DTC/PSE Update – Transmission Customer Forum
September 30, 2015

Agenda

DTC Update

- DTC Strategy
- DTC 101
- Upper/Lower Limits
  - DTC Innovation – TIP 281
- COI DTC Limits
  - DTC Innovation – ColumbiaGrid Study
  - DTC Innovation – TIP 355
  - BP Changes
- DTC Future State

Agenda

CAISO EIM Update

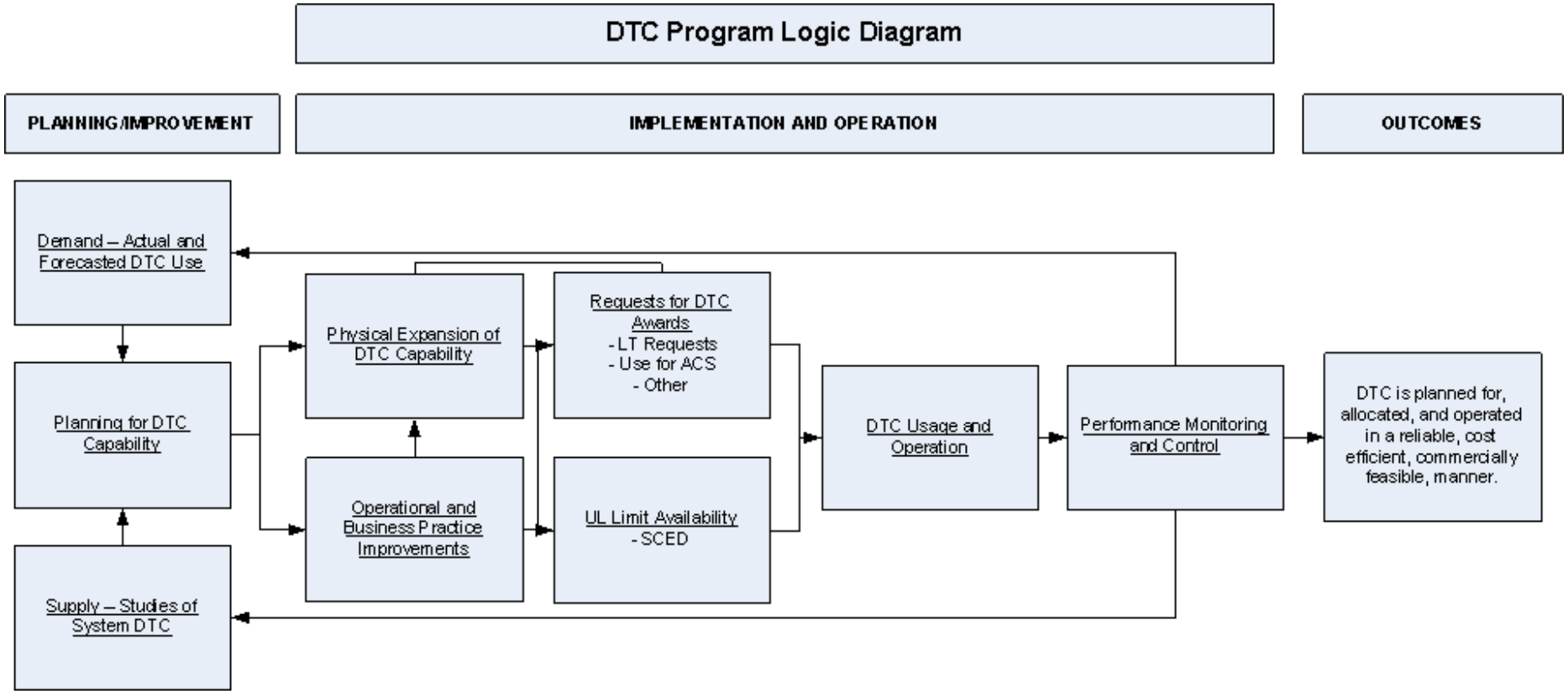
- CAISO EIM Overview
- PSE Participation Overview
- Issues Log Overview
- Approach and Timeline
- PacifiCorp integration into CAISO EIM update

