



# Utility Wind Integration Group: Spring 2010 Technical Workshop

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Proposed WECC Efficient Dispatch Toolkit:  
Stakeholder Discussion and Comments

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A decorative graphic at the bottom of the slide consists of several overlapping, wavy lines in shades of orange, yellow, and grey, creating a sense of motion and energy.

# What is the problem?

- **The West needs expanded reliability tools**
  - *Why? Future high penetration of renewables*
    - **Less predictable flows**
    - **Less controllable flows**
    - **More difficult and expensive task to balance generation and load**

# What is the problem?

- **The West needs expanded reliability tools**
  - ***Solution: Propose expanding the applicability of the WECC reliability toolkit to address two primary issues***
    - ***Congestion management***
    - ***Energy balancing***

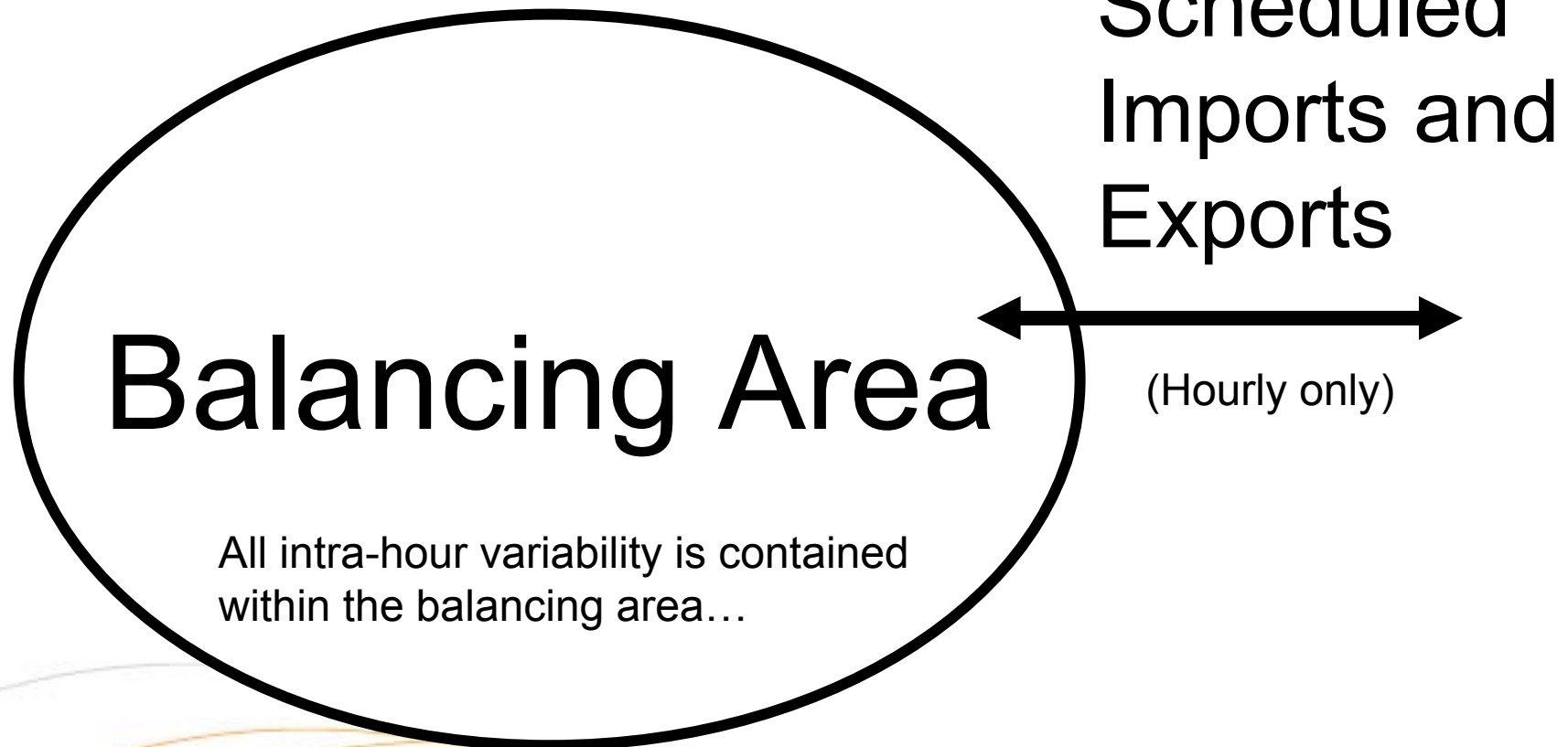
# WECC Response

- **The WECC Seams Issues Subcommittee (SIS) assignment:**
  - **Propose an effective congestion management and imbalance mechanism**
  - **No Regional Transmission Organization (RTO) proposal**
  - **No full LMP-style market design**

# Why a WECC opportunity?

- **Capitalize on existing Reliability Coordinator assets and infrastructure**
  - **Achieve ability to perform efficient and equitable management of reliability concerns**
  - **Situational awareness helps the RC's anticipate potential degraded reliability situations; now the industry needs better tools to respond rapidly and efficiently to the operating conditions**

# Single Balancing Area Variability



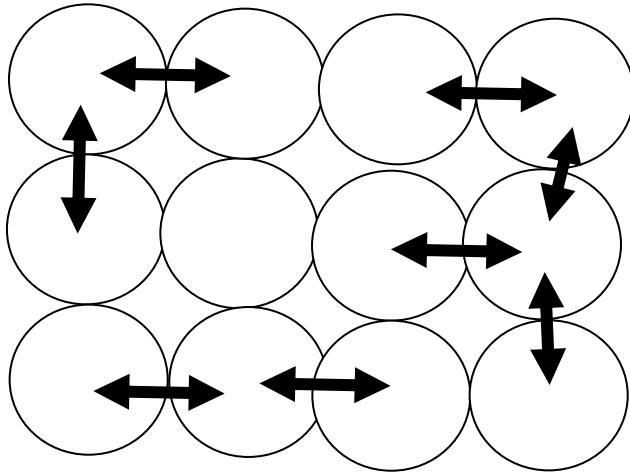
**Balancing Area**

All intra-hour variability is contained  
within the balancing area...

