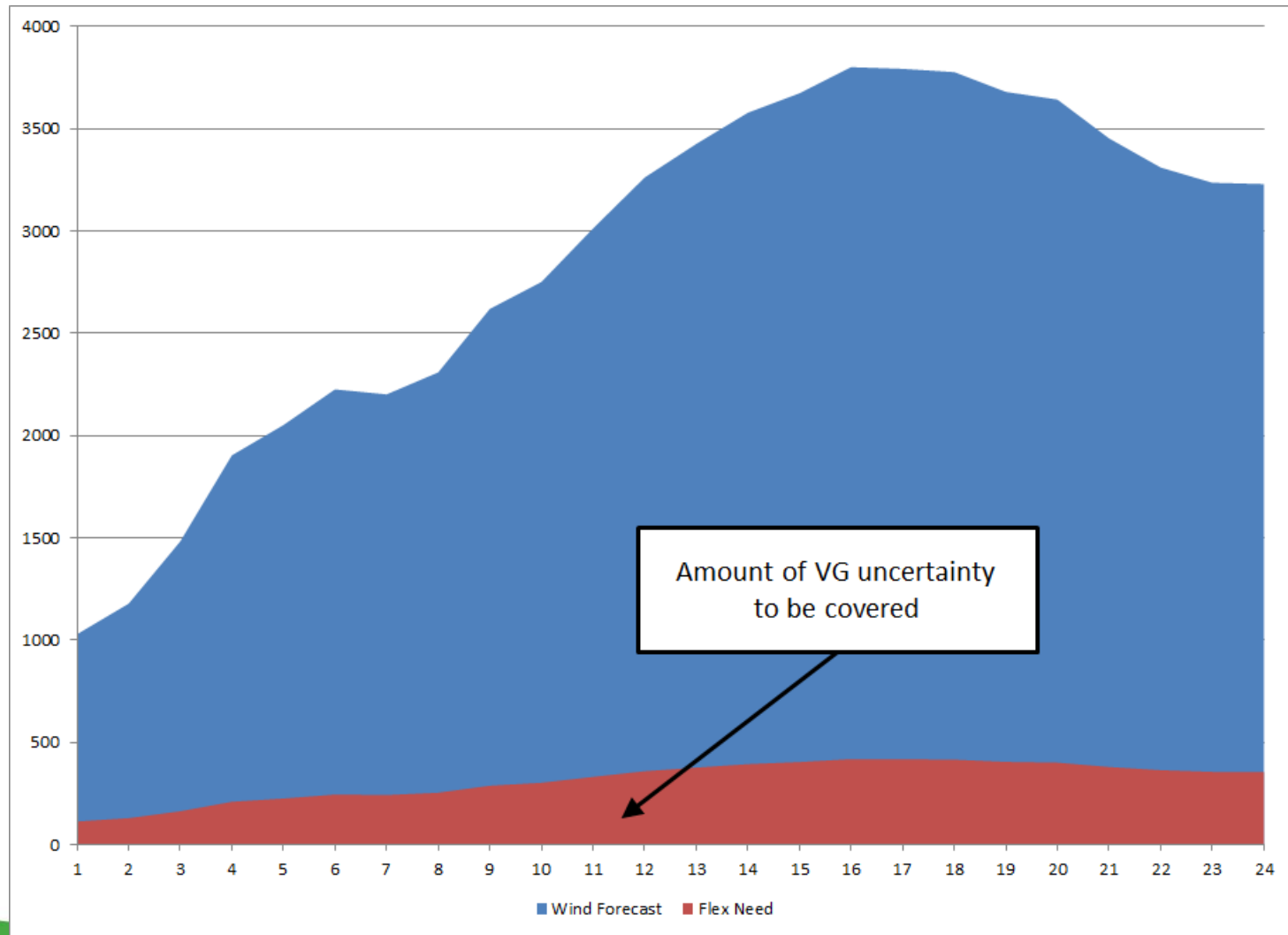
Proposal: Use operating reserve for flexibility

