Northwest **Power** and **Conservation** Council

September 3, 2014

MEMORANDUM

TO: **Council Members**

FROM: **Ben Kujala**

SUBJECT: **BPA/NW Power Pool EIM Update**

BACKGROUND:

Presenter: Michelle Manary, Manager of Strategy Integration

Summary: BPA has requested time to address the Council Members concerning the NW Power Pool Energy Imbalance Market effort. The NWPP is considering the design for a within-hour energy only market, called a security constrained economic dispatch (SCED), for a subset of NWPP balancing areas (BAs).

Relevance: The Energy Imbalance Market could improve the dispatch of the regional power system and reduce the reserve requirements for balancing authorities.

Workplan: 1. D. Prepare for Seventh Power Plan and maintain analytical capability

Background: The NW Power Pool is exploring the potential of using a Security Constrained Economic Dispatch to more efficiently dispatch power plants on a shorter schedule. This would aid in integrating intermittent resources, such as wind.

More Info: http://www.nwpp.org/our-resources/MC-Initiative

Northwest Power Pool Market Assessment and Coordination Committee (NWPP MC) SCED Initiative

Overview

NWPP MC Overview

- The Northwest Power Pool (NWPP) Members' Market Assessment and Coordination Committee (MC) is a **collaboration of 19 public and investor owned utilities** from across the NWPP footprint.

- The MC is considering the design for a **within-hour energy only market**, called a security constrained economic dispatch (SCED), for a subset of NWPP balancing areas (BAs).

- BPA has been a participant of the NWPP MC initiative since the **kickoff in 2012** and has been providing significant resources and time commitment toward the MC initiative throughout.

SCED Overview

Security Constrained Economic Dispatch (SCED) Overview

- The SCED is an intra-hour redispatch mechanism to economically optimize the generation resources that have been voluntarily offered (or committed) ahead of the operating hour. **Not just for imbalance**.
- Within the market footprint, a SCED will determine the least costly means of obtaining energy to serve the next increment of load at each settlement location within the market footprint, while maintaining reliability.
- In performing these calculations, the SCED will dispatch offered resources that can serve load at a bus at the lowest cost.
- Resources may either be “Available” for market dispatch or “Self-dispatched” (not available) to serve scheduled transactions and/or native load.
- Resources that have elected to be market dispatched (“Available”) will have their offered range subject to market dispatch control.
- Dispatch is regional and is calculated using a security constrained, offer-based economic dispatch (SCED) every 5 minutes.
- The SCED is security-constrained, meaning dispatch outcomes are constrained within actual real-time physical limits on generation and transmission elements.

NWPP SCED Overview

What the SCED is:

- An intra-hour market for non-firm energy
- A tool for centralized real time re-dispatch of units' *voluntarily* offered range operations
- A market in which participation
  - is voluntary for generators offering economic re-dispatch flexibility (ie. offered dispatchable range)
  - is mandatory for imbalance loads and generators in the participating BAs

What the SCED is NOT:

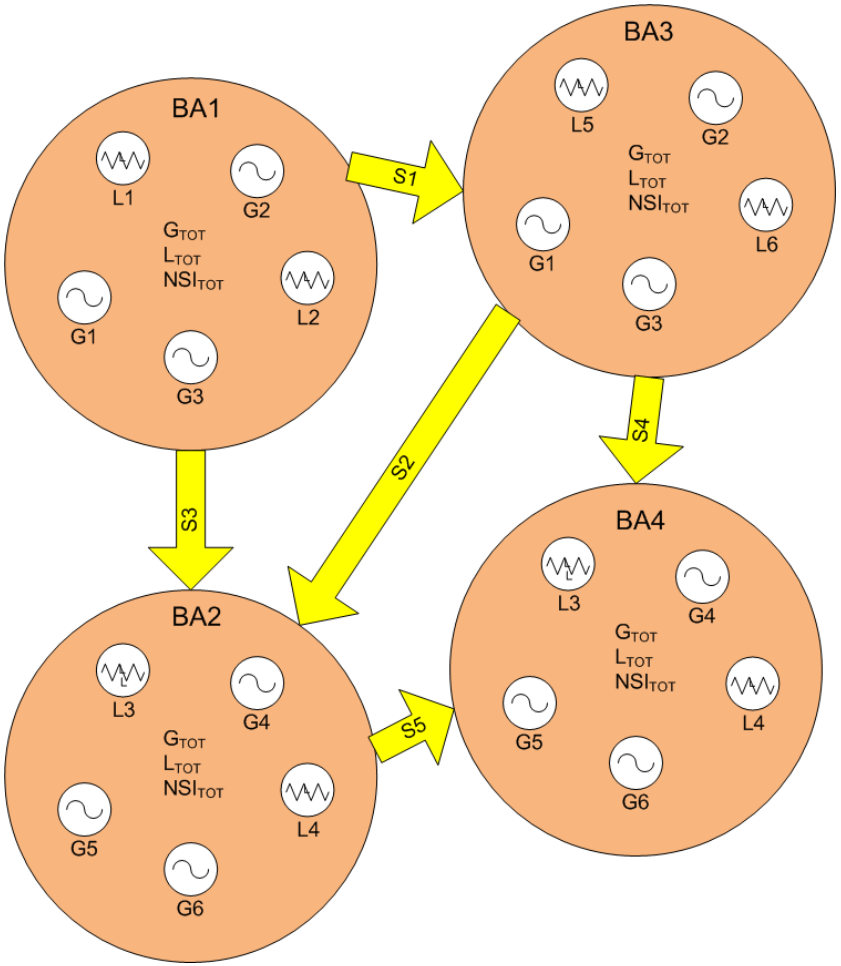
- An RTO (with planning, day-ahead markets, BA consolidation)
- A centralized unit commitment tool
- A capacity market
- A replacement for the current contractual business structure