Scheduled  
Imports and  
Exports

(Hourly only)

# Multiple Balancing Areas

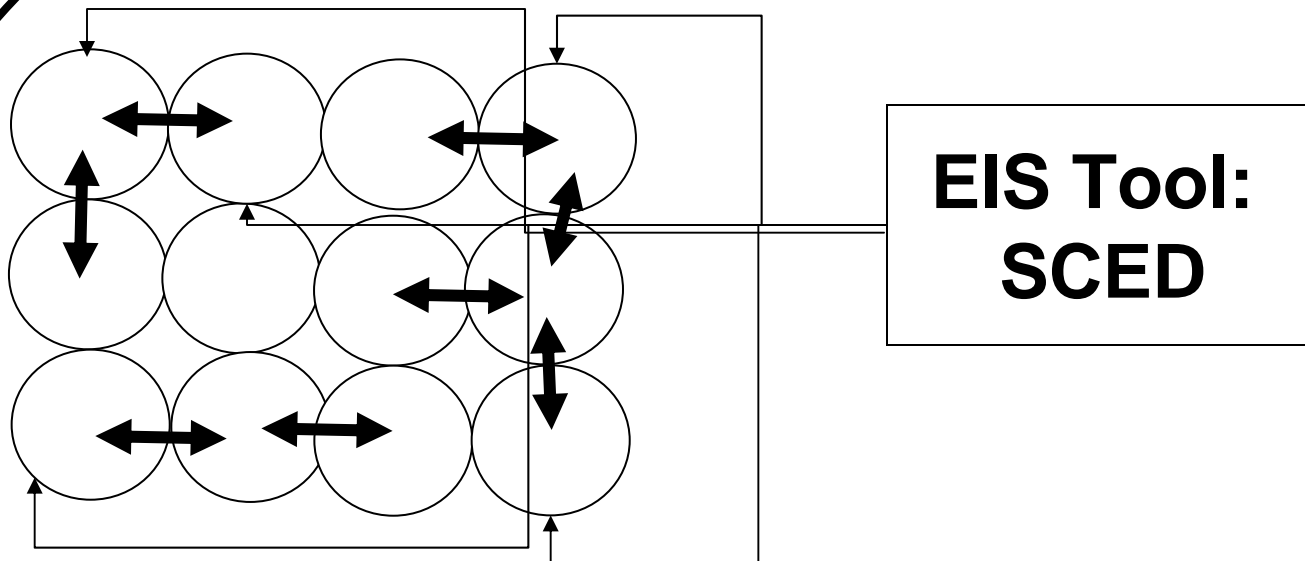


Each balancing area contains  
Its own intra-hour variability...



# Multiple BA with EIS

## EIS Footprint



Intra-hour variability is captured and allocated in real-time within the entire region, limited by the physical capability of the wires.

Diversity benefit reduces operating costs for balancing.

# OK, what are the toolkit benefits?

- Efficient provision of reliability services
  - *Use least-cost optimized provision of reliability services*
    - **Security-Constrained Economic Dispatch**
    - **Voluntary resource offers for redispatch & balancing service**
      - **Eliminate the balancing area boundary for energy imbalance calculations**
        - **Replace OATT Schedules 4 and 9**

# OK, what are the toolkit benefits?

- Meet the reliability goals equitably
  - *Establish a level playing field basis for operational actions*
    - **Compliance with reliability standards and their relationship to pro forma transmission tariff duties**
      - **Note current FERC Notice of Inquiry in Docket RM10-11-000**

# Proposal Overview

## WECC Efficient Dispatch Toolkit



# Two Tools for Three Functions

## ■ Seams Coordination Tool

- Coverage: The entire WECC footprint
- Function: Flow impact calculator tied to transmission service use in real-time

## ■ Energy Imbalance Tool

- Coverage: Participating balancing areas in WECC footprint (not CAISO, possibly others)
- Two Functions for Energy Imbalance Tool:
  - Energy balancing service
  - Congestion redispatch service

**Want more details?**

**Let's start with the Seams  
Coordination Tool...**

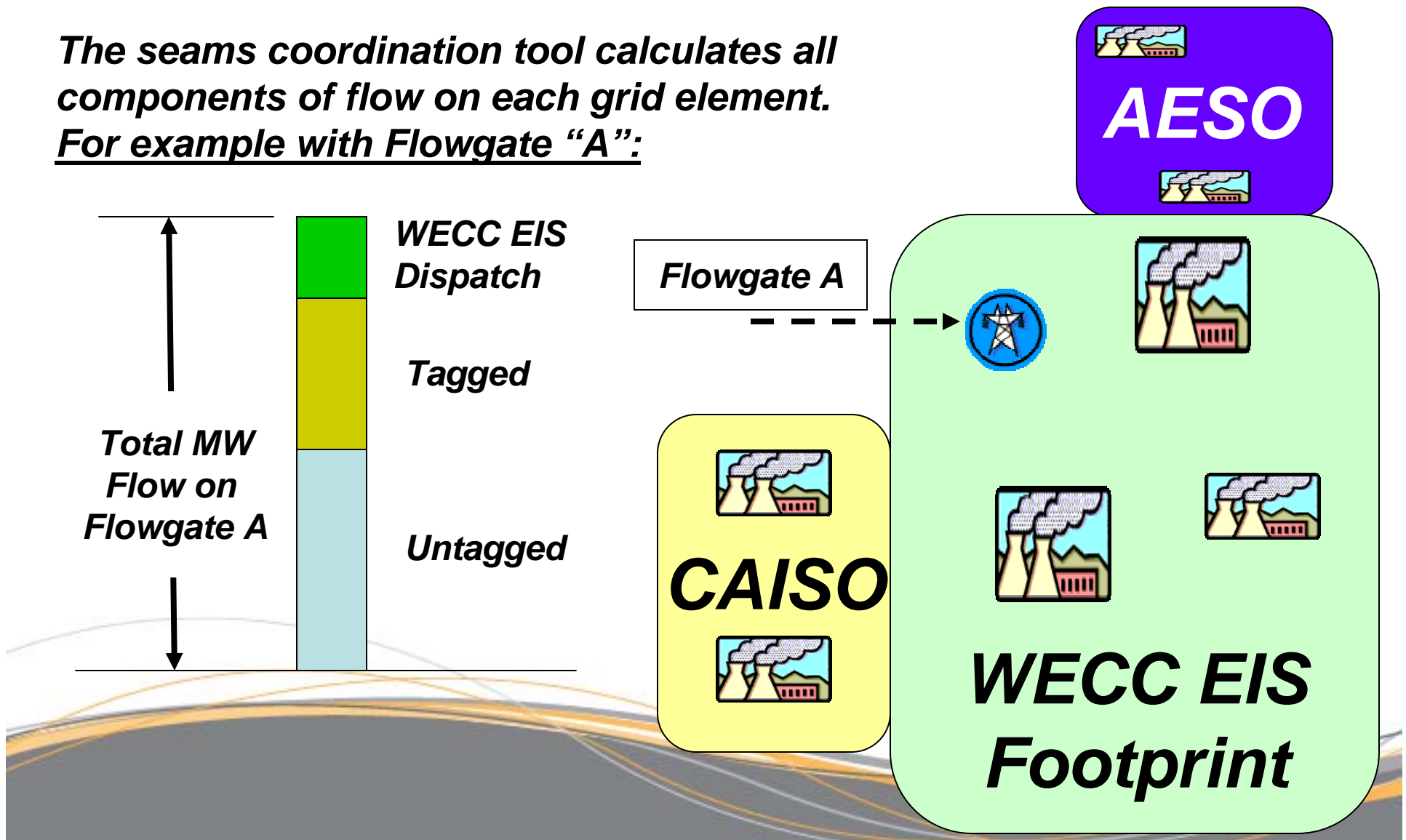
# Seams Coordination Tool

- **Seams coordination tool**
  - **Determines transmission service curtailment priority for flow components on the grid, based on the transmission service reservation being used to deliver energy**
    - **Will include tagged flows and non-tagged flows**
  - **Ranks which transactions must be assigned a curtailment obligation when congestion occurs**
  - **See illustrations on next slides...**