DTC Update

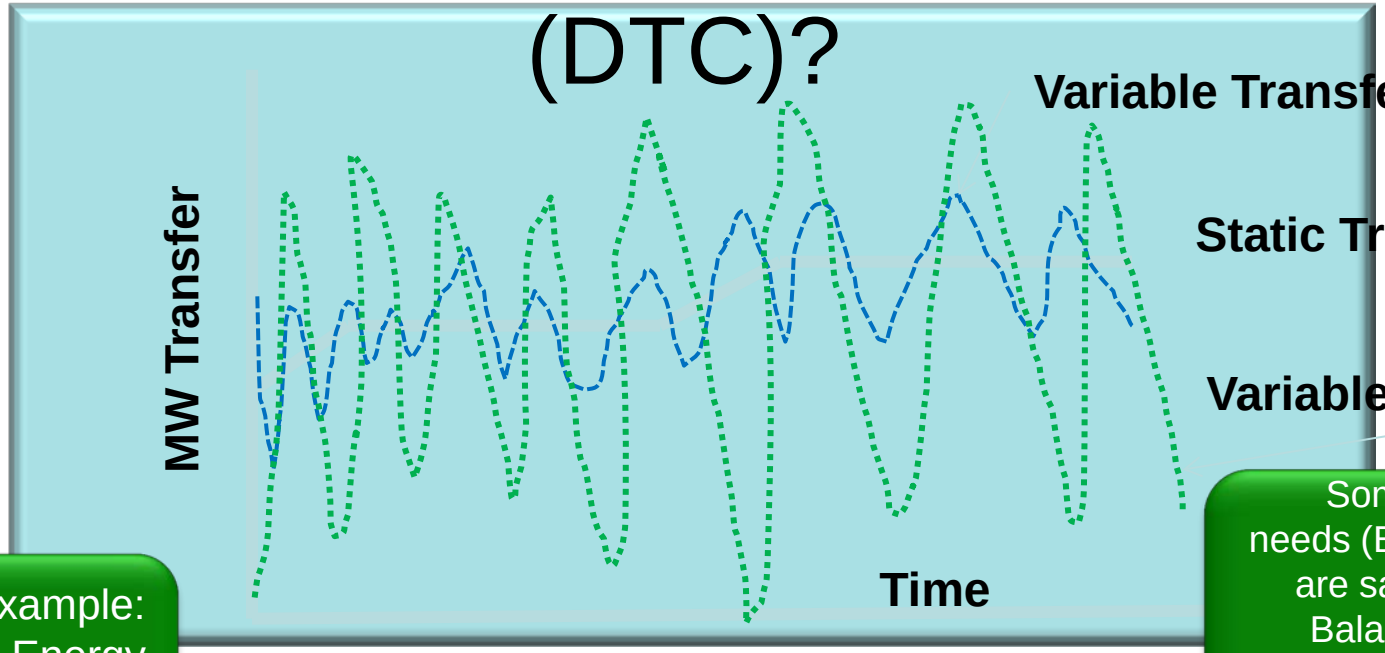
DTC Program Overview

- BPA's DTC Program has several key components
  - Reliable and fair operation of existing DTC
  - Evaluation of existing system DTC
  - Evaluation of demand for DTC
    - Now and in the future
  - Reliably and cost-effectively plan for DTC