Today's World (No Regional SCED)

Largely for the 60-min Operating Hour

- Each BA takes on the obligation to balance within their own bubble
- Outside of emergency situations, each BA must balance in their own circle and cannot use resources/load in another circle to balance

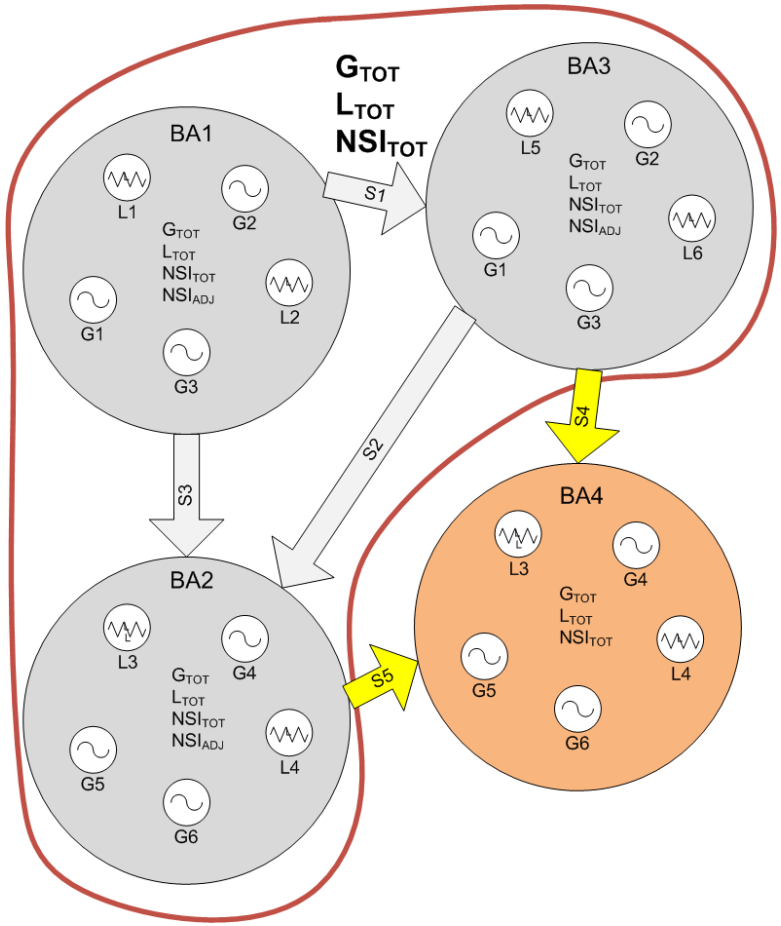
BA = Balancing Authority
L = Load
G = Generator
NSI = Net Scheduled Interchange
S = Schedule



Regional SCED with Centralized Dispatch

- In a SCED, a Market Operator (MO) optimizes and dispatches resources every 5 minutes across the entire market footprint sufficient to serve the aggregated net load and obligations of the market footprint, including net market exports (S4 + S5)
- Offered resources may be dispatched off their schedule by the Market (within their dispatchable range)
- Net Scheduled Interchange for each Balancing Authority is adjusted to account for Market Dispatches
- Physical transmission constraints are honored