Potential Interim Use of Reserve for Flexibility

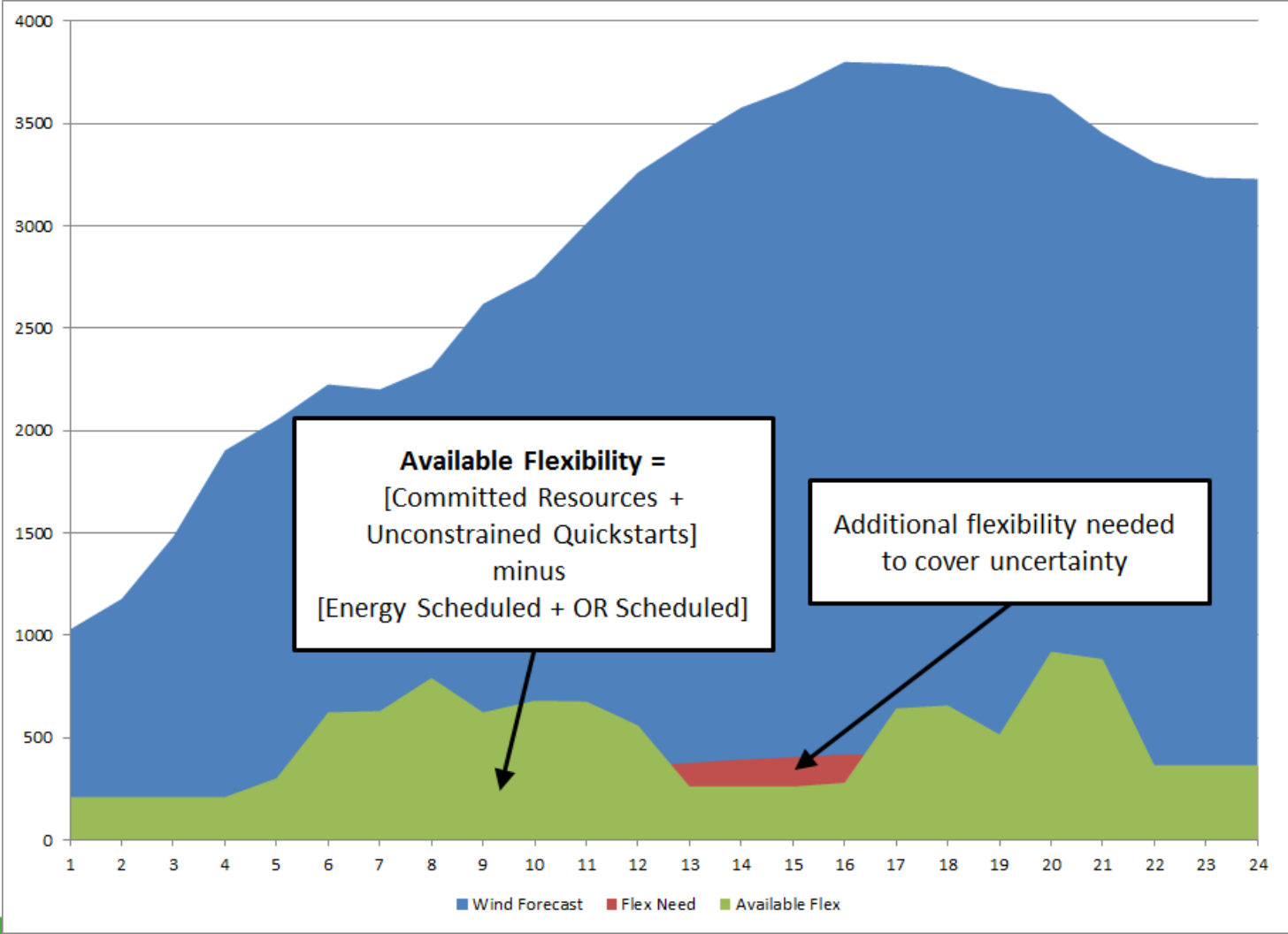
High-level concept

1. Assess flexibility requirement as an amount of VG uncertainty to be covered
2. Determine flexibility available
3. Compare required and available flexibility and determine hours which need coverage
4. Increase 30 minute reserve requirements for hours needing more flexibility coverage
5. Economically schedule resources using pre-dispatch and commitment processes