DTC Strategy

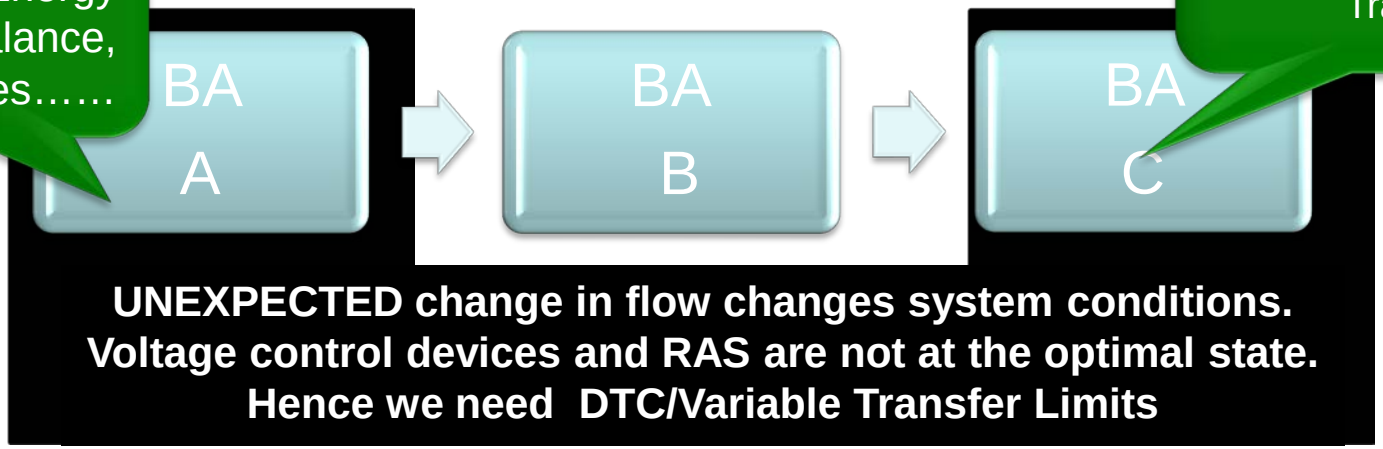


What is Dynamic Transfer Capability (DTC)?



Example: Regulation, Energy Imbalance, Reserves……

Some combined needs (BA A & BA C) are satisfied using Balancing Area B Transmission System.



UNEXPECTED change in flow changes system conditions.
Voltage control devices and RAS are not at the optimal state.
Hence we need DTC/Variable Transfer Limits

Why is DTC Limited in the NW?

No ISO/RTO
- **No one coordinates and controls all the reactive devices in real time.**

Stability
- **Voltage and transient stability are not yet studied in real time.**

Automatic Control
- **Many shunt devices and transformer taps are not automatically controlled.**