# Determining curtailment priority of transmission flows

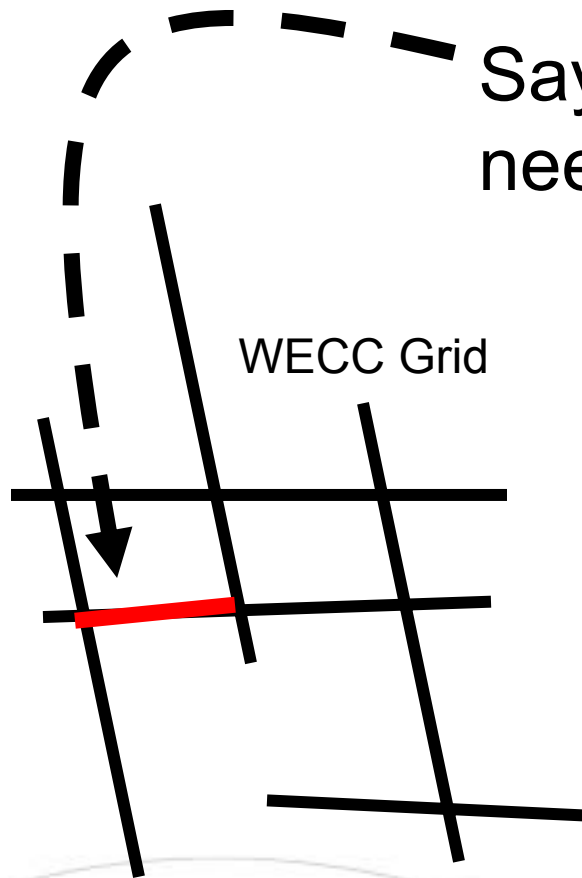


*The seams coordination tool calculates all components of flow on each grid element. For example with Flowgate "A":*



# Seams Coordination Tool

Say this grid element is congested and needs relief...



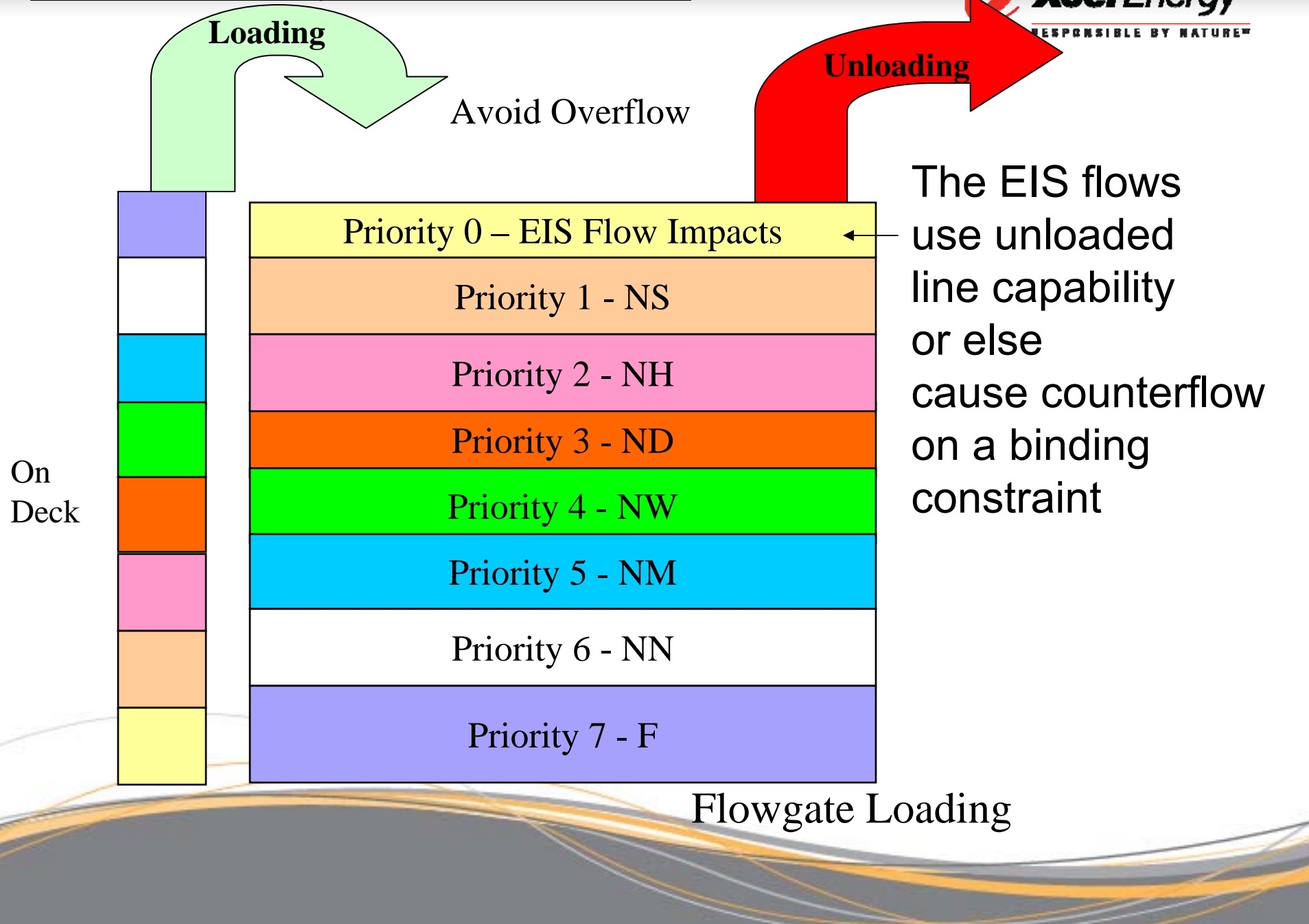
**The tool prepares the following list for the element:**

<u>Transaction ID</u>	<u>Service Priority</u>	<u>Transaction MW of flow on element</u>
Tag # x	2	13
Tag # y	2	4
Tag # z	6	20
BA1 – native	7	8
Tag # a	7	2
BA2 – native	7	6
.....	.....	.....

## Seams Coordination Tool

- Curtailments are allocated pro-rata within each transmission service priority bucket.
- Each lower-priority curtailment level is exhausted prior to calculating curtailments of higher priority service.
- Calculations continue until the necessary amount of relief obligation is obtained.