For Each 5-min Dispatch Interval

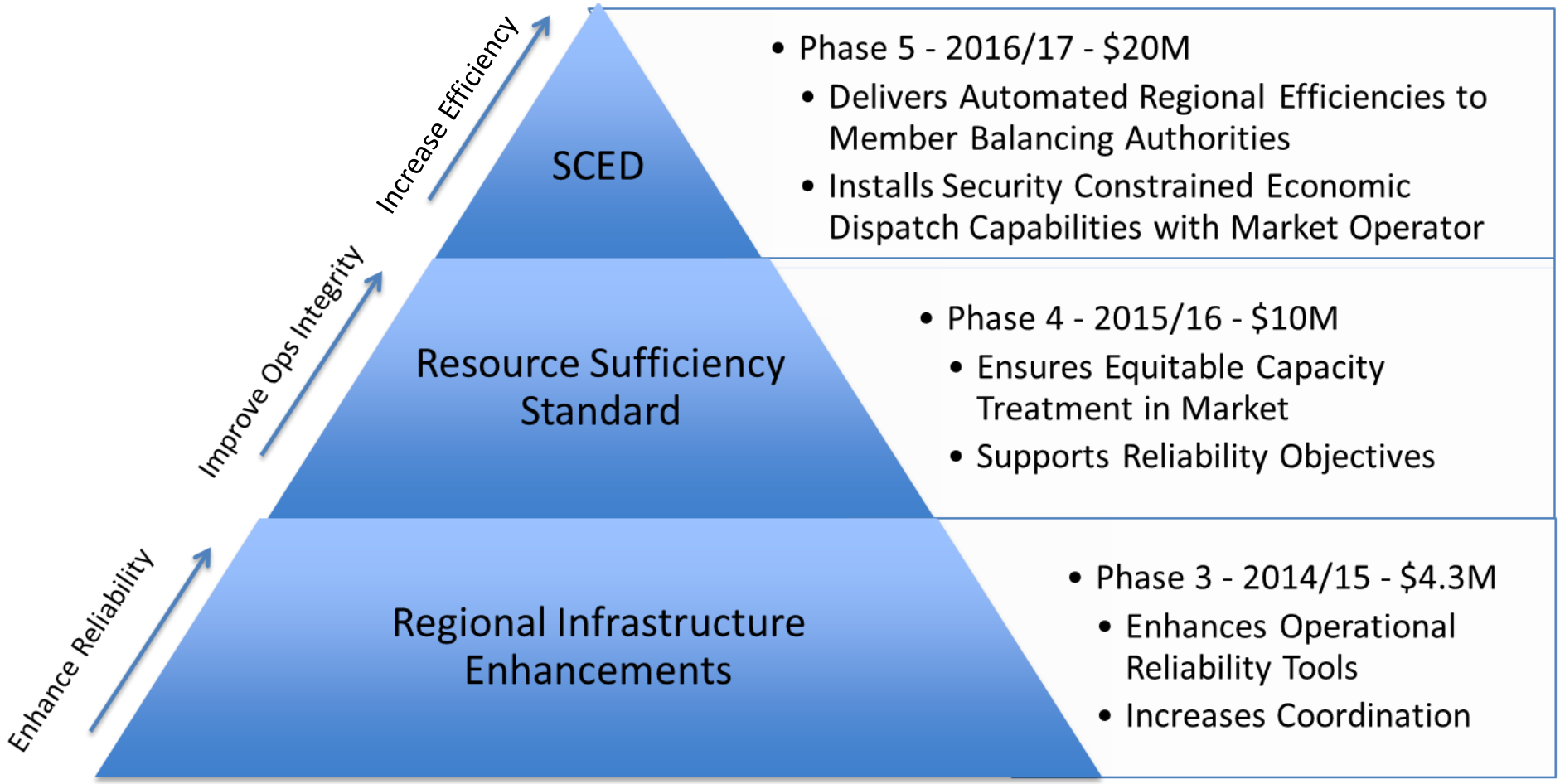


SCED Value Proposition

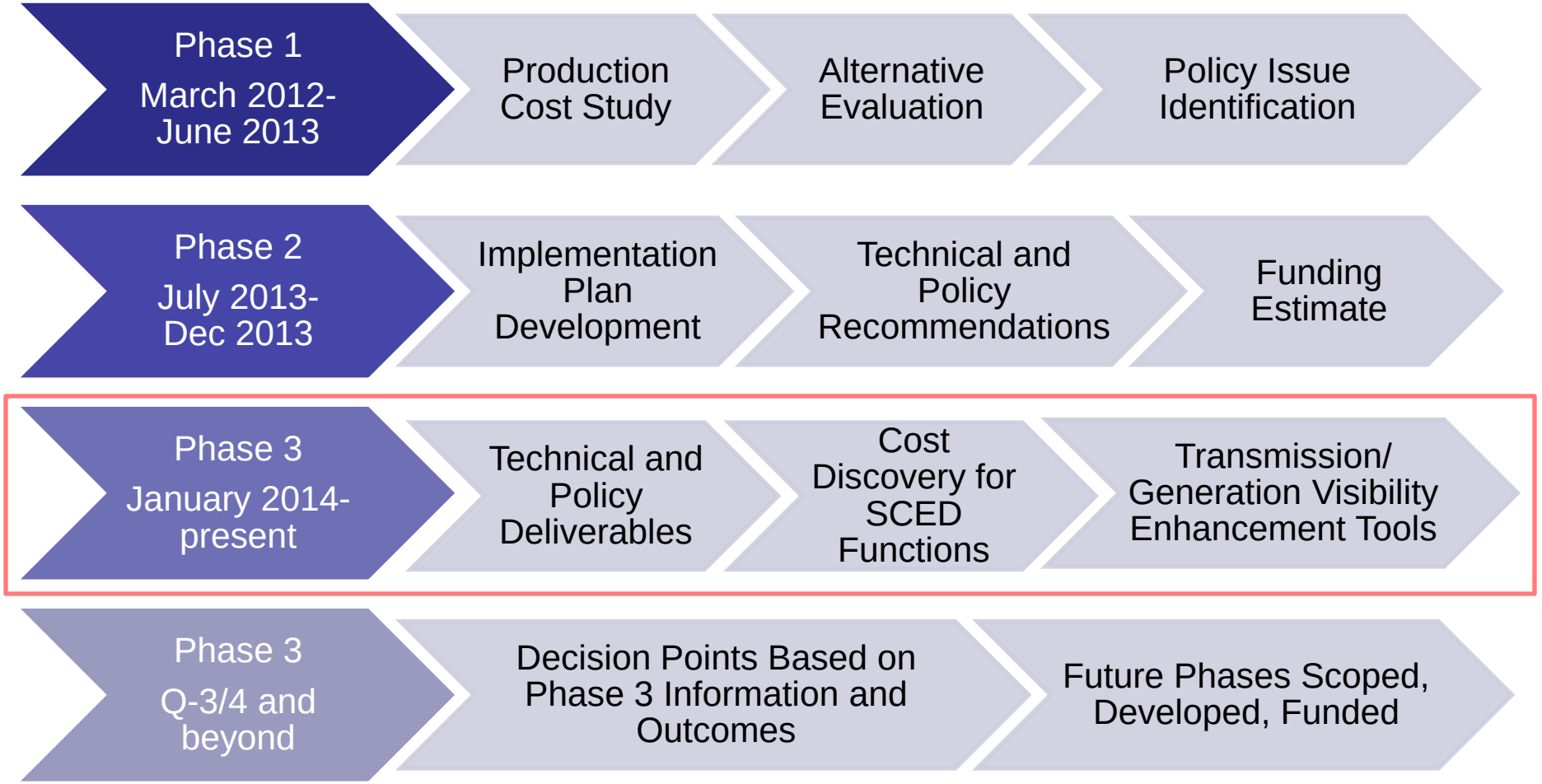
- LSEs could reduce their cost of meeting load through:
  - Access to a broader range of resources than they have today under current scheduling practices
  - Better understanding of deliverability risks
  - Lower production costs
  - Aggregated (net) the variability of generation and load imbalances over the market footprint, thereby reducing the required amount of balancing resources deployed
- Generators retain scheduled revenues and could reduce production cost and/or increase revenue through:
  - Least cost dispatch
  - More frequent and transparent pricing
  - Optimization of unused physical transmission capability within the operating hour
- BAs could improve system reliability at a least cost through:
  - Improvements to transmission system visibility afforded by SCED
  - Better recognition of the diversity of forecast error and ramping needs (ie. reduced or netted) across the footprint
  - Aggregation of the (net) the variability of generation and load imbalances over the market footprint, thereby reducing the required amount of balancing resources deployed
  - Optimization of unused physical transmission capability within the operating hour
  - Access to a broader range of tools and resources to help address transmission system constraints more effectively

