EnergyImbalanceMarket

PUGET SOUND ENERGY

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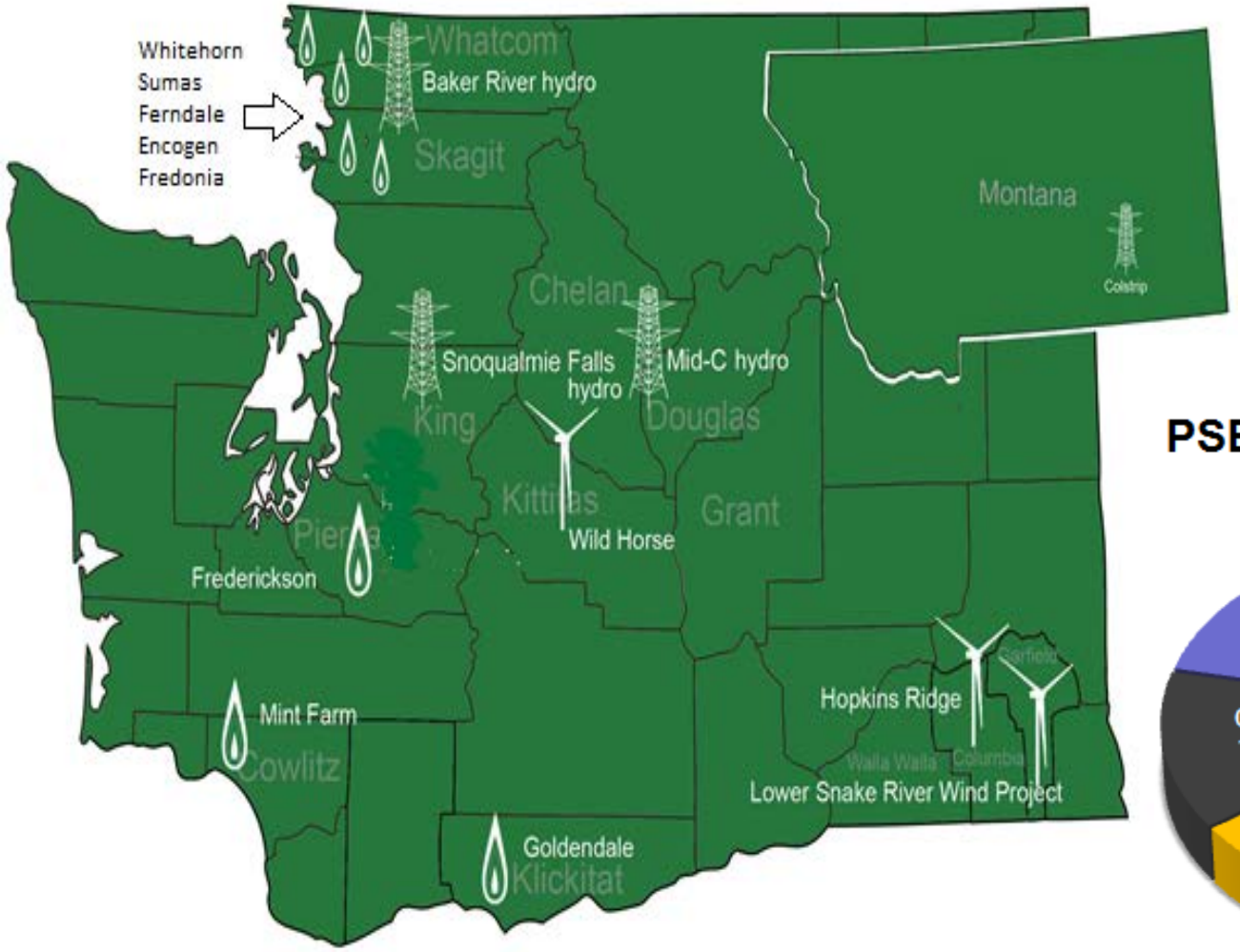
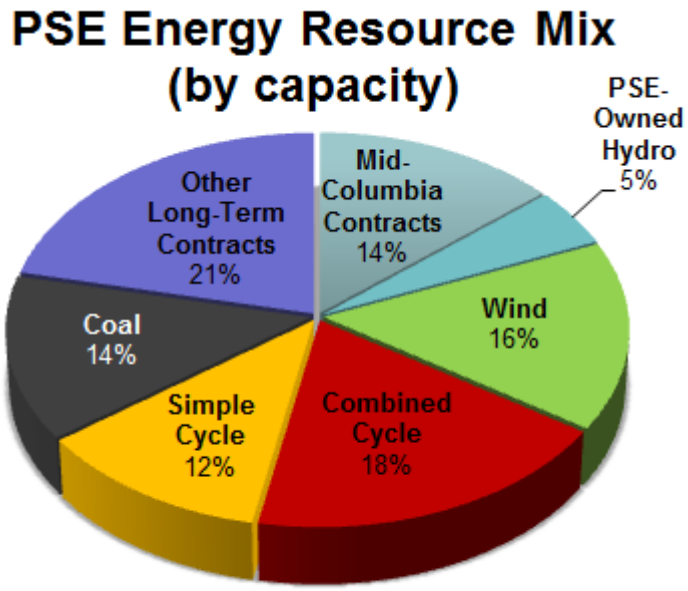
Power Portfolio Overview





Managing PSE's changing resource mix

Load
2337 MW

Coal
677 MW

Hydro
1376 MW Mid-C
234 MW
Baker/Snoqualmie

Wind
150 MW
Hopkins Ridge

Gas Fired Generation
902 MW

Load
2585 MW

Coal
677 MW

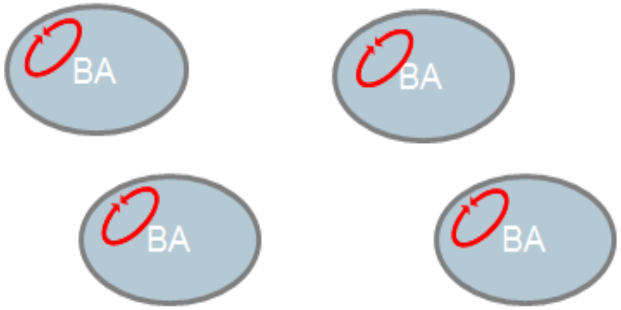
Hydro
740 MW Mid-C
254 MW
Baker/Snoqualmie

Wind
773 MW

Gas Fired Generation
1871 MW

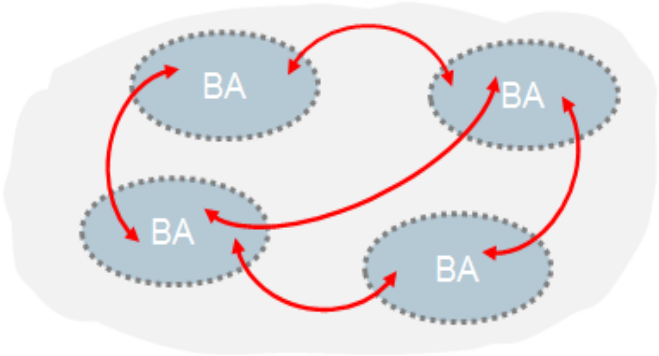
EIM Basics

Today:
Each BA must balance loads and resources w/in its borders.