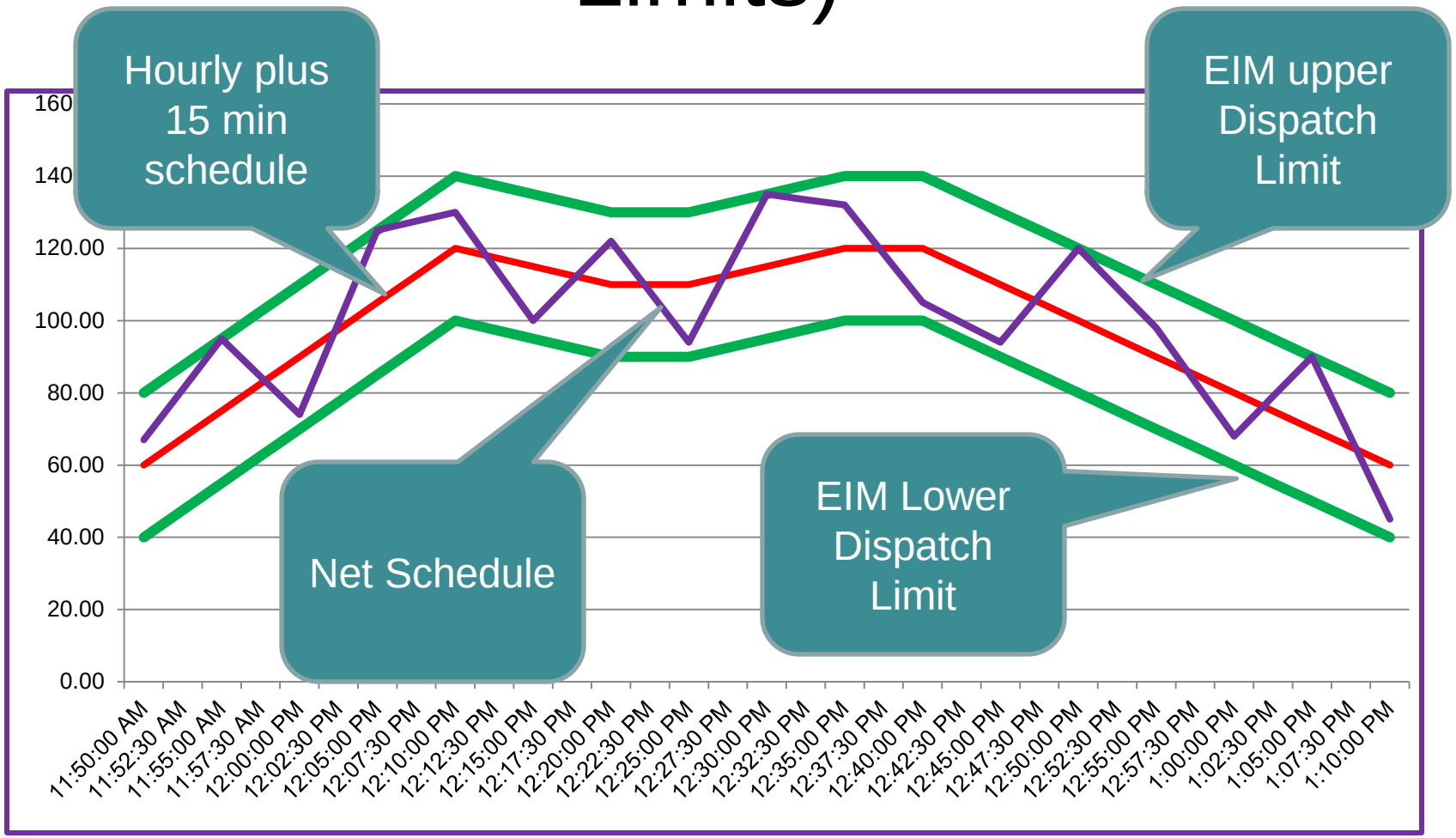
RAS
- **RAS is manually armed.**

Variable Energy
- **Energy Imbalance Markets and Variable Energy Resources**

Conditions that Restrict DTC

Condition 1	Condition 2	Condition 3
Customer Impacts Acceptable?	Equipment Impacts Acceptable?	Operating Point Reliable?

DTC Controls for the EIM (Upper/Lower Limits)