NWPP MC Initiative Update

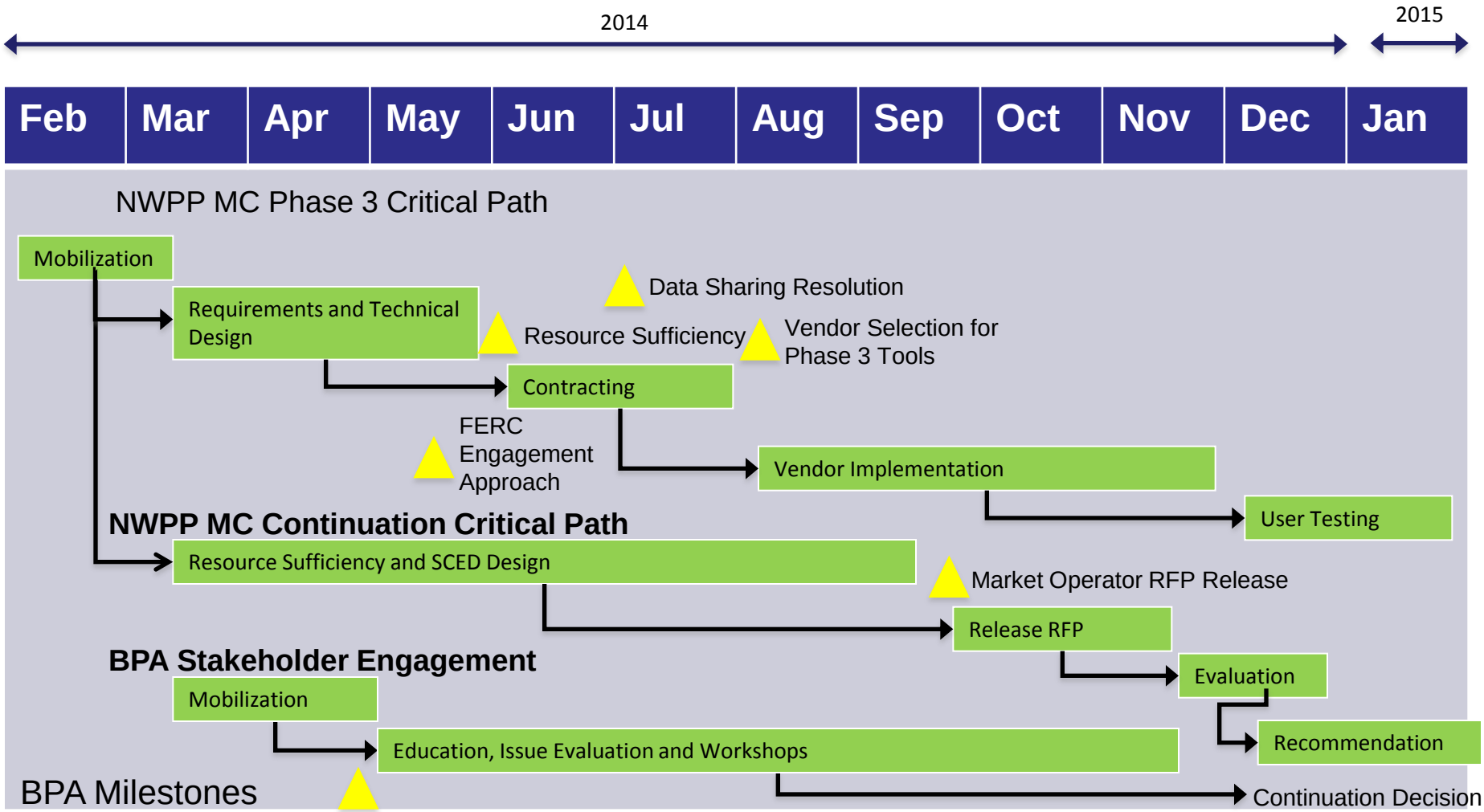
Building A Comprehensive Pacific Northwest Solution