- Limited pool of balancing resources
- Inflexibility
- High levels of reserves
- Economic inefficiencies
- Increased costs to integrate wind/solar

In an EIM:
The market dispatches resources across BAs to balance energy



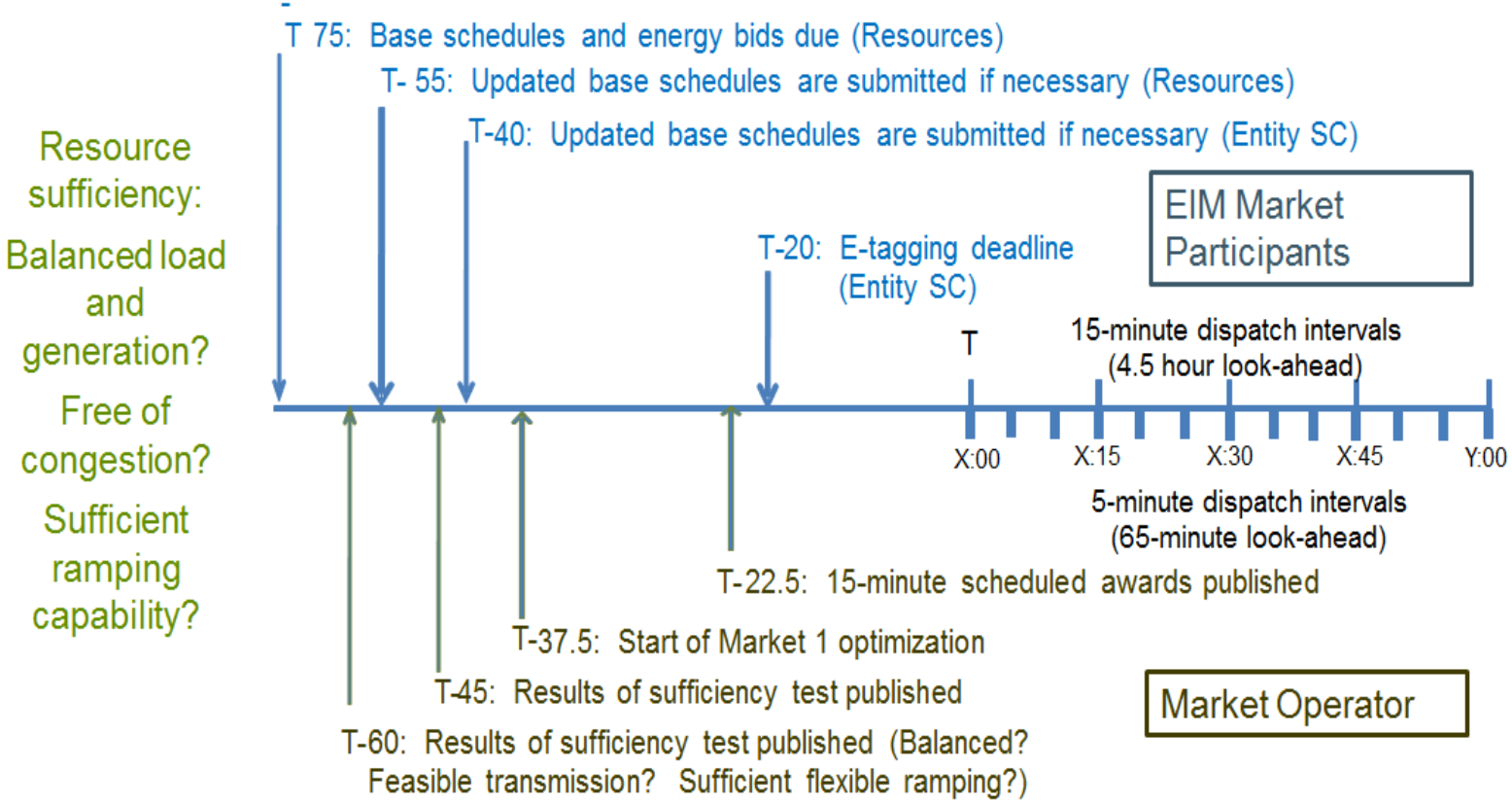
- Diversity of balancing resources
- Increased flexibility
- Decreased flexible reserves
- More economically efficient
- Decreased integration costs
- Voluntary participation

EIM Benefits for PSE

Benefit Category	Benefits Attributed to PSE ($MM/Yr)	Notes
Intra-Hour Dispatch Savings	**$16.7 -18.5**	Low Range is 300 MW transfer variability limit (TVL) and 400 MW north to south COI capacity. High range is 900 MW TVL and 700 MW N-S COI capacity.
Reduced Load Following Reserve Requirement	**$1.60**	Based on WECC-wide 74.5 aMW expected reduction and PSE reduction of 26.3 aMW at $6.98/MWh.
Renewable Curtailment Savings	**$0.0 – 0.8**	$0.8 MM represents the average costs for BPA DSO 216 and PSE reliability curtailments on wind facilities.
Avoided BPA VERBS Charge	**$0.0 – 9.1**	Max = 800MW wind at BPA rate less additional reserve costs Min = Assume wind stays in BPA BA
Total EIM Benefit	**$18.3 – 30.0**	