Assessing Flexibility Requirement



Determining Flexibility Need



Flexibility Requirement

Near term flexible capability required is up to 740 MW

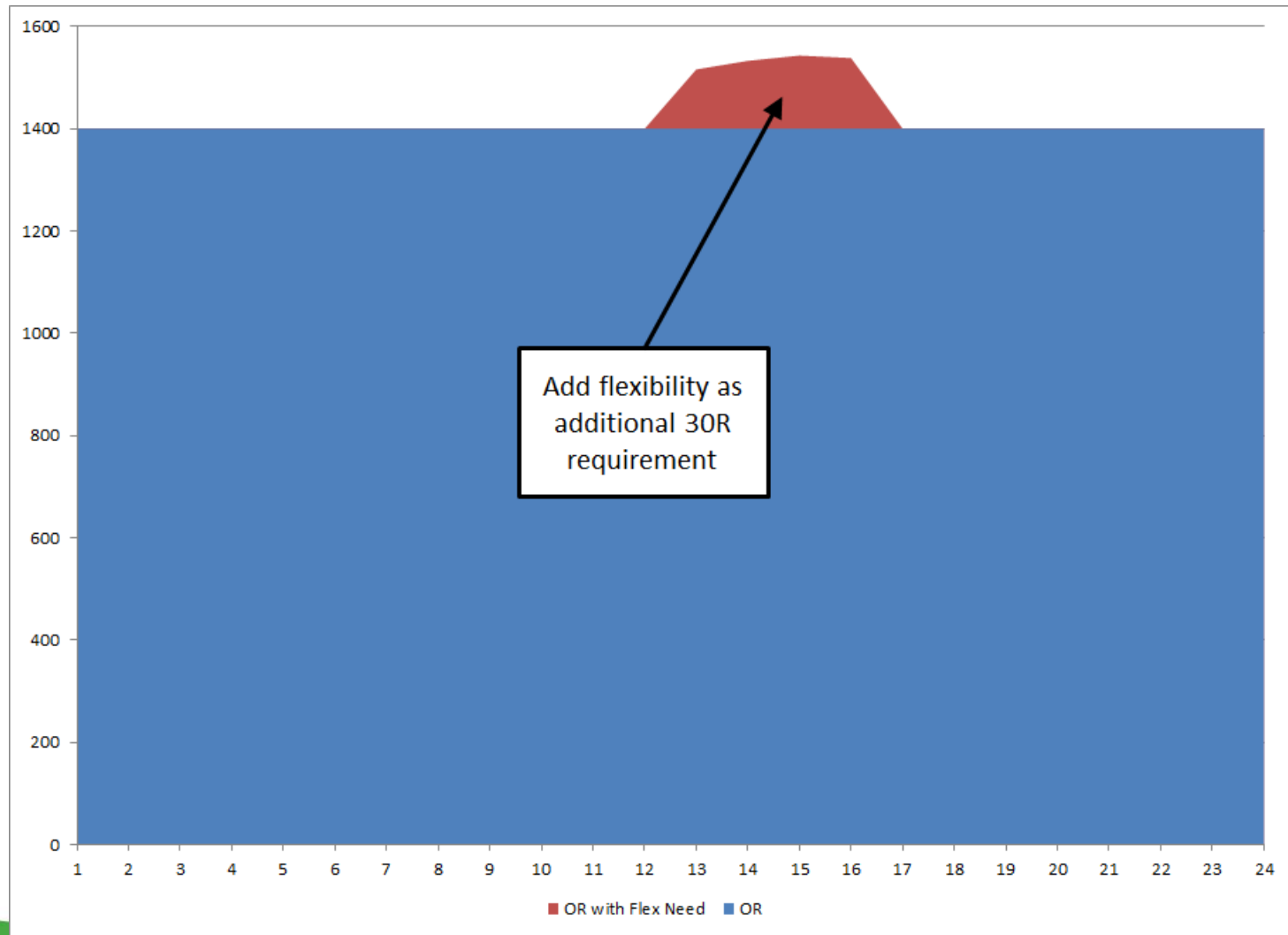
- Propose to add calculated flexibility requirement as 30-minute OR over current reserve requirements

Proposed OR requirements with flexibility

10-minute OR + 30-minute OR + 30-minute OR

For single largest contingency For 1/2 of 2nd largest contingency For flexibility