NWPP MC Initiative

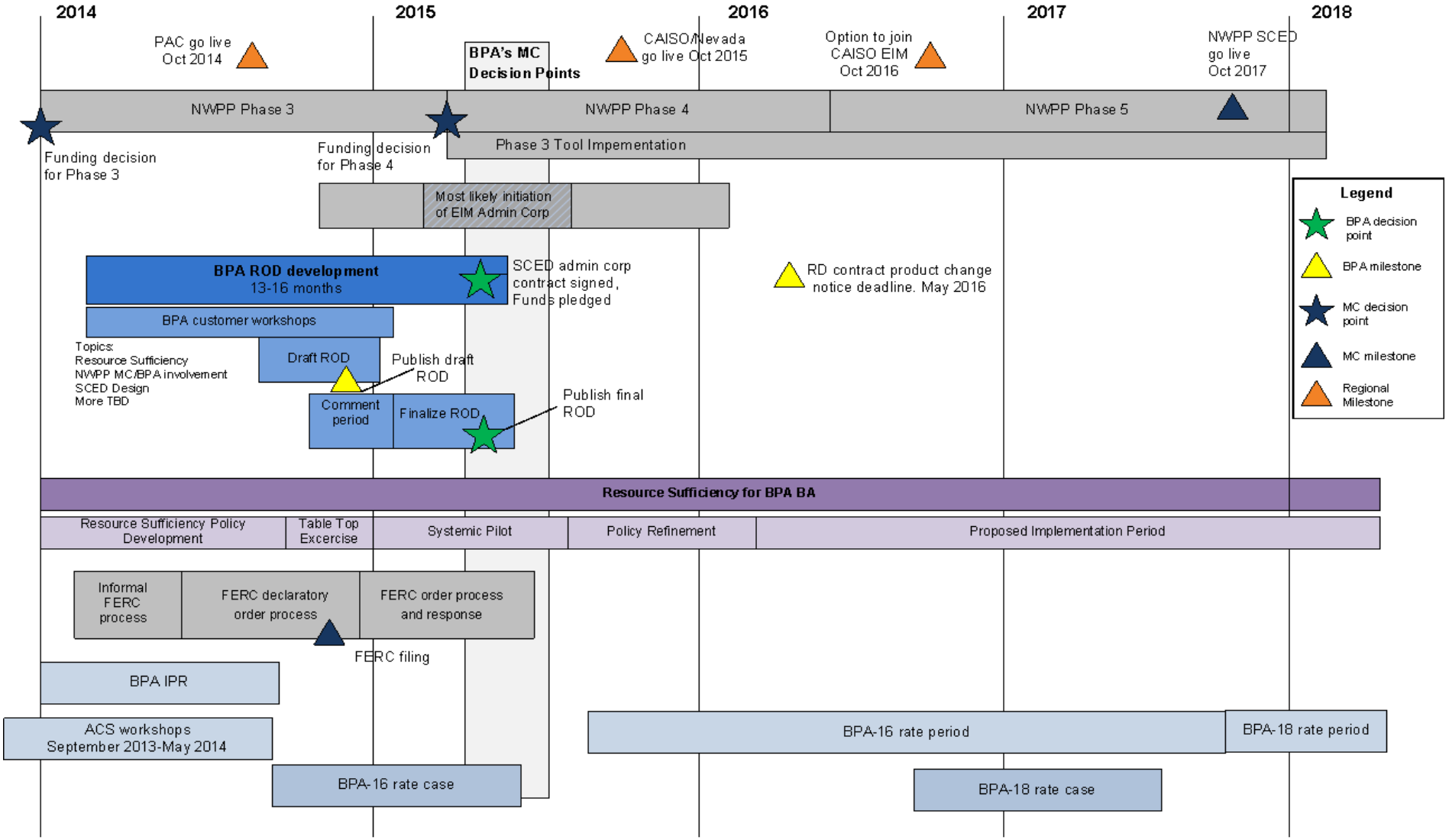


NWPP MC Phase 3 Paths and BPA Milestones



Long-Term View Provides Context for MC and BPA Timelines

Based on Regional SCED Go Live Date of October 2017
Subject to Change



What Might SCED (Phase 5) Mean for BPA?

Factor	Key Driver	Forum
Market Operator Costs	▪ Amount ▪ Payback Arrangement	▪ NWPP MC Phase 3 ▪ NWPP MC Phase 3
Market Participant Costs	▪ Amount ▪ Allocation	▪ BPA Internal Assessment ▪ BPA Stakeholder Engagement
SCED Production Cost Benefits	▪ Regional Amount ▪ Parsed Regional Benefits	▪ NWPP MC Phase 1 ▪ NWPP MC Phase 1
Other Efficiency and Reliability Benefits of SCED	▪ BPA Costs[1] ▪ BPA Benefits[2]	▪ BPA Stakeholder Engagement ▪ BPA Stakeholder Engagement

Notes:
1. Those costs to BPA not otherwise included in the market participant costs.
2. Those benefits to BPA not otherwise included in the regional benefits.