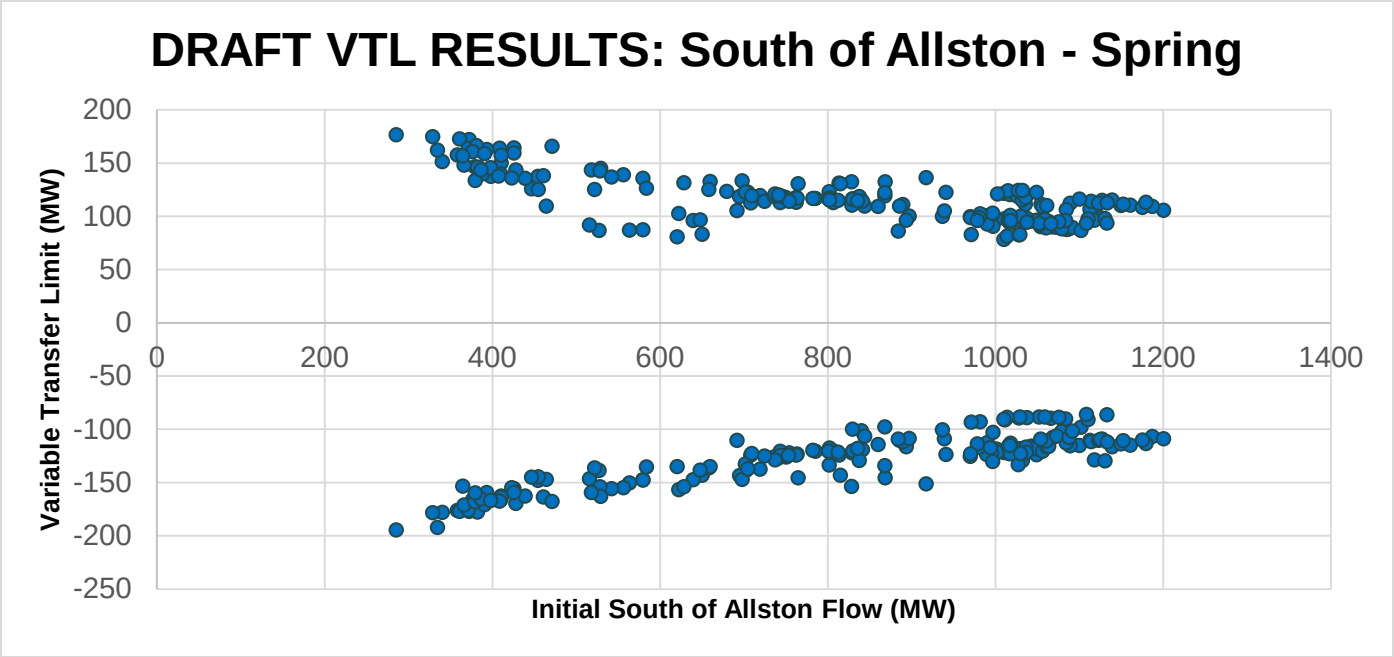


DTC Innovation – TIP 281

- TIP 281 is a Technical Innovation Project focused on creating a tool to determine appropriate Variable Transfer Limits on flowgates within the Bonneville BA
  - Variable Transfer: The transfer of variable resources, such as regulation, energy imbalance, or reserves
- Variable Transfer Limits are needed to maintain voltage stability and transient stability and operate the system reliability for customers across the region
- Using State Estimator cases, the VTL Tool changes the generation at a pre-determined pair of generator sets, in order to simulate a variable transfer. This change in generation is increased until customer impact (allowable voltage change) or flow stability/reliability constraint is reached, and this resultant value is specified as the limit for that case

DTC Innovation – TIP 281

- VTL Tool being used to study the appropriate VTL for the South of Allston flowgate
- VTL Tool produces nomogram-style results, from which we determine a static limit
- The VTL limit is based on many real time system operating conditions.



DTC Innovation – TIP 281

- The VTL tool will be used to determine Variable Transfer Limits for all flowgates within the Bonneville BA. Ultimately, the desire is to create a real-time VTL for each flowgate (as opposed to the current static limit implementation), allowing for maximum Dynamic Transfer Capacity while minimizing customer impact and maintaining reliability

DTC Innovation – ColumbiaGrid Study

- ColumbiaGrid commissioned a study by Power Engineers to reevaluate DTC limits on COI.
  - The study ran for approximately 6 months
  - Results of study showed that 400 MW of DTC can reliably be allocated.
  - At lower flows, additional DTC is available.
    - Until a methodology is created that would allow different levels of DTC based on flow, the additional DTC cannot be utilized

COI DTC Limits/BPA Additional Study

- Following the ColumbiaGrid study, BPA Planning performed a voltage stability study.
  - Study was vetted with the group that participated in defining then reviewing the ColumbiaGrid study
  - Results of study showed that when COI flows came within 400 MW of the SOL, no DTC is available on COI due to voltage stability concerns.
  - BPA is implementing an automated system to ensure that dynamic transfers do not cause a voltage stability issue when COI flows are within 400 MW of the COI SOL.

COI DTC Limits/BPA Additional Study

- Automated process for limiting DTC on COI
  - When COI flows are within 400 MW of COI SOL for 10 seconds, take the upper limit to the actual dynamic flow for all N-S dynamic schedules. Freeze all S-N dynamic schedules.
  - As N-S dynamic schedules decrease, bring the upper limit down with them, lowest amount being zero.
  - Once COI flows are more than 450 MW less than the SOL, release the limitations.

DTC Innovation – TIP 355

- TIP 355: Evaluation of Technical Approaches to Increase Dynamic Transfers
  - This Technology Innovation Project is specifically for COI dynamic transfers
  - Multi-year project
  - First year is to create a technology roadmap for future research topics to increase Dynamic Transfer Capability on the California-Oregon Intertie

DTC Innovation – TIP 355

- Five tasks
  1. Review of adequacy of study tools for assessment of dynamic transfer capability in planning and operating horizons
  2. Qualify system reinforcements that can be used to increase DTC
  3. Voltage control improvements to increase DTC
  4. Situational Awareness Tools
  5. Safety Nets – can synchronized-wide area measurements be used as a safety net.