Curtailment priority coordination concept:



# Seams Coordination Tool

- The Seams Tool capability is useful to WECC even if the Energy Imbalance tool is not developed.
- WECC does not presently have the ability to perform the type of calculation just described for the seams tool.
- If the Energy Imbalance tool is developed, the new Seams Tool would be augmented to share coordinating information

# Energy Imbalance Service Tool

**Two services provided by this tool, in  
one package...**



# Energy Imbalance Service Tool

- **Uses security-constrained economic dispatch to provide two functions:**
  - **Balancing Service**: Redispatch to balance deviations from scheduled generator output and errors in load schedules
  - **Congestion Redispatch Service**: Redispatch to relieve overload constraints on the grid

## Are these new services?

- **Balancing Services**: Prior to the EIS tool, Balancing Areas provide these under their Tariff Schedules 4 & 9.
  - The EIS Tool replaces a part of the Balancing Area services, resulting in a “virtual consolidation”
    - Other roles and responsibilities for local services remain with the Balancing Areas
- **Redispatch Services**: This is a new regional service (outside of CAISO/AB).

## How is balancing service provided?

- **Balancing Service** is provided based on hourly MWH deviations from schedule
  - For example: load scheduled 15 MWH but actually consumed 18 MWH
    - Purchase of 3MWH of energy balancing service
  - For example: generator scheduled 200 MWH but actually produced 203 MWH
    - Sale of 3 MWH of energy balancing service

## How is congestion redispatch service provided?

- **Congestion Redispatch Service is provided to deliveries that have a new scheduled value due to curtailments issued from the Seams Coordination tool.**
  - **For example: Scheduled Tag for 100MWH was curtailed 20MWH by the seams tool, but continued to flow at 100MW. This results in an imbalance settlement.**
  - **Continued on next slide...**

## How is congestion redispatch service provided?

- (continued)

- The energy imbalance is calculated based on the new scheduled volume of 80MWH. This results in an imbalance settlement of 20MWH at both the source and sink of the tag. The difference in price between source and sink is the net congestion cost paid by the tag owner.
- Continued on next slide...

## How is congestion redispatch service provided?

- (continued)
  - The revenues from this price difference are paid to the resources that cleared in the security-constrained dispatch.
  - If the curtailed delivery matches its new curtailed value, the schedule source/sinks have no imbalance and do not purchase redispatch service

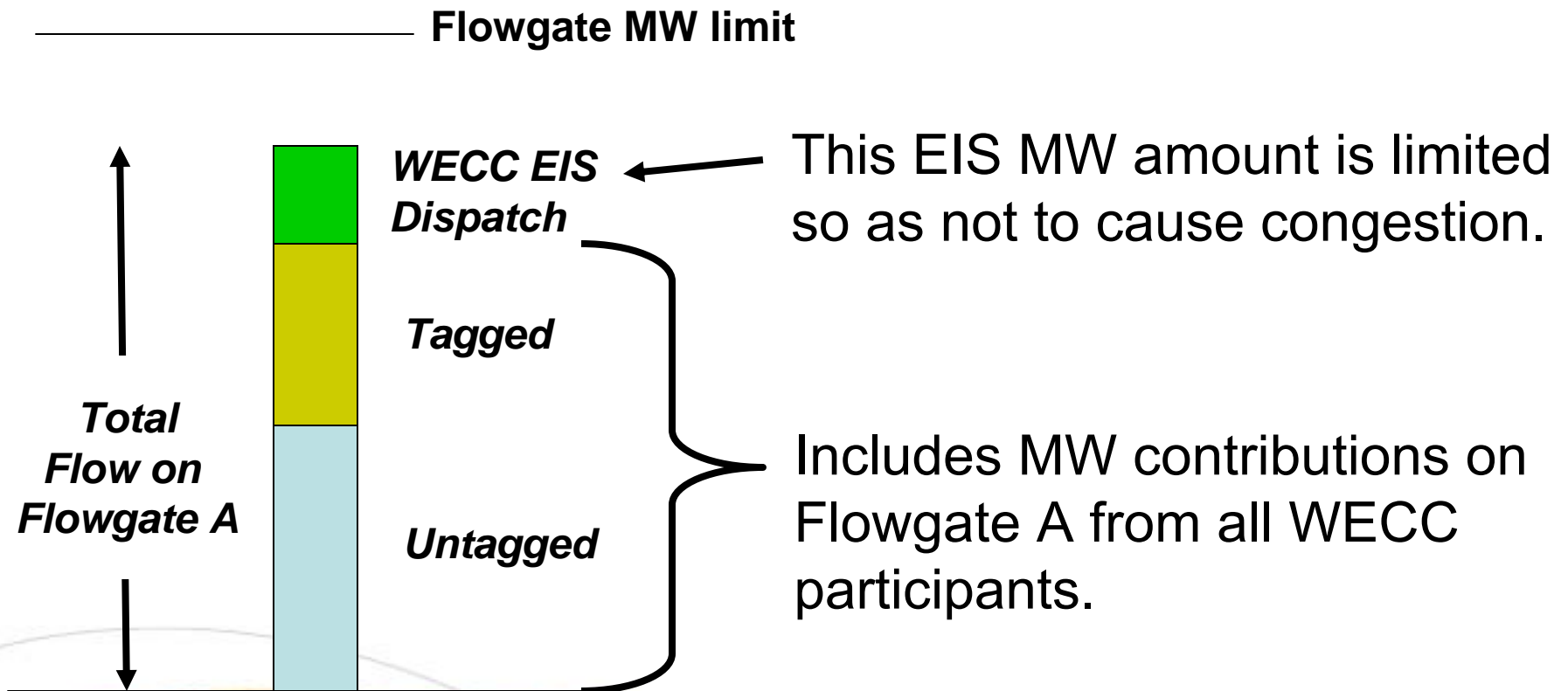
## **Who supplies energy balancing and congestion redispatch?**

- **Balancing and congestion redispatch are provided by resources that have voluntarily offered responsive dispatch capability**
- **The resources are cleared by the security-constrained economic dispatch to meet the spot-forecasted balancing need plus any congestion redispatch**