Scheduling Timelines

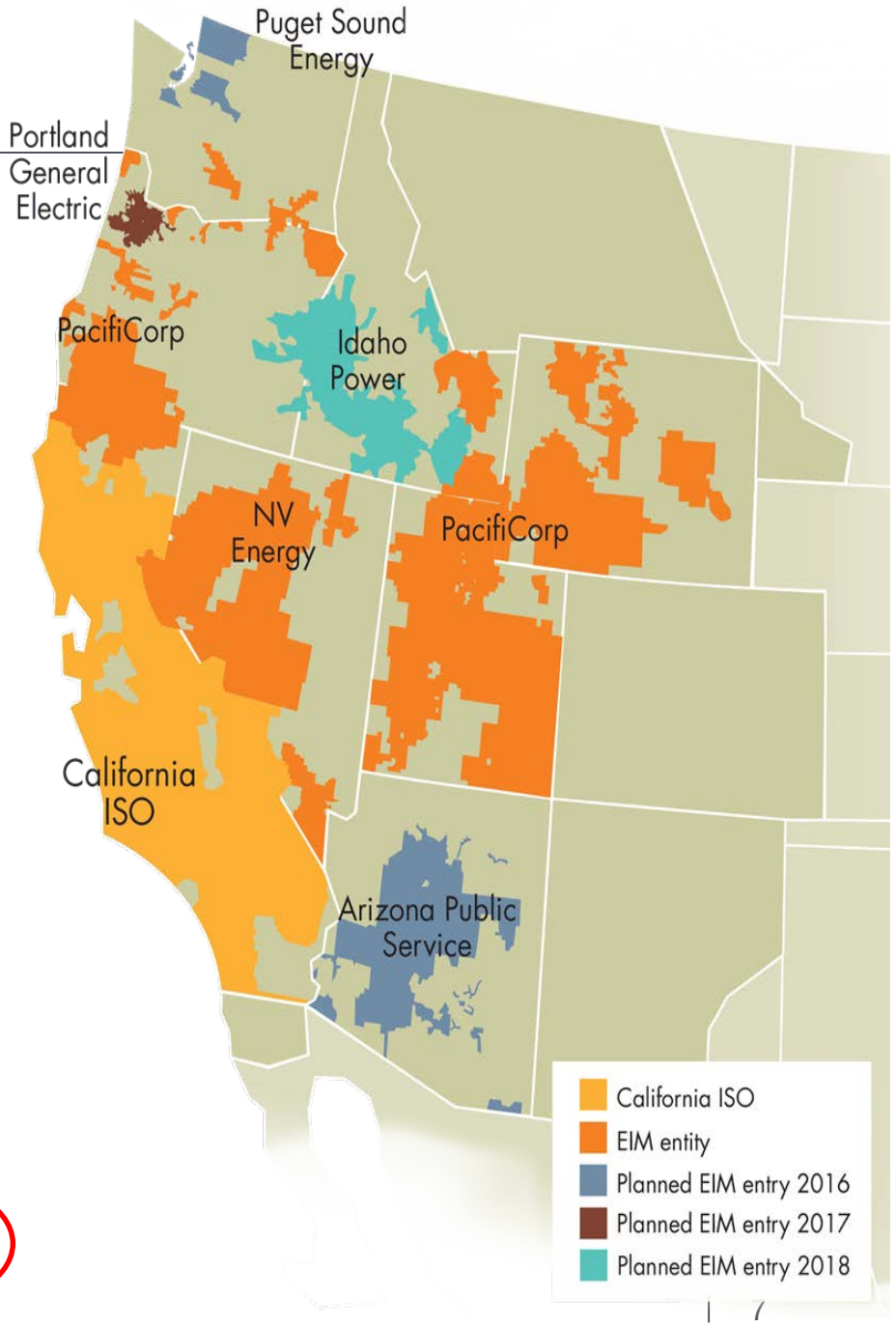
After advisory feedback period, final submission of hourly base schedules and resource plans is interactive



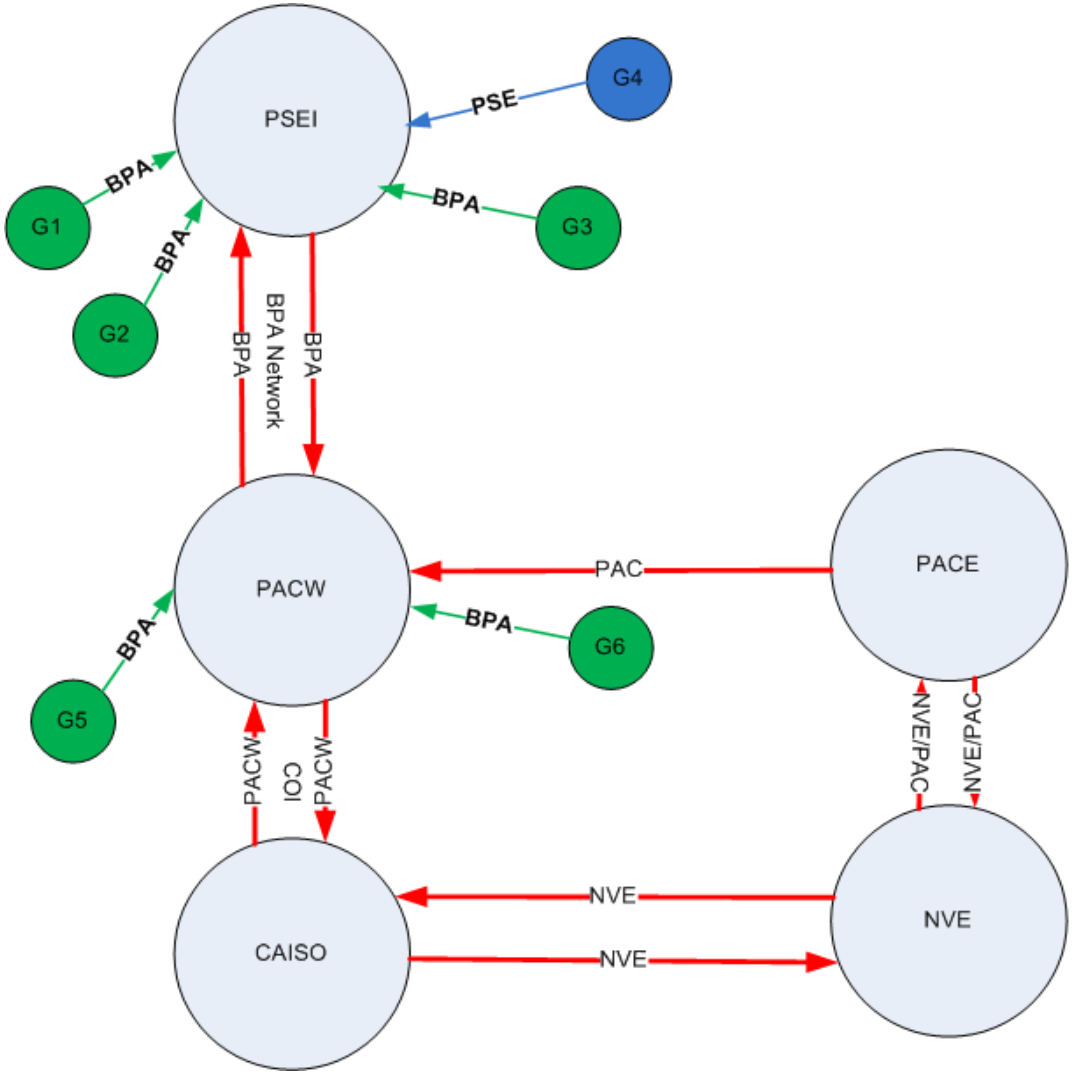
(T = start of the hour)