Regional Changes on October 1st, 2014

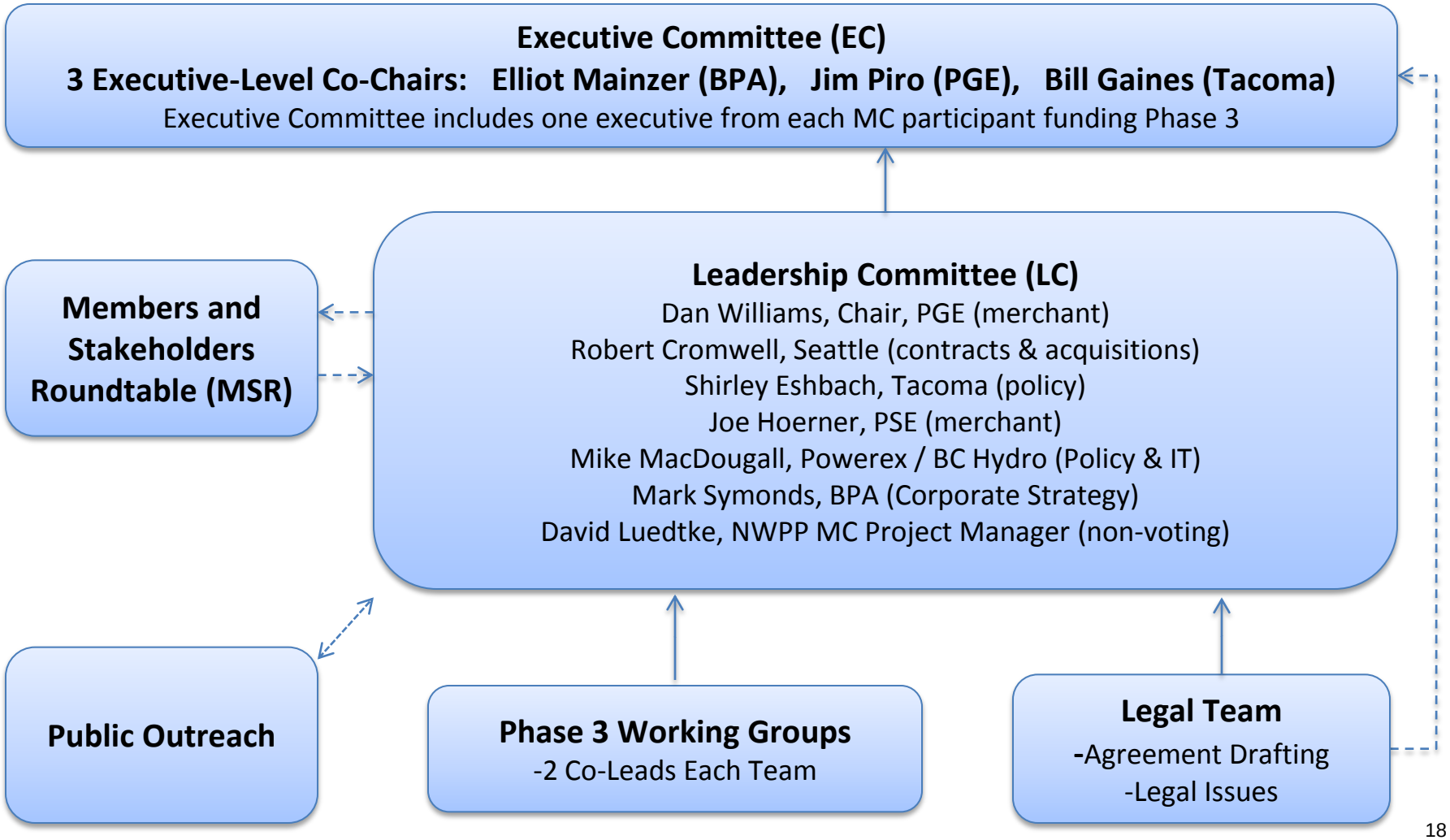
- BPA implements 15 Minute Scheduling
  - Allows schedules consistent with FERC Order 764, enables greater integration of VERs, and reduces seams issues with neighboring BAAs
- PAC-CAISO EIM launches
  - CAISO's EIM expands into PNW, dispatching resources according to CAISO market design
- BAL-002-WECC-2 becomes effective
  - Updated standard simplifies the calculation of contingency reserves requiring 3% of Generation + 3% of Load in a BA
- CAISO expands Full Network Model
  - Approved tariff allows CAISO to enforce physical flow constraints in its Day Ahead Market based on regionally modeled loop flow

For More Information:

http://www.bpa.gov/Projects/Initiatives/marketassessment/Pages/Northwest-Energy-Market-Assessment.aspx