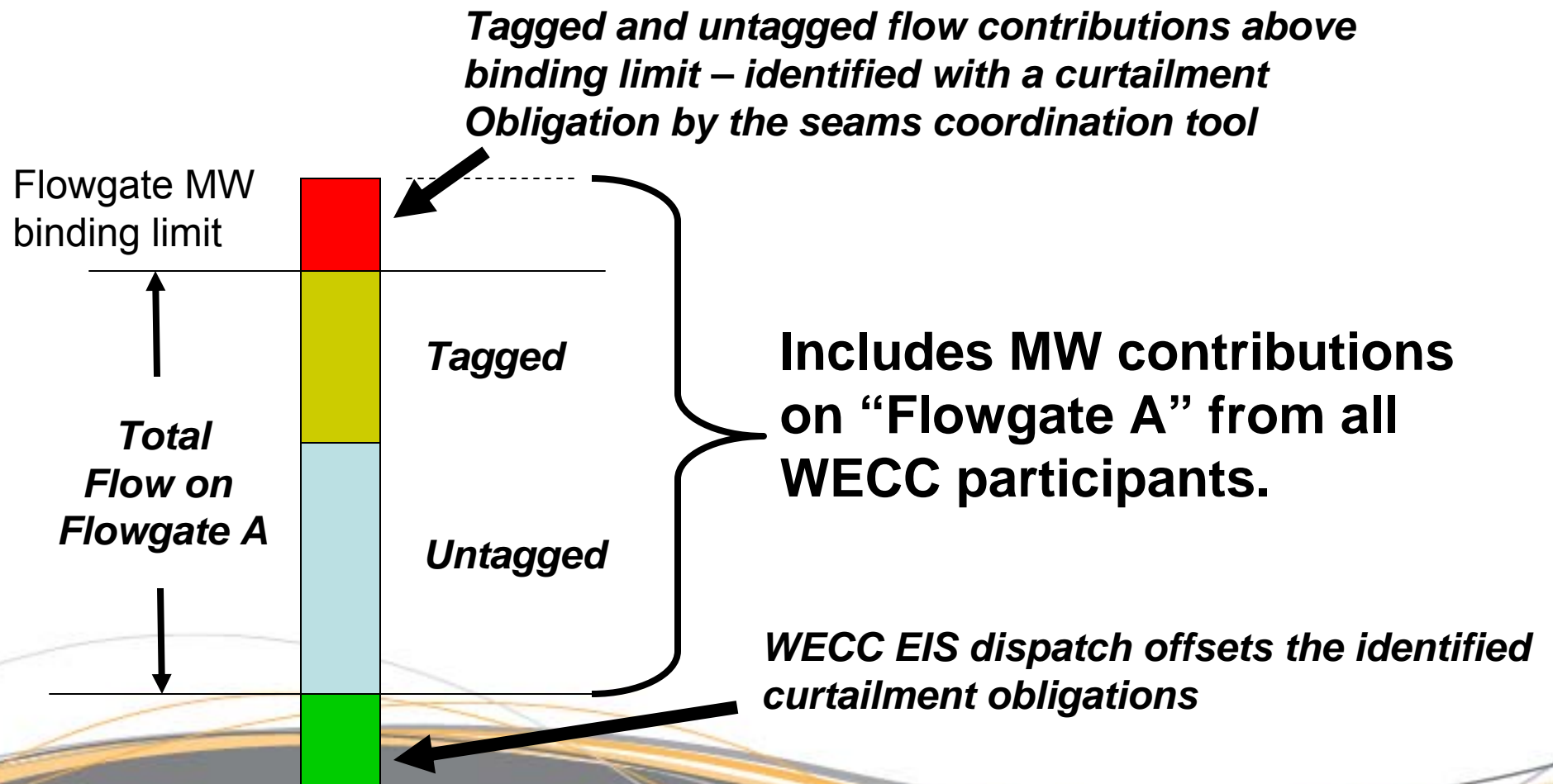
## **What transmission service is used to support the EIS function?**

- **All scheduled deliveries continue to use traditional reserved transmission service.**
- **The EIS dispatch is provided without using pre-reserved transmission service.**
- **The proposal for the EIS function includes an after-the-fact payment to participating transmission providers to recognize flow on their systems.**
- **EIS flow has the lowest service priority, so it does not displace any reserved service.**

# In this example EIS flows for imbalance are within the line loading limit:



# In this example EIS flows offset the flow that has a curtailment obligation:



# Additional Discussion

## Next Steps and Open Items



## What are the next steps?

- **Seek authorization on 4/30/10 from the WECC Board of Directors to perform a benefit/cost analysis.**
- **Regular WECC Seams Issues Subcommittee meeting scheduled for 5/4/10 - 5/5/10.**
- **Goal to complete analysis in first half of 2011.**
- **Over this period also continue to refine tool specifications and perform outreach on design details.**

## Additional open items?

- **Need to develop the EIS service umbrella agreement (tariff?) for proposed use by participating systems**
  - **Address OATT Schedule 4 & 9**
  - **Address tool cost recovery**
  - **Address transmission service payment**
- **Need to specify the associated market monitor function that would be used to detect and mitigate abusive market or scheduling practices**

**END**



## **Bonus Material – time permitting**

**Example of current WECC  
Congestion Management process  
(Unscheduled Flow Mitigation  
Procedure = UFMP)**

# WECC Congestion Today

- **There are six “Qualified Paths” in the WECC for coordinated congestion management**
  - **Assumptions used in today’s UFMP method could be improved:**
    - **System intact topology assumption is used**
      - **During congestion, the “intact” assumption may be in error – line outages contribute to congestion!**
    - **Currently use a seasonal case assumption (two updates per year) and zonal approximations for source/sink**

# WECC Congestion Today

- What happens if the transmission owner or reliability coordinator sees a potential overload?
- Initiate the UFMP - *if the element is a WECC Qualified Path*
- Or – Transmission Owner manages the issue locally using their own accommodation or tariff curtailments

# WECC Congestion Today

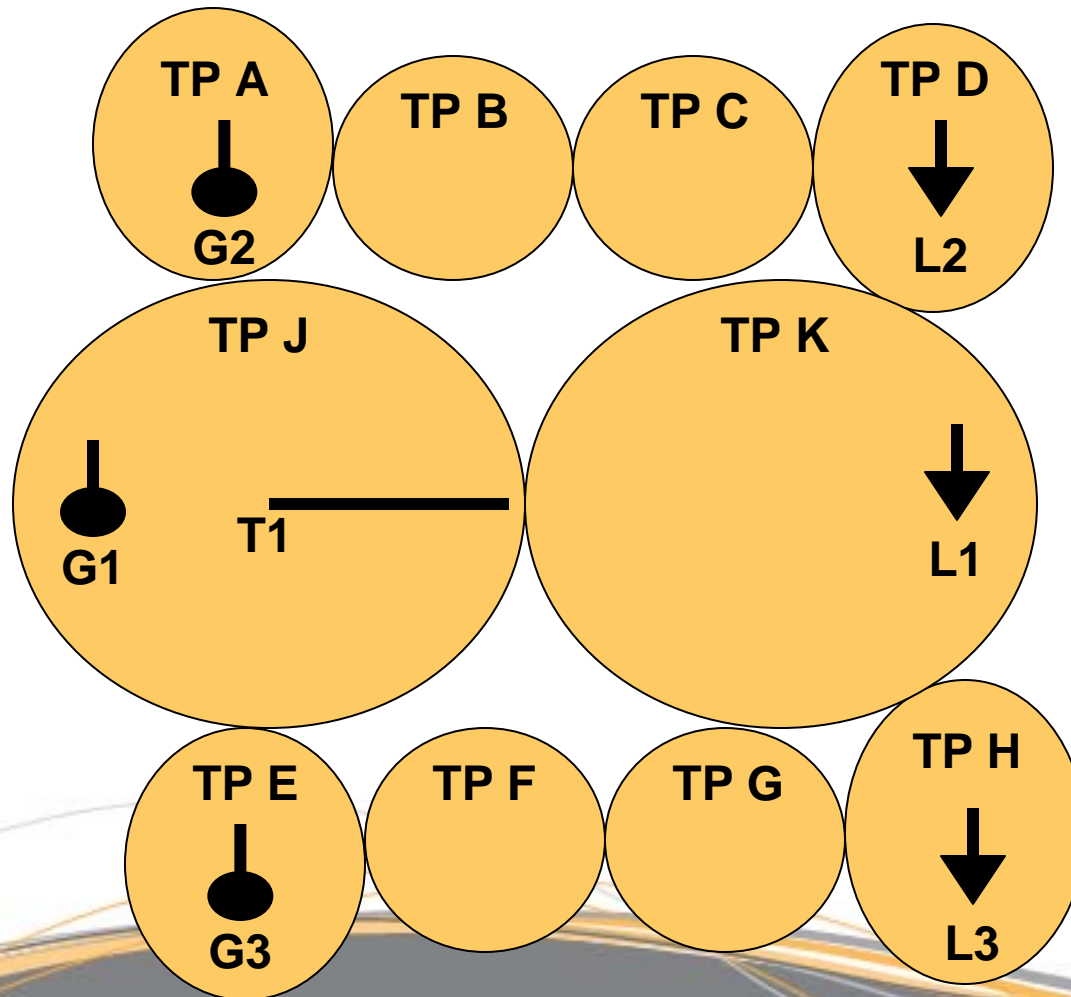
- If the overload is “local”, there is no WECC method to ensure loop flow impacts of lower service priority are curtailed prior to curtailing the higher priority local uses
- And as we will see in an example, even if the element is a Qualified Path, there is no process to differentiate the priority of the external loop flow contributions