2015 Market Results

2015	CAISO	PAC	NVE	Total
Q1	$1.44M	$3.82M		$5.26M
Q2	$2.46M	$7.72M		$10.18M
Q3	$3.48M	$8.52M		$12M
Q4	$5.28M	$6.17M	$.84M	$12.29M
Total	$12.66M	$23.23M	$.84M	**$39.73M**



Transmission in the EIM



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▶

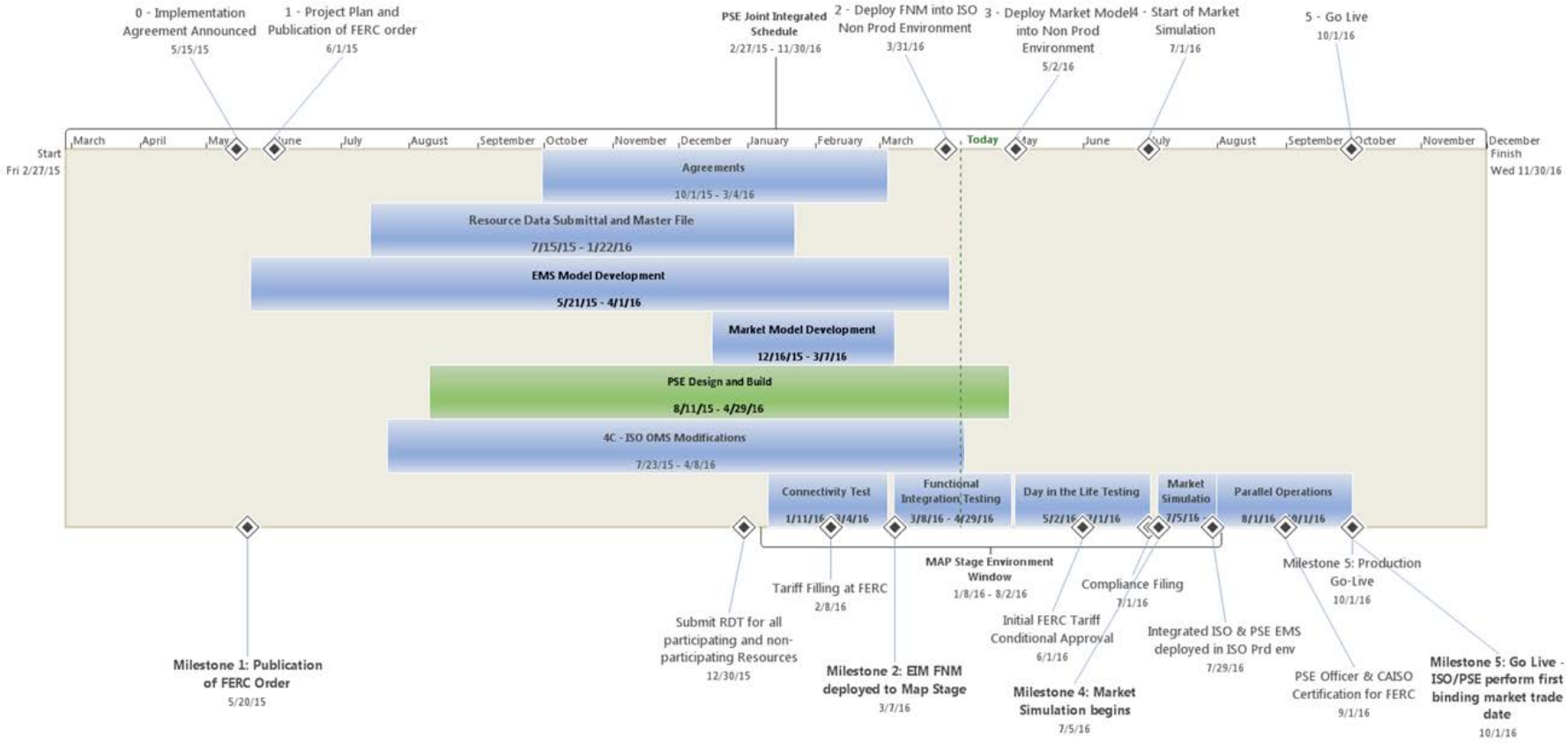
Generation that is "local" to the PSE BA (i.e. it does not require BPA transmission to be delivered to PSE load).

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.

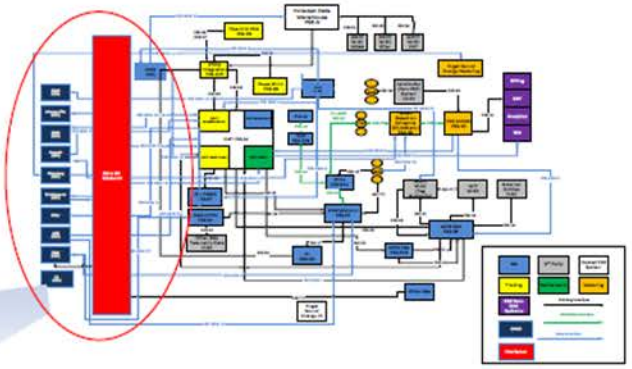
**BPA slide from Customer Meeting on 9/30/15*