COI DTC Changes

- BPA has proposed moving the COI DTC Scheduling limits to 400 MW as a result of the recent COI DTC studies.
- BPA, as the Path Operator on the northern portion of the COI, is planning to automate real-time controls for dynamic signals to manage voltage.
- BPA will continue to work with regional parties on ongoing studies

Upcoming DTC Changes & Issues

- Possible COI DTC Expansion
- EIM Implementation and Controls
- COI DTC Allocation Timelines
- Scheduling and Tagging for DYNAMIC tags

CAISO EIM Update

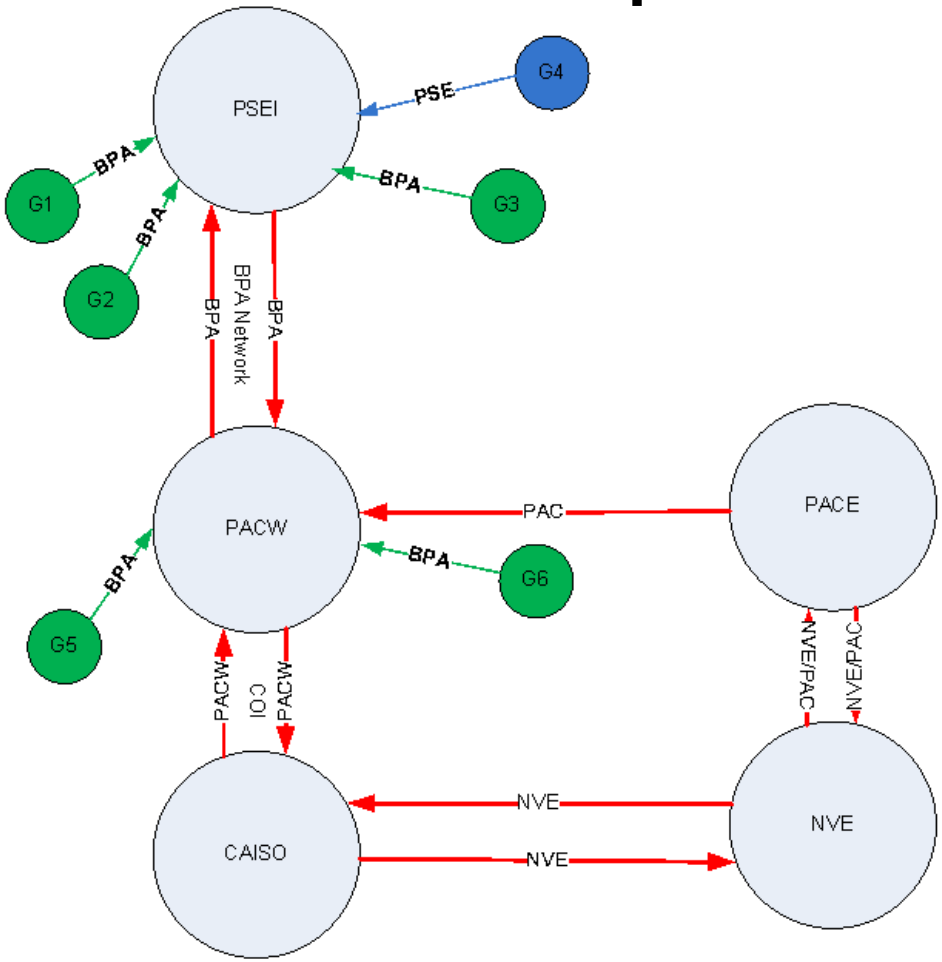
Principles for EIM Implementation Using BPA Transmission

- BPA's ability to maintain reliability is not diminished
- BPA continues to provide transmission service consistent with the quality and reliability of service required by its OATT and any other agreements and obligations
- BPA manages impacts on its own customers in EIM Balancing Authorities

CAISO EIM – Puget Sound Energy

- The CAISO is a centralized real-time market that optimizes generation and load within and among participating Balancing Authorities
- The market includes a 15-minute market and a 5-minute market.
- The 5-minute market requires DTC.

PSE Participation Overview



PSEUDO-TIE —BPA▶

Delivery of PSE generator the PSE BA over Firm BPA transmission via a PSEUDO-TIE tag. These tags and deliveries exist today for PSE's BA operation.

LOCAL Resource —PSE▶

Generation that is "local" to the PSE BA (i.e. it does not require BPA transmission to be delivered to PSE load).