# WECC Congestion Today: Example



# UFMP curtailment: Example

## Base assumptions



### Diagram Key:

“TP ‘n’” = Transmission Provider “n”

Line T1 in “TP J” is the limiting element in the Path.

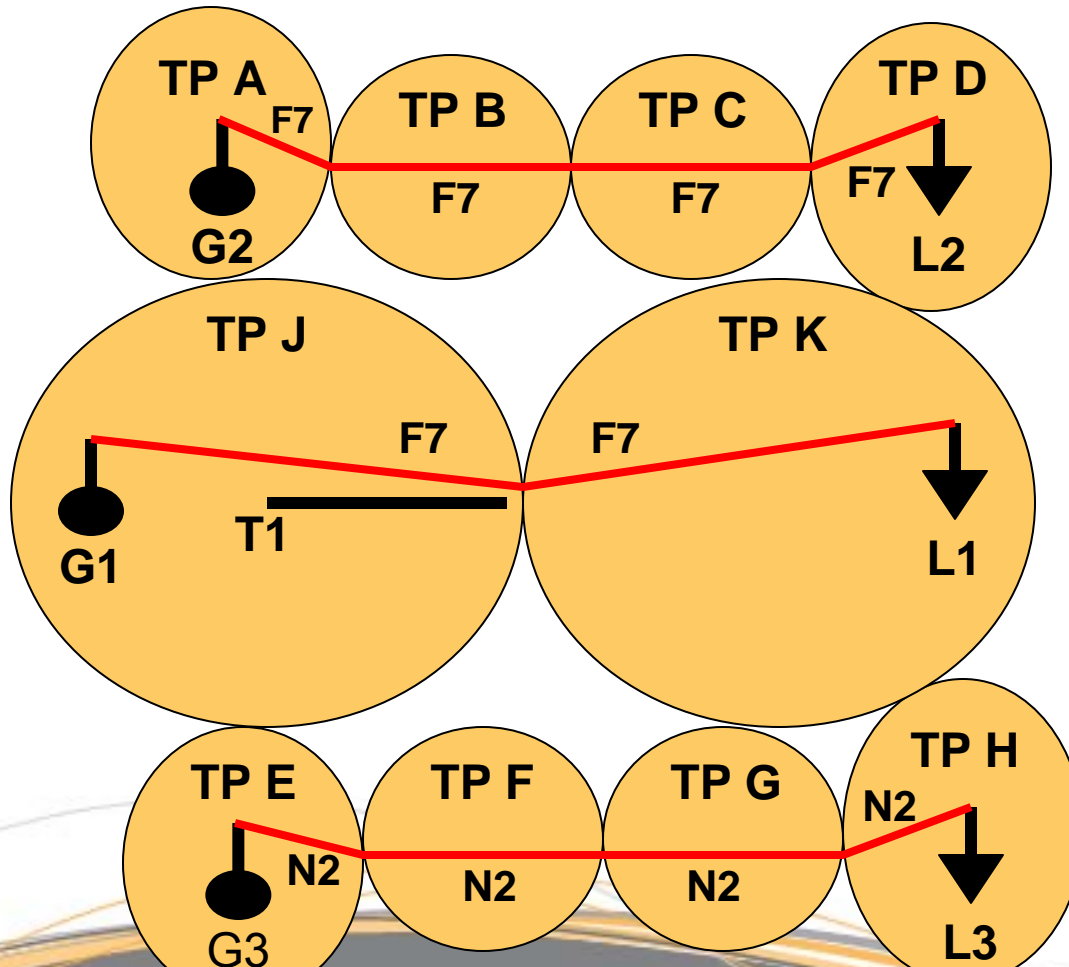
Etag from G1-L1 uses TSR J-K

Etag from G2-L2 uses TSR A-D

Etag from G3-L3 uses TSR E-H

# UFMP example: TSR assumptions

(TSR = Transmission Service Request)



## Diagram Key:

Etag from G1-L1 uses  
TSR J-K (Firm\* service)

Etag from G2-L2 uses  
TSR A-D (Firm\* service)

Etag from G3-L3 uses  
TSR E-H  
(Non-firm\*\* service)