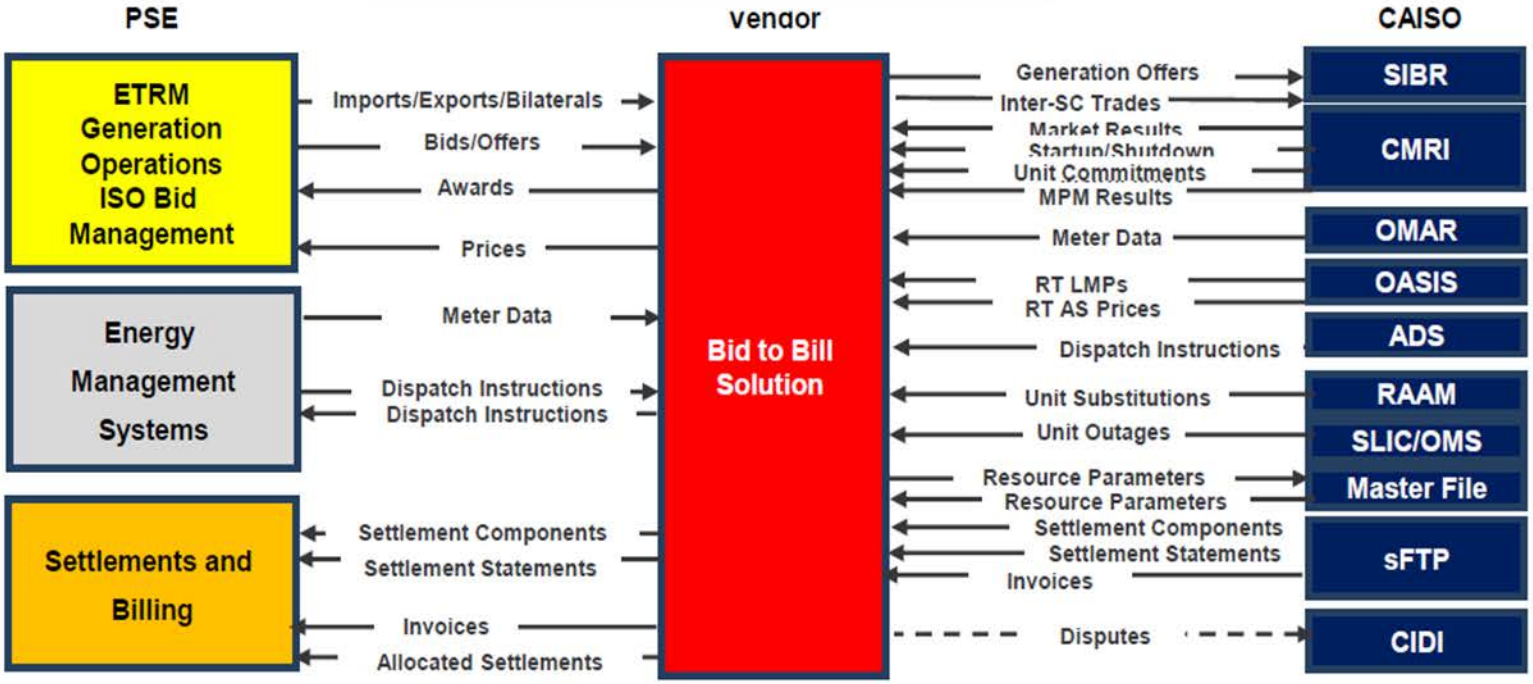
EIM Project Timeline



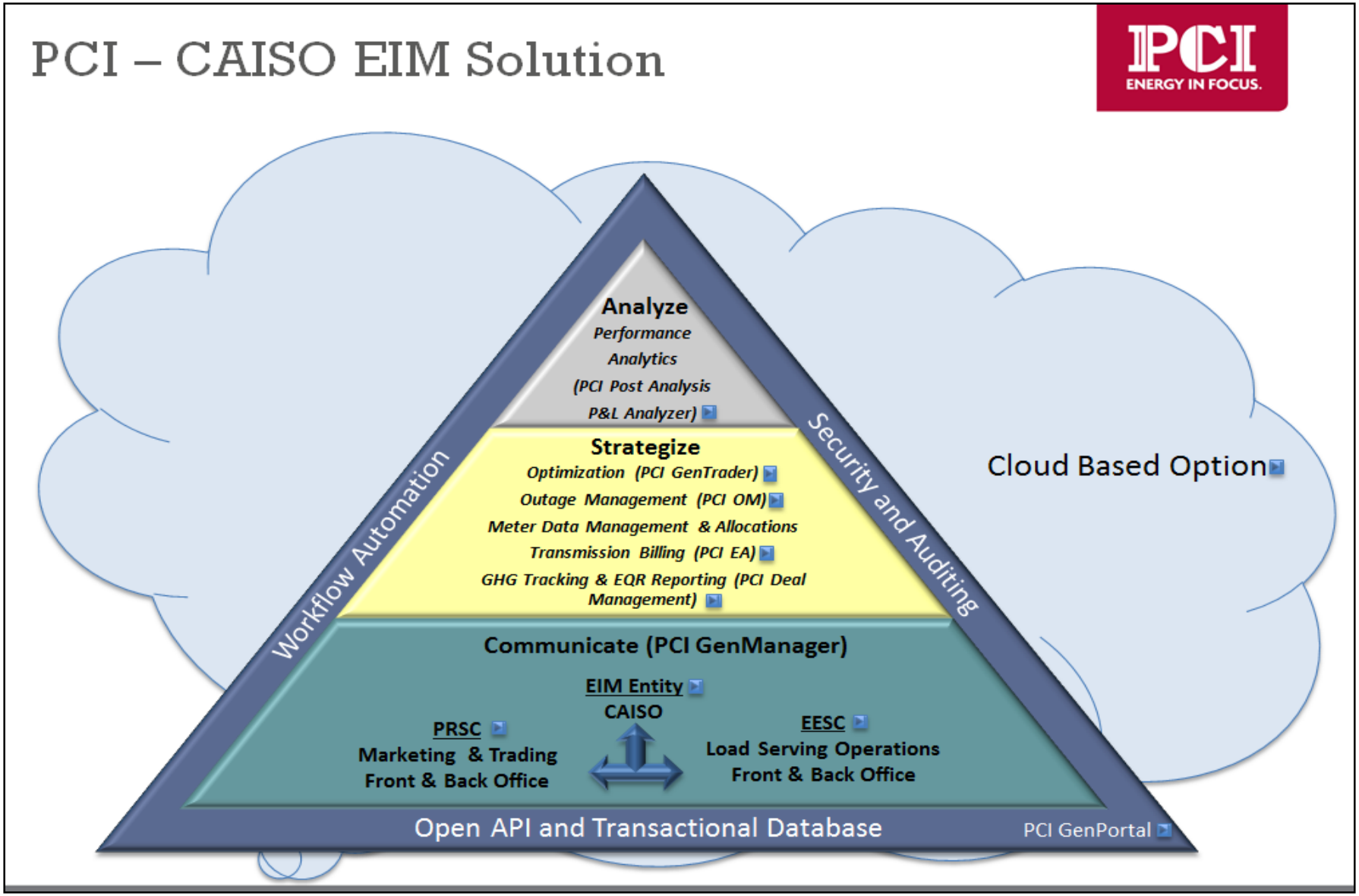
PSE's EIM Technology Project

Major impacted areas include:
Trade Floor, Grid Operations, Settlements, Metering, Generation and I/T