Increase Reserve Requirements

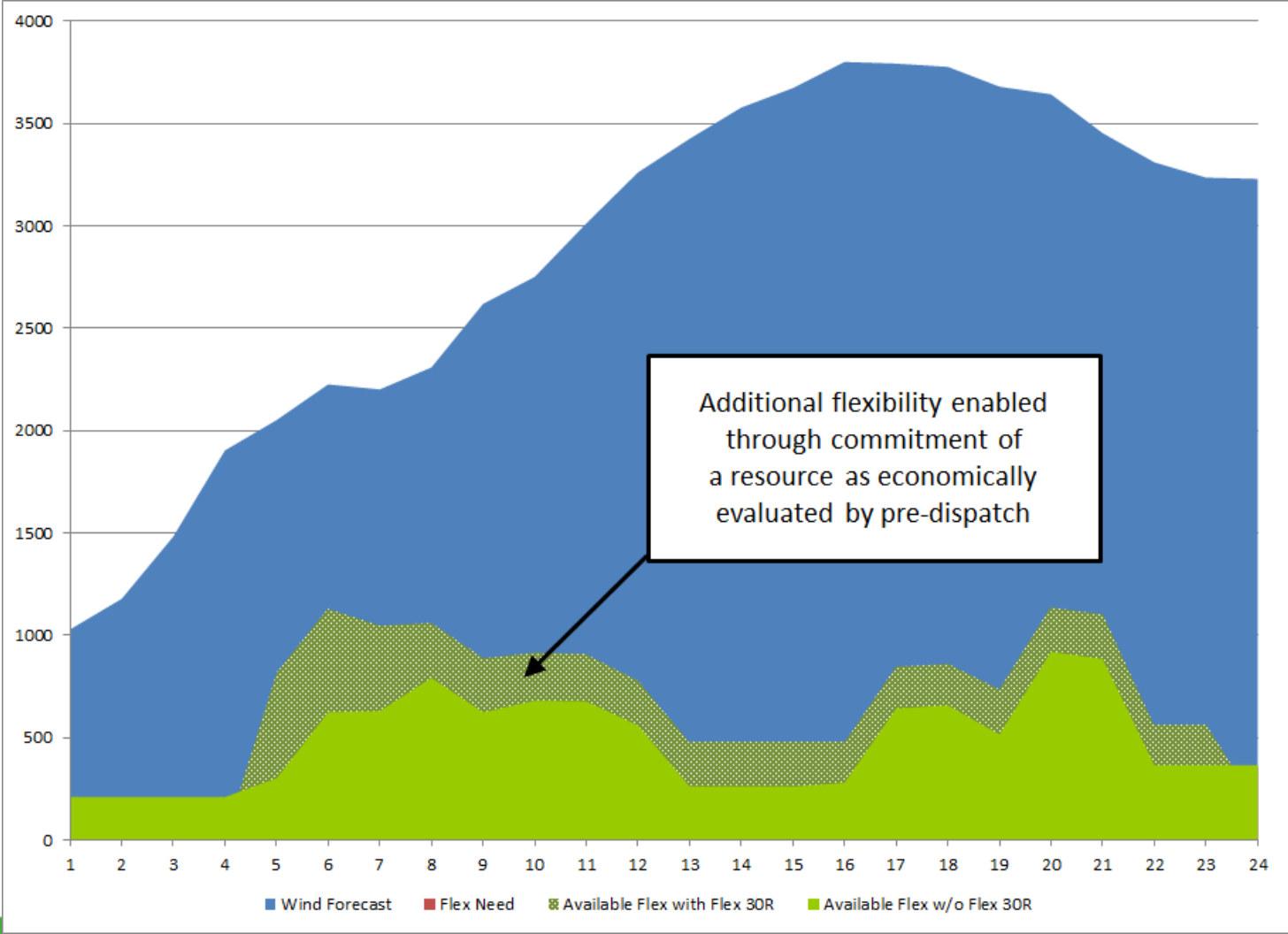


Advance Signaling of Flex Need

Flexibility need represented as additional 30-minute OR will be determined sufficiently ahead of real-time dispatch

- Allows resources to adjust offers to provide flexibility
- Pre-dispatch processes will be used to economically schedule resources for additional OR requirement

Economically Schedule Flexibility



Next Steps

Next Steps

Overview of achieving system flexibility through Stakeholder Engagement and Market Renewal

Near term

- Development of interim use of OR for flexibility
 - Stakeholder as details are developed
- Continue to investigate other potential near term ways to enable flexibility
- Assess flexibility needs as resource mix evolves and other IESO initiatives are introduced

Market
Renewal

- More frequent intertie scheduling
- Enduring solution/new flexibility product
 - Informed by experience of interim solution(s)