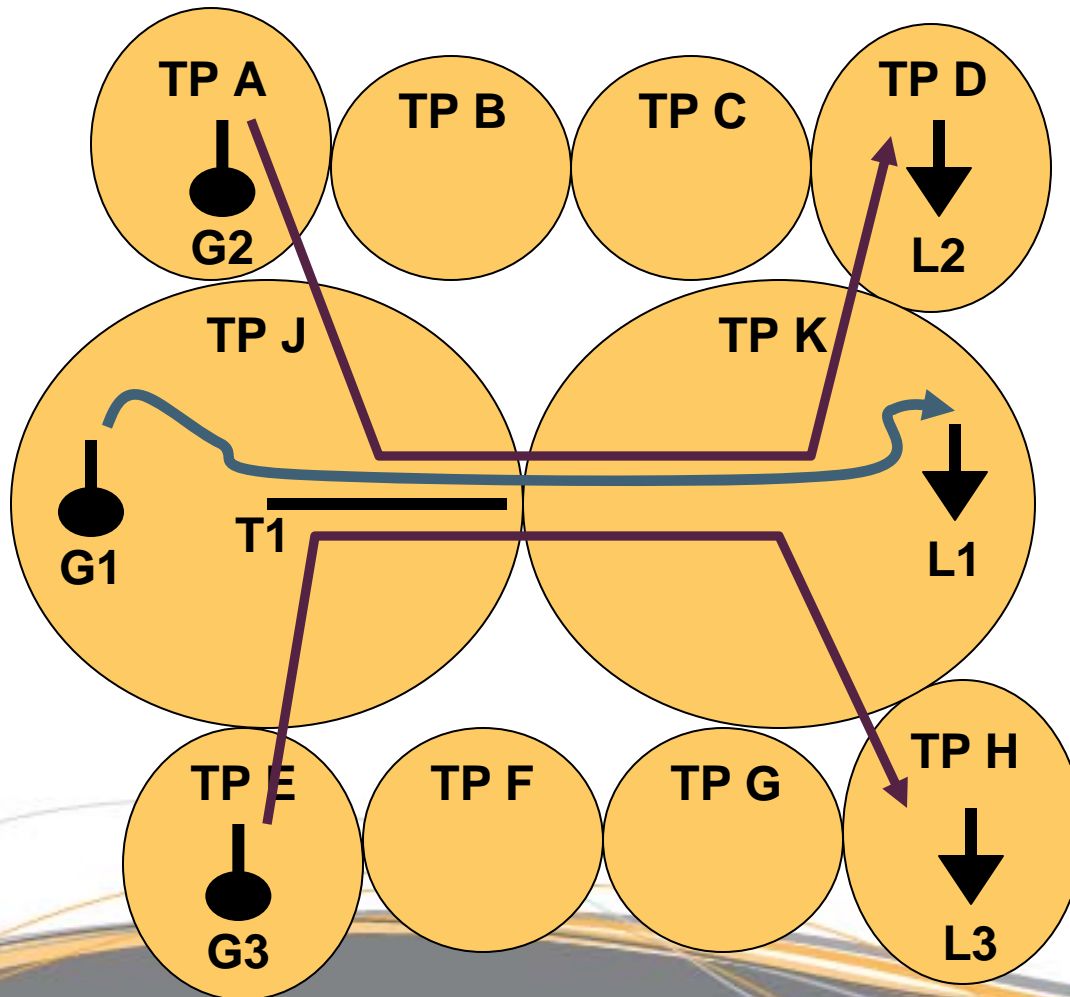
**\*Firm = Firm Curtailment Priority F7**

**\*\*Non-firm = Non-firm Hourly Curtailment Priority N2**



# UFMP example:

Assume T1 is a qualified path



## Diagram Key:

Etag from G1-L1 is a Scheduled Flow on T1

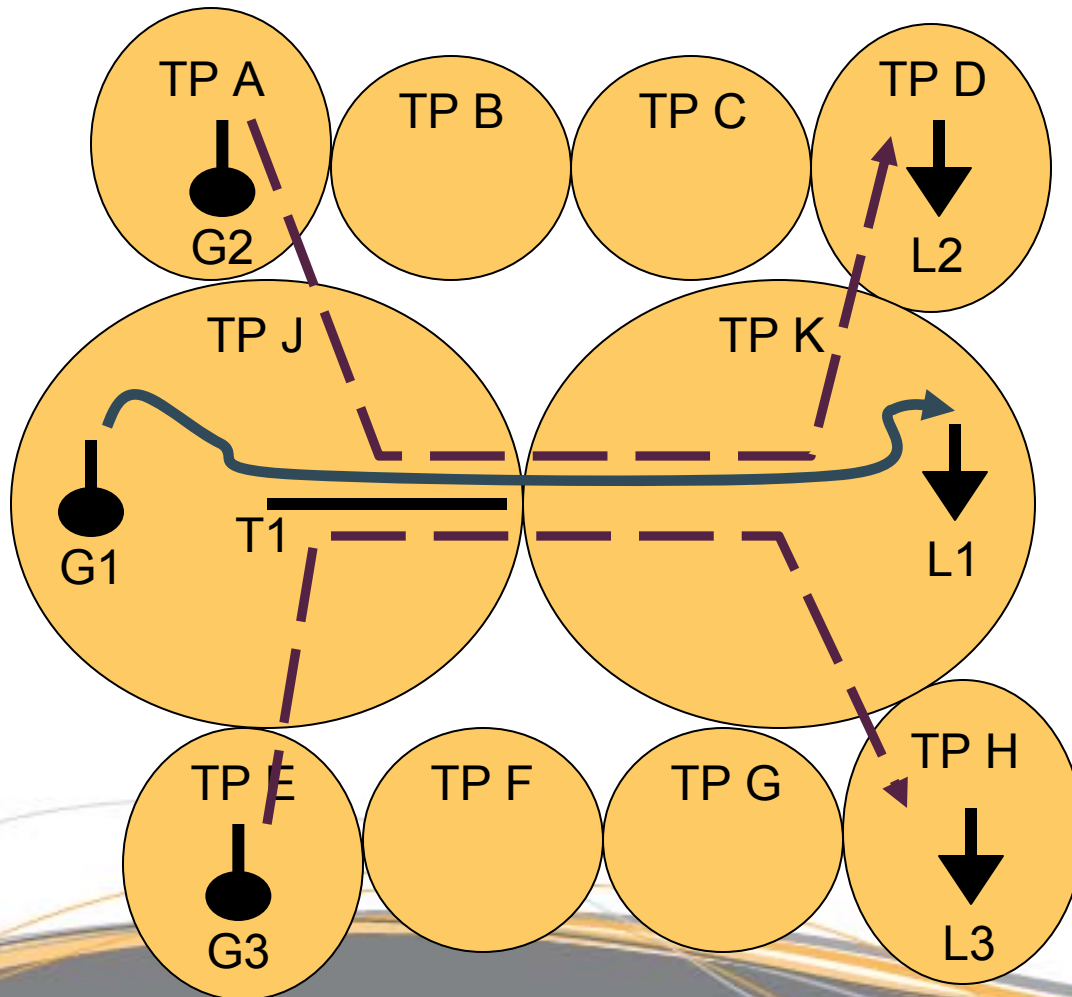
Etag from G2-L2 is an Unscheduled Flow on T1

Etag from G3-L3 is an Unscheduled Flow on T1

The purpose of the “flow” illustration is only to show impact on T1. Clearly the flow distributes throughout the grid based on physics.

# UFMP example:

Assume TSR A-D and TSR E-H have same % TDF on Qualified Path T1



## Discussion:

Under UFMP today, TSR A-D and TSR E-H would both be curtailed at the same step and by the same amount. Also TSR J-K would curtail (accommodate) to permit some continuation of TSR E-H.

In other words, the UFMP is not able to differentiate between the F7 external flow and the N2 external flow. And UFMP compels F7 Accommodation of N2.

The proposed EIS would instead curtail all N2 flow impacts on the limiting element prior to F7 cuts or F7 redispatch.