APPENDIX

NWPP MC Current Administrative Structure



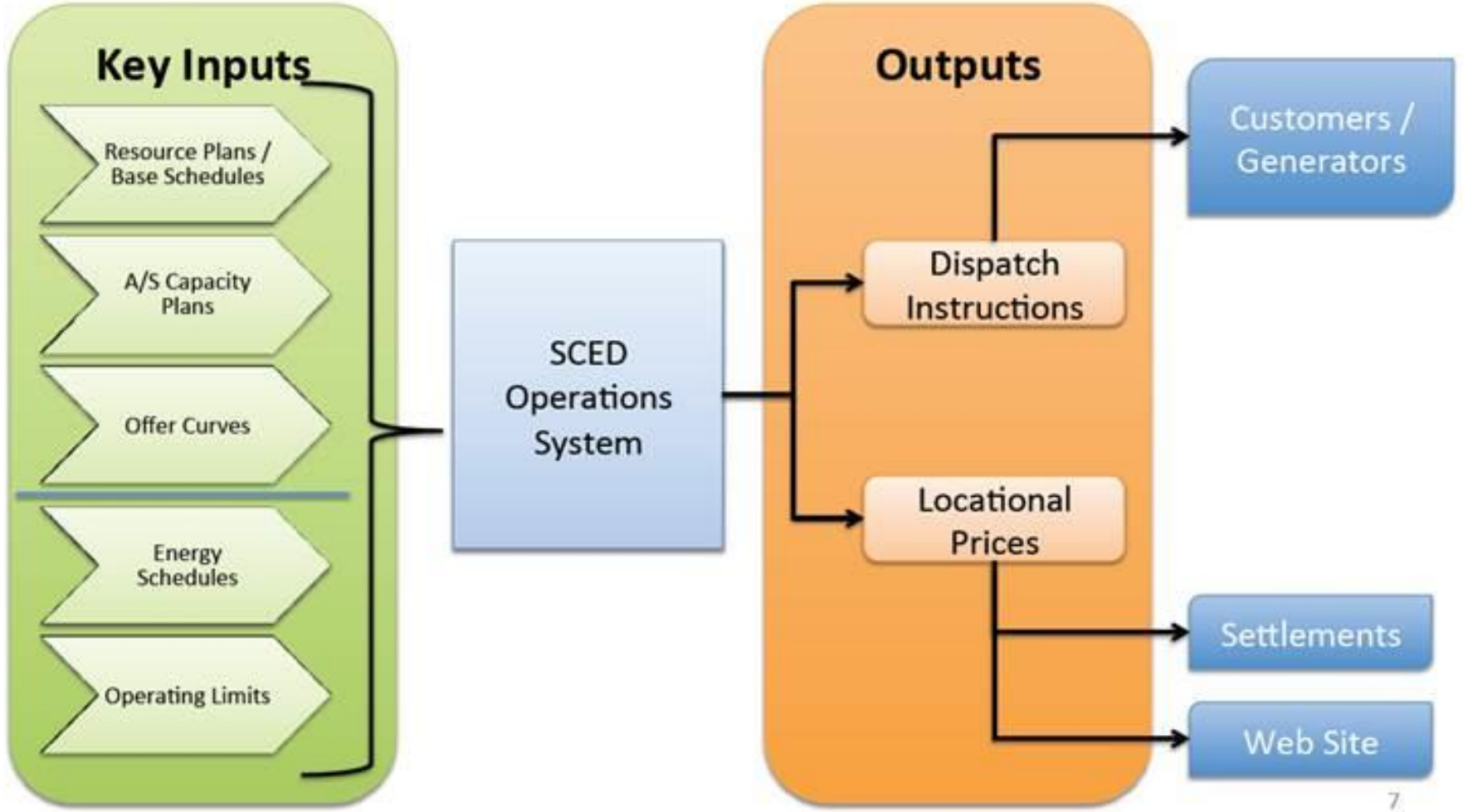
NWPP MC Funding Organizations

- Avista Corporation
- Balancing Authority of Northern California (BANC)
- Bonneville Power Administration
- B.C. Hydro/Powerex
- Eugene Water & Electric Board
- Idaho Power Company
- NaturEner
- NorthWestern Energy
- Puget Sound Energy
- Chelan County PUD
- Clark County PUD
- Grant County PUD
- PacifiCorp
- Portland General Electric
- Snohomish County PUD
- Seattle City Light
- Tacoma Power
- Turlock Irrigation District
- WAPA, Upper Great

SCED Market Functions & Entities

- **Administration** - The market is planned to be administered by an independent Administrative Corporation.
- **Market Operator** – The entity that is collecting the data needed to run and settle the market and that is configuring, supporting and running the market & related systems.
- **Market Participants -** Generator Asset Owners & LSEs in market participant BA's (or generators linked via pseudo-tie), supply resource plans, ancillary service plans, offer curves & load forecasts to MO.
- **Participating BA** – EI & GI supplied by market, TOP's receive generator dispatches & NSI adjustments & enable market dispatches.
- **SCED** – The Security Constrained Economic Dispatch computational software engine that is computing locational prices and resource dispatches based on all of the underlying data.
- **Settlement** – The function of calculating the elemental costs of the economic dispatches and resoultion of generation and energy imbalances after-the-fact.
- **Market Monitoring** – A function carried out that will monitor the behavior of market participant entities and the market operator to insure market rules are followed.

SCED Basic Inputs / Outputs



Courtesy of Southwest Power Pool

MC Phase 1
Production Cost and Policy Analysis

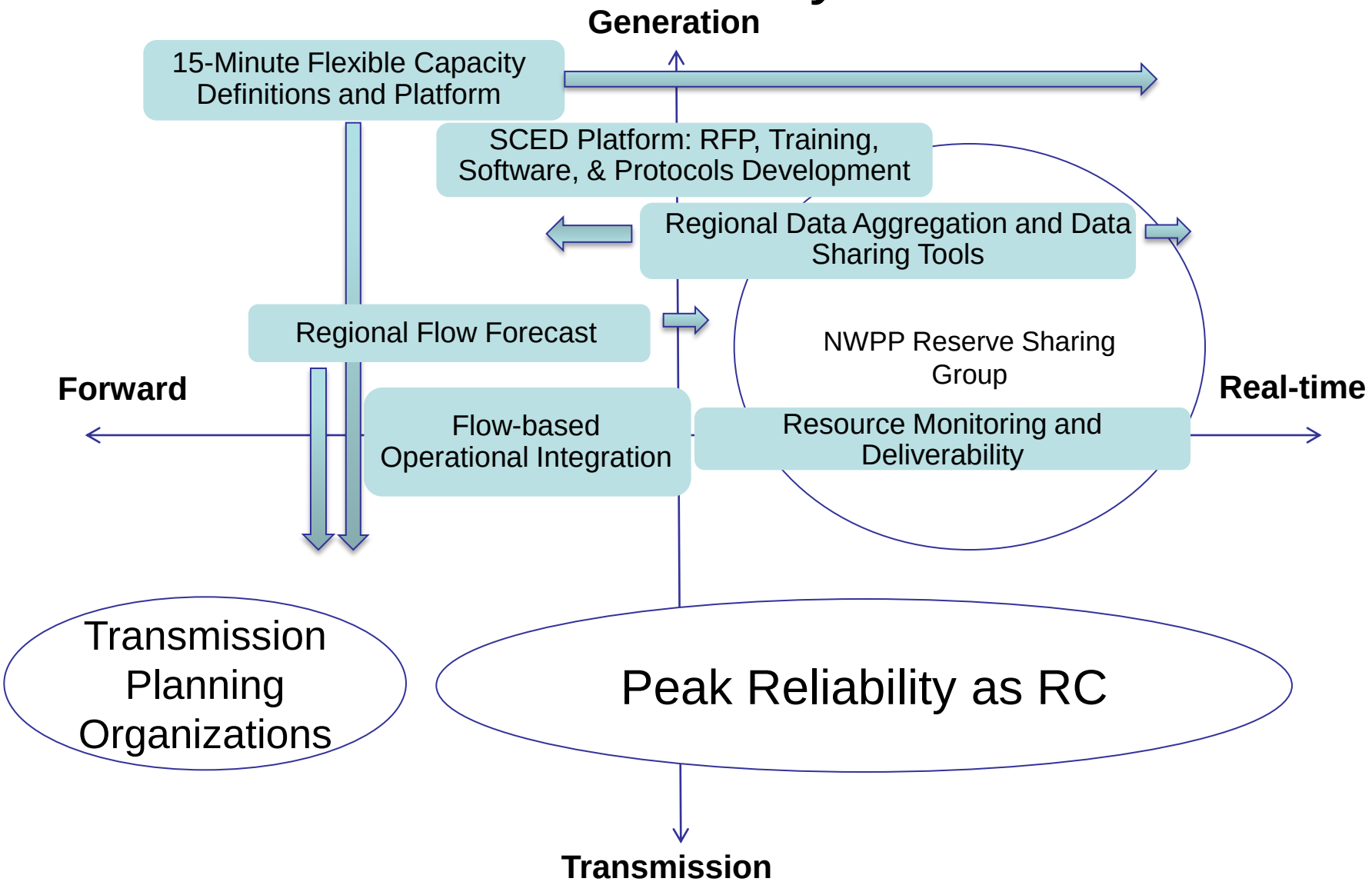
- Quantitative benefits through generation cost savings
- Market design decisions drive overall costs
- Market Participant costs outweigh Market Operator costs
- Key concerns:
  - Governance (FERC Jurisdiction, EIM Admin Corp)
  - Policy (Hydro, Transmission, Capacity)
  - Technical (Infrastructure, Market Platform)