EIM TRANSFER —BPA▶

EIM Transfers represent the net market dispatch among the EIM Entity BAAs. These transfers exist today for PAC, but PAC uses its own transmission for these transfers. They are tagged as system to system and use NORMAL tags for 15-Minute dispatches and DYNAMIC tags for 5-minute dispatches on the COI. DYNAMIC tags are currently used for other EIM Transfer paths.

PRE-DECISIONAL – DISCUSSION PURPOSES ONLY

Stakeholder Approach – Issues Log

- BPA is developing a log of issues that it intends to address in its stakeholder process.
- The issues relate to three primary subject areas, similar to the PAC-EIM process.

Issues Log – Operations and Reliability

- These issues will pertain to BPA maintaining sufficient visibility and controls to ensure reliable operation of its transmission system.
- Operational impacts are managed while maintaining quality of service to other customers as well.
- Includes DTC, congestion management, etc.

Issues Log – Access to Transmission and Transmission Policy

- These issues pertain to BPA ensuring that EIM participation is implemented without impacting other transmission rights of customers who are not EIM participants.
- The EIM is implemented in a way can be comparably be scaled for future EIM participants that are BPA customers.
- BPA can effectively manage such EIM impacts on an ongoing basis.

Issues Log – Transfer Service

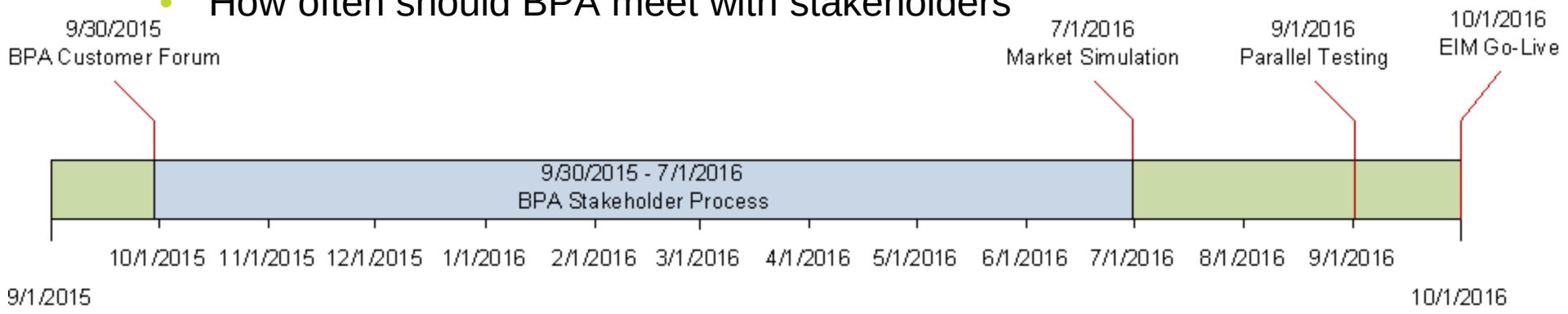
- BPA is effectively engaging with EIM participants regarding service to BPA customers in EIM Balancing Authorities.

Issue Log Discussion

- What specific issues should BPA address within these three areas?
- Are there any other areas that BPA should address?

Stakeholder Approach – Timeline and Logistics

- BPA would like to develop any potential implementation changes prior to PSE's market testing.
- BPA would like input on the best way to engage with customers
- Type of Discussion
  - Public meetings?
  - Individual meetings or focus groups?
  - Other?
- Frequency
  - How often should BPA meet with stakeholders



PacifiCorp EIM Integration Update

- PAC went live with the EIM in November 2014.
- Dynamic schedules on the COI began in February 2015.
- BPA has not observed reliability issues related to the EIM

PacifiCorp EIM Integration Update

- BPA continues to monitor Upper/Lower Limits.
- The system is new and BPA is working with CAISO and PacifiCorp on issues that are expected with new systems.
- BPA receives real-time information on PAC EIM participation in addition information that is standard with generation connected to our system
  - Individual plant 15-minute dispatch targets
    - Advisory and binding
  - Individual plant 5-minute dispatch targets
    - Advisory and binding
  - Individual plant shift factors for monitored flowgates
  - Load and NSI for PACW, PACE, and CAISO