# Energy Balancing Discussion



# Today's energy imbalance

- **Each BA must set aside resources to provide balancing service**
- **As BA variability increases, the amount of flexible reserve that must be set aside by each BA increases along with corresponding costs**
- **For variable resource transactions that cross balancing areas, present WECC interchange scheduling rules are inefficient**

## **Proposed Energy Balancing Tool:**

- **Real-time energy balancing transactions occur on unused transmission capability**
  - **Regional balancing pool eliminates the artificial limitation of the balancing area boundary**
  - **Multi-party economic dispatch coordination with 5-minute setpoint adjustments**
- **Replaces OATT Schedules 4 and 9 on participating transmission provider systems**

# Energy Imbalance Service - EIS

- **EIS creates a more holistic solution than some other alternatives under discussion**
  - **For example: bilateral dynamic scheduling only moves the problem**
- **Bilateral dynamic scheduling does not capture the aggregate diversity benefit**
  - **It does establish infrastructure that could be used by an EIS – a necessary transitional step!**
- **EIS captures aggregate diversity benefit**

# Overview of EIS Concepts

**Note: the WECC EIS design  
specification is not final**

# EIS market concepts

- **An EIS-style market retains the majority of grid delivery on the basis of traditional self-schedule or bilateral dispatch**
  - **For example: In the SPP EIS 90% of the energy delivery to load continues under these mechanisms**
  - **In SPP the remaining 10% EIS-based dispatch uses voluntary offers from generators to manage congestion and supply energy imbalance.**
  - **The EIS-style design provides for real-time dispatch operation only**
  - **“Schedules” against which imbalance service is calculated must be provided to the EIS Market Operator by a deadline prior to the operating hour**

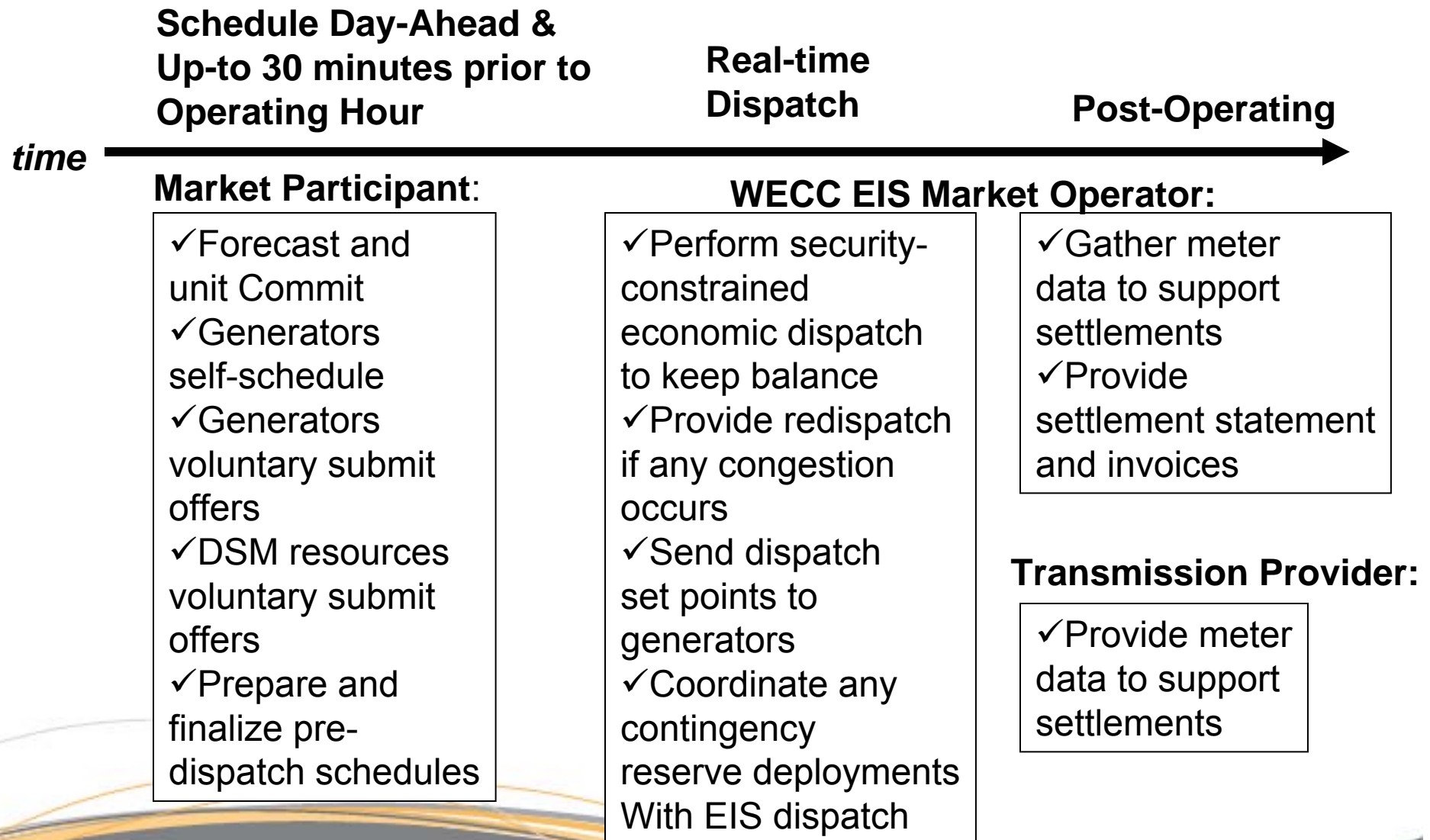
# EIS market concepts

- **The EIS design leaves unit commit decisions with individual market participants**
  - **The option to offer resources for economic dispatch to the EIS remains with the generator owner. (This is not a must-offer requirement as exists in full-LMP-based RTO markets.)**
  - **Just like today, each load-serving entity must bring sufficient available resources to real-time operations to meet their load obligation**

# EIS market concepts

- **The EIS design does not require Balancing Area consolidation, as demonstrated by SPP's experience**
  - **ACE Diversity initiatives can continue under an EIS design with the added benefit of a security-constrained evaluation of the pseudo-tie transfers**
  - **For purposes of renewable integration the EIS accomplishes a “virtual consolidation” of balancing areas through diversity benefits**

# Operation Timeline and Activity for the proposed WECC EIS Toolkit



## **Contract with Balancing Areas Transfers compliance responsibility**

- ***Scheduled and Actual Interchange:***
  - *INT-002, -003 and -004; BAL-006*
- ***EIS Market:***
  - *IRO-006; BAL-006; INT-002, -003*
- ***Dynamic Scheduling and Inadvertent Interchange:***
  - *BAL-005, -006*
- ***Balancing Authority Area Control and Performance:***
  - *BAL-001, -002, 003; TOP-002; EOP-001*
- ***Data Exchange:***
  - *TOP-002, -005*
- ***Ancillary Services:***
  - *Section 3 of Open Access Tariff*
- ***Emergency Operations:***
  - *EOP-002, -003, -008*