MC Phase 2

Five areas of focus:

- Address SCED design issues that were identified during Phase 1
- Refine “all-in” costs including Market Operator, Market Participant and other requisite costs for starting and operating a SCED
- Develop an Implementation Plan that maximizes benefits and options
- Provide illustrative Bylaws for EIM Admin Corp that would help shield its members from FERC jurisdiction

Phase 3 Leverages Enhanced Generation Visibility



Phase 3 – Summary Scope

Technical

- Regional Flow Forecast: Provide MC participants with a regional flow forecast on targeted flowgates
- Resource Monitoring and Deliverability: Improve deliverability assessment of regulation, contingency, post-contingency and balancing reserves/energy
- Regional Data Sharing Tools: Provide Balancing Authorities and merchants with access to selected operational data
- Flow-based Operations Integration: Identify, specify and enable the integration points between RSG, BA, TSP and RC

Policy

- 15-Minute Flexible Capacity: Define Flexible Capacity products, facilitate WSPP approval, and trading on established platform if feasible
- Resource Sufficiency: Develop BA-level data collection and reporting process, protocols, and agreements w/ and w/o a SCED Platform end-state
- SCED Tasks: Complete Market Operator RFP based on finalized SCED design, including operational protocols and agreements
- Legal: Vendor Agreements, evaluate jurisdictional risks and advance FERC engagement

Proposed Phase 3 Solutions

Problem Statement	Phase 3 Solution	Outcome
Manage Variable Energy Resources	15-minute Capacity Product Regional Flow Forecast	Up to 3 hour-ahead flow forecast will reflect expected VER output and provide merchants the opportunity to trade feasible replacement energy.
Share Diversity	Regional Flow Forecast	Forward flow forecast provides traders with window to capitalize on access to broader set of resources.
Manage Transmission Constraints	Regional Flow Forecast	Forward flow forecast shows paths that are at risk of being curtailed. Provides incentive to trade around congestion. Curtailments are reduced.
Contain Compliance Exposure	Operational Integration	Centralized infrastructure with decentralized NERC roles limits compliance costs and regulatory risk.
Address Cost Causation	Data Sharing Generator Modeling EIM Protocols	Provides technical platform and protocols for Resource Sufficiency and SCED. Phases 4 and 5 will address Cost Causation.
Leverage Existing Tools	Peak Reliability and NWPP	NWPP vendor agreement with Peak expected to provide IT, engineering and operational synergies.
Preserve Existing Reserve Sharing	Improved Resource Monitoring and Deliverability	Provides increased confidence of resource deliverability and a platform to evaluate replacement energy and regulation pooling.

Phase 3 Costs and Benefits

- Costs in Phase 3 are expected to be modest
  - Regionally, the total cost of Phase 3 is expected to be $4.3 million
  - BPA's financial contribution is 23% of the actual cost, up to $1 million
- Benefits of Phase 3 are predominantly operational
  - Enhances situational awareness of operational reliability tools
  - Increases coordination to drive potential reduction in curtailments
  - Improves information to evaluate appropriate System Operating Limits
- Potential Phase 4 and Phase 5 (SCED) benefits expected to be incremental to benefits in Phases 3

Evolution of Regional Capabilities

	Phase 3	Phase 4	Phase 5
Monitor	Resource Sufficiency Pilot	Resource Sufficiency Implementation	Energy Deliverability
Forecast	3hr Regional Flow Forecast	24hr Regional Flow, Load and Wind Forecast	Near real-time Demand Forecast
Dispatch	Advisory Resource Sufficiency Guidance		Energy

Summarizing Costs & Benefits of Phase 5

- Regional cost estimate of Phase 5 is $27 million.
- Benefits expand to other areas due to the centralized, coordinated nature of the SCED
  - Generation cost savings from the centralized dispatch modeled in NWPP MC Phase 1 indicated minimum conservative regional benefits clustering at $70 to $80M annually.
  - Diversity creates future opportunity to reduce amount each balancing authority carries to cover balancing reserve requirements.
- Operational and reliability benefits enhanced
  - Efficient transmission constraint management enabled by automated changes to the output of generating resources (re-dispatch) as compared to solely through power-sales curtailments.
  - Modeling and nodal operations for load and generation improve reliability.
  - Improved reliability coordination through automated mechanism to manage operating limits, tighter integration with contingency analysis, and complimentary function with Enhanced Curtailment Calculator.

Regional Cost/Benefits Analysis Overview

- The NWPP MC analysis is focusing on four elements in evaluating a SCED and other potential tools.
  - Benefits Analysis – Production Cost Model
  - Market Operator Costs
  - Market Participant Costs
  - Qualitative Costs and Benefits