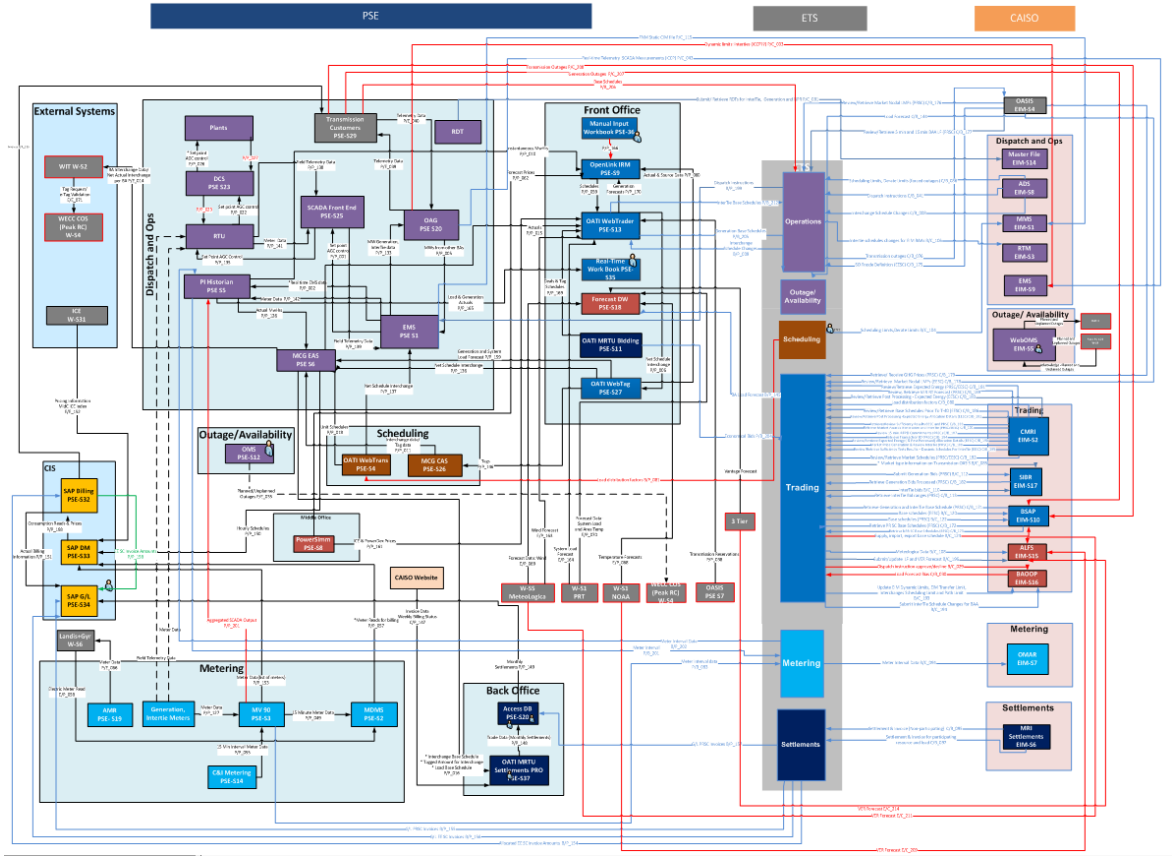


Bid to Bill Solution

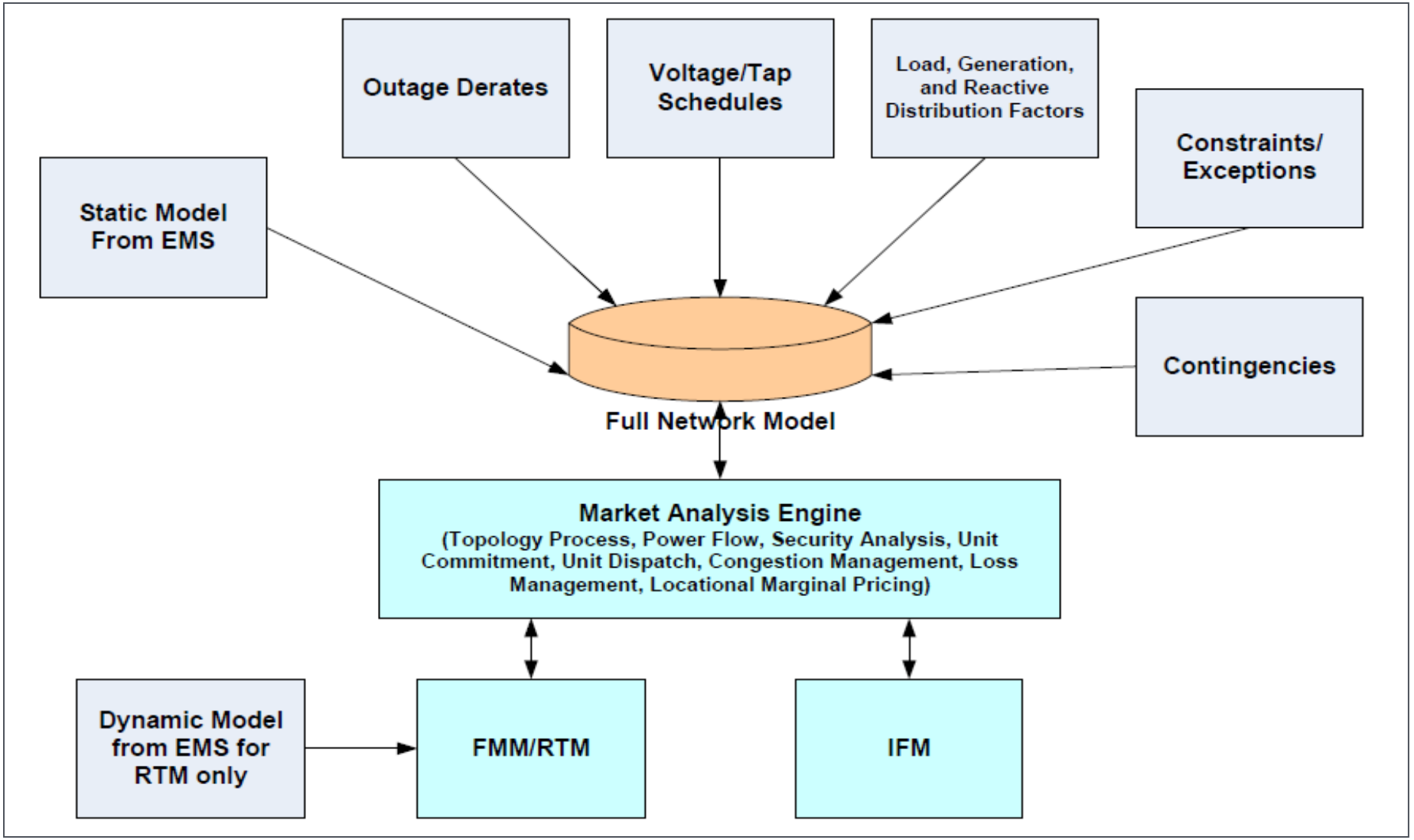


System Integrations

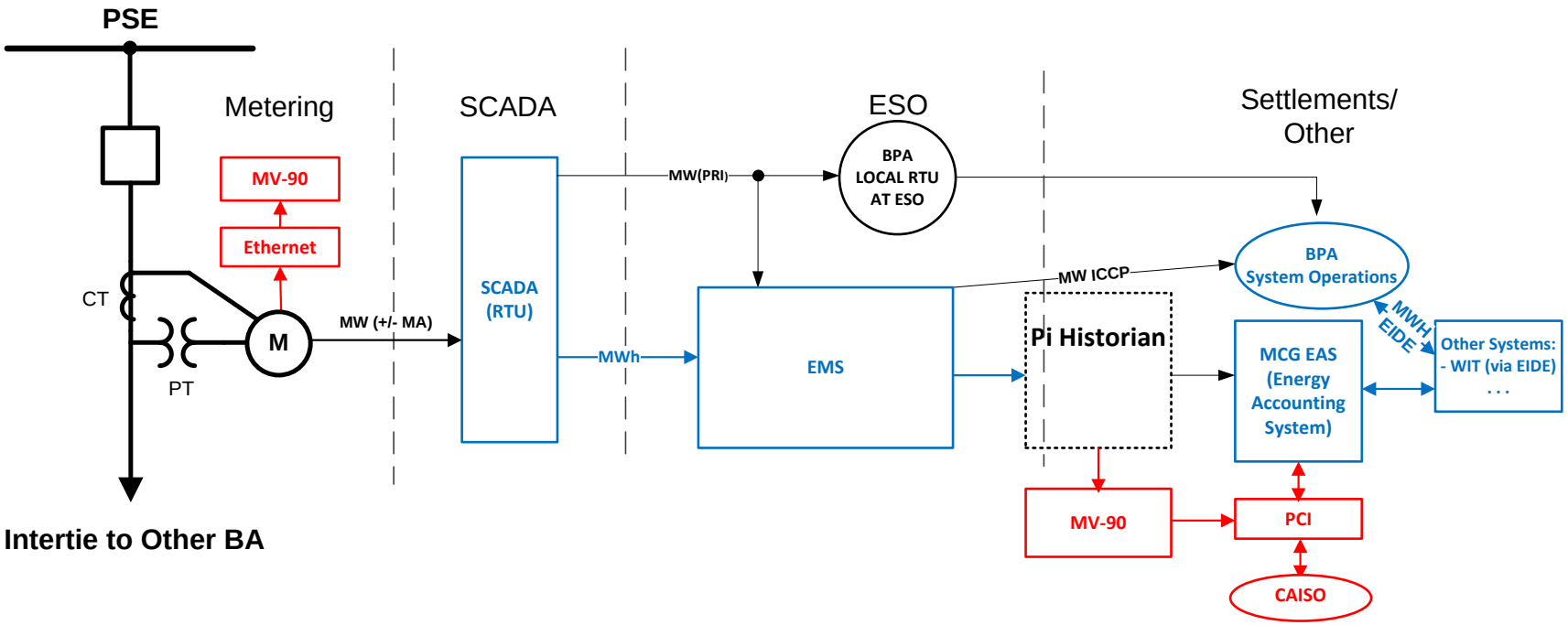
- Over 60 interfaces included in the EIM solution
- Hundreds of configurable business rules in the Bid to Bill solution that need to be defined and set-up



Full Network Model



Metering



- Generation/Intertie/Load meter data requirements
- Metered Entity Options: ISOME vs. SCME
- Settlement Quality Meter Data
- Meter data submittal timing
- For PSE 43 generation and 50 interchange meters impacted

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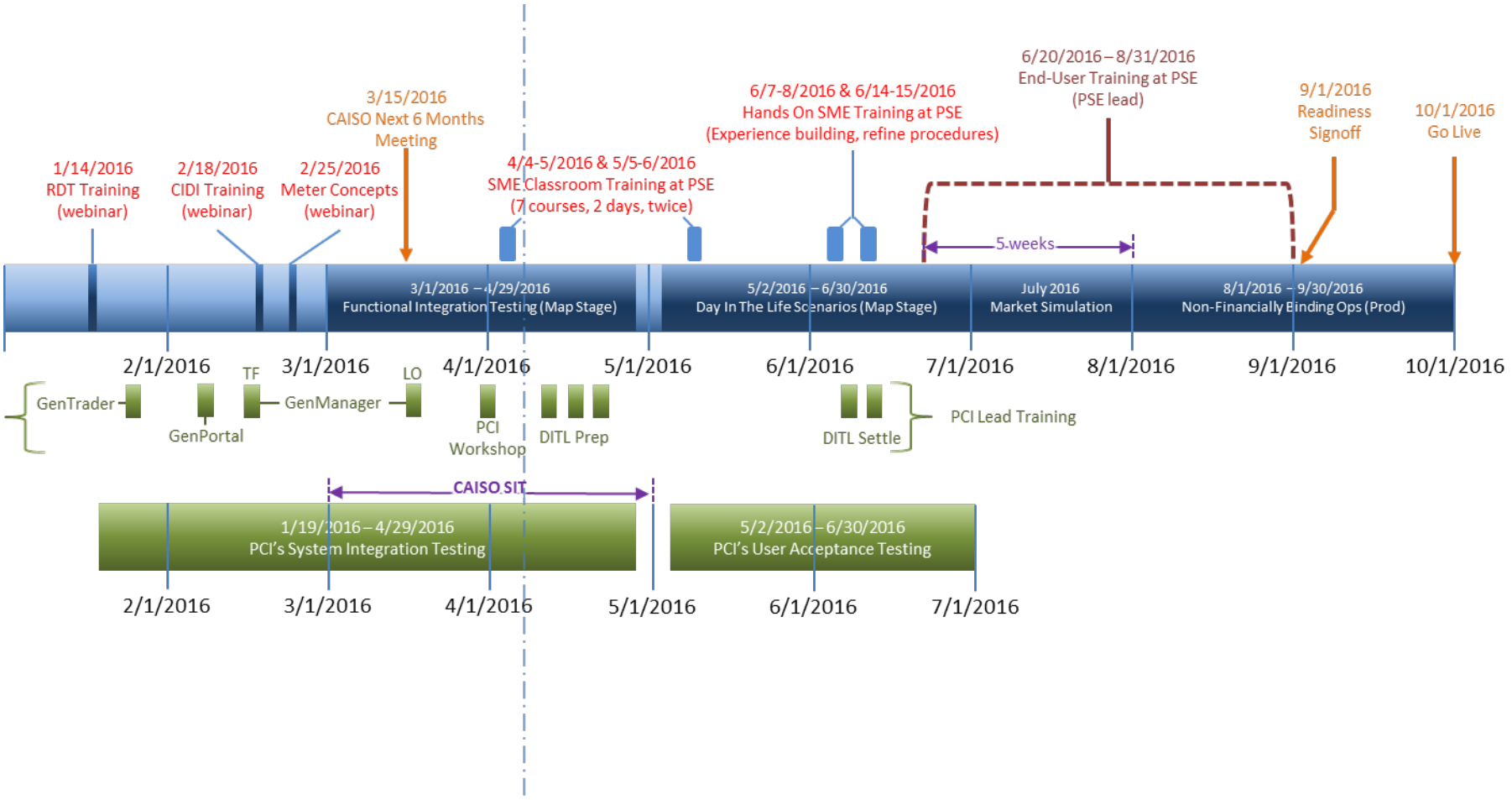
Training & Testing Timeline



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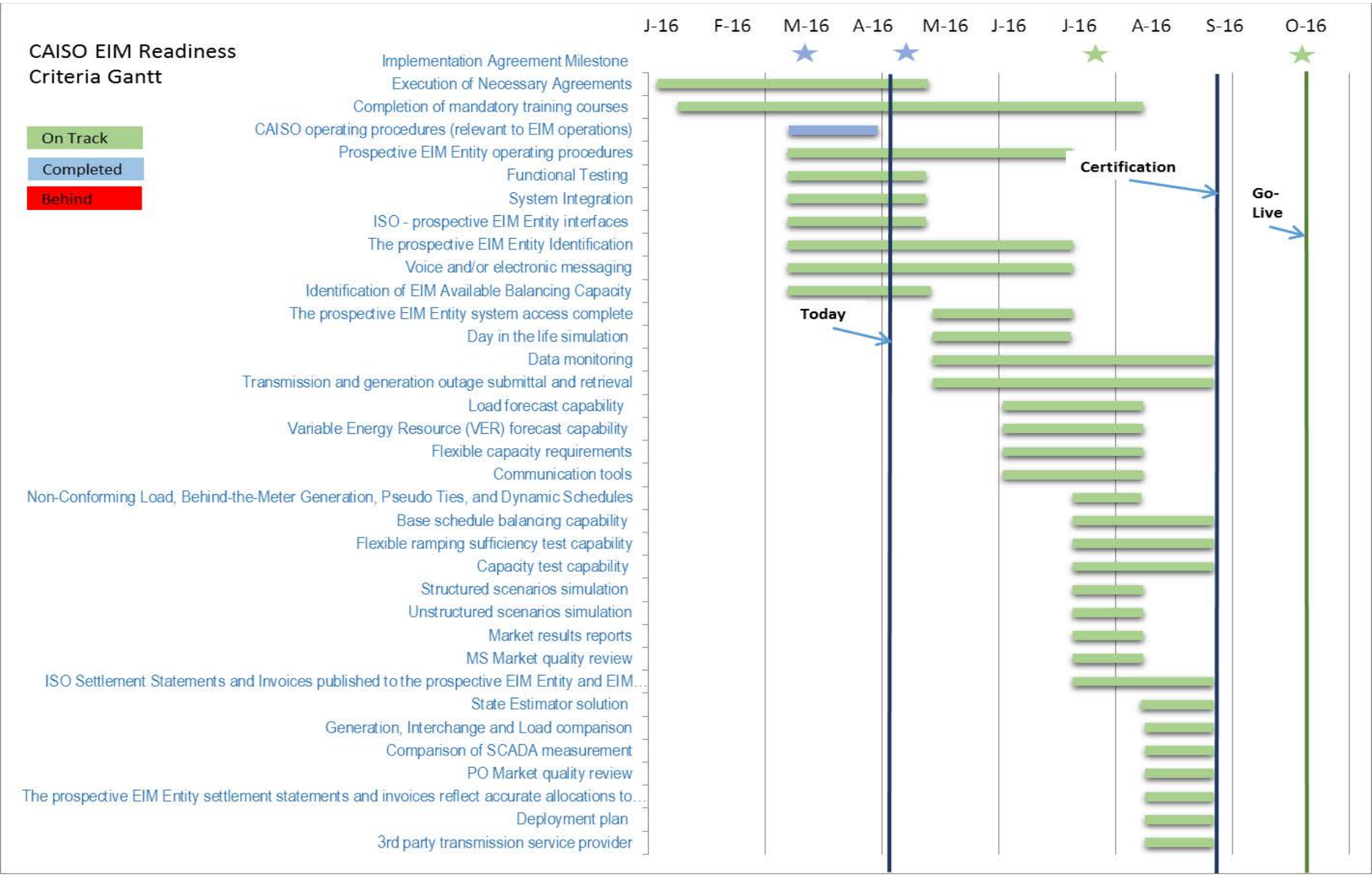
EIM Readiness Criteria



Lessons Learned

Technology

- RFPs and agreements take time
- Be flexible – assumptions aren't always correct

Process

- Get end users engaged early and owning it
- Everyone's different

People

- Don't underestimate OCM
- Communicate
- Have dedicated project staff where possible

Questions

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