California ISO
Shaping a Renewed Future

Energy Imbalance Market
3rd Revised Straw Proposal and Governance

Stakeholder Meeting

August 20, 2013

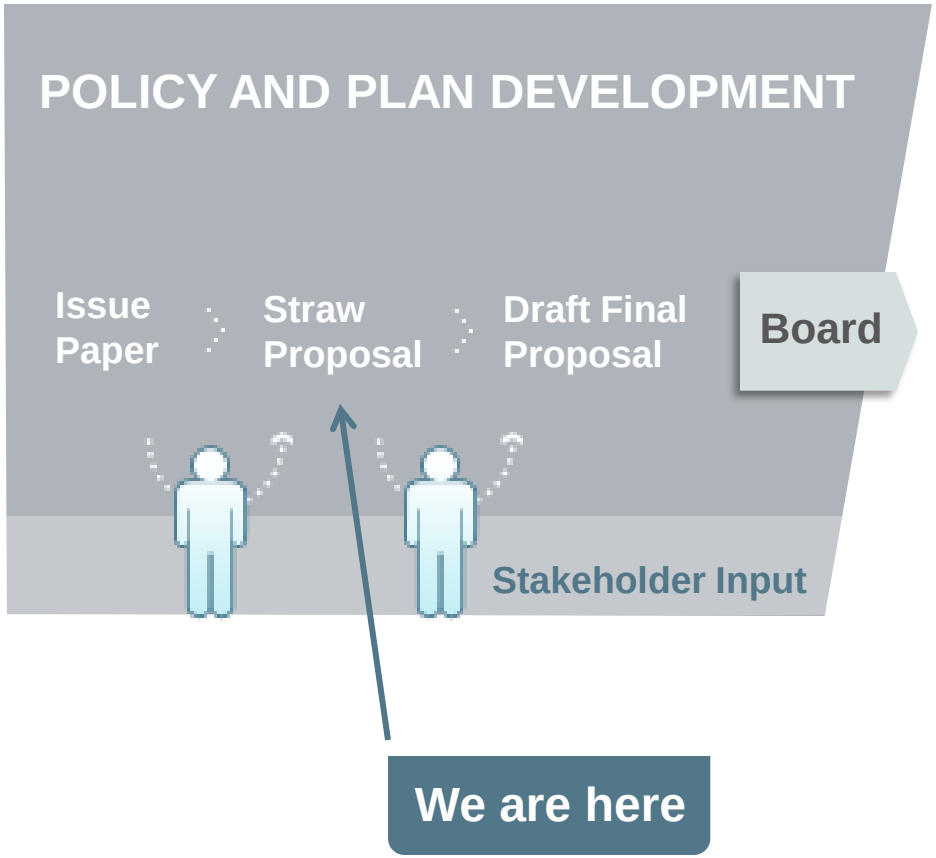
Agenda

Time	Topic	Presenter
10:00 – 10:10	Introduction	Mercy Parker-Helget
10:10 – 11:10	Governance	Don Fuller
11:10 – 12:00	EIM Overview Summary of Design Changes	Don Tretheway
12:00 – 12:30	Lunch Break	
12:30 – 2:30	Resource Sufficiency Evaluation Settlement of Convergence Bids GHG Proposal	Don Tretheway
2:30 – 2:40	Break	
2:40 – 3:50	Neutrality Accounts RT Bid Cost Recovery Areas of Focus for Draft Final Proposal	Don Tretheway
3:50 – 4:00	Wrap-up and Next Steps	Mercy Parker-Helget

ISO Policy Initiative Stakeholder Process

We are here

ISO Policy Initiative Stakeholder Process

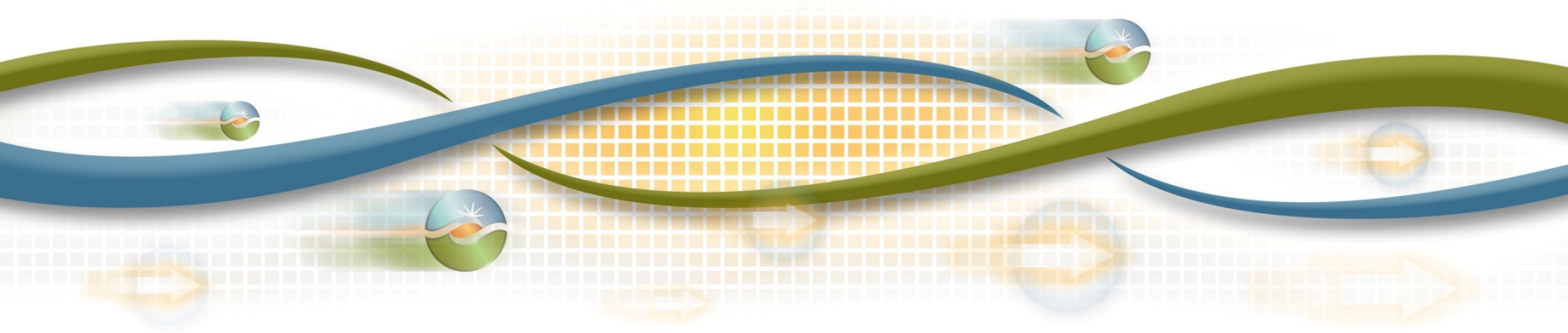


California ISO
Shaping a Renewed Future

Energy Imbalance Market
Governance

Don Fuller
Director Strategic Alliances

Stakeholder Meeting
August 20, 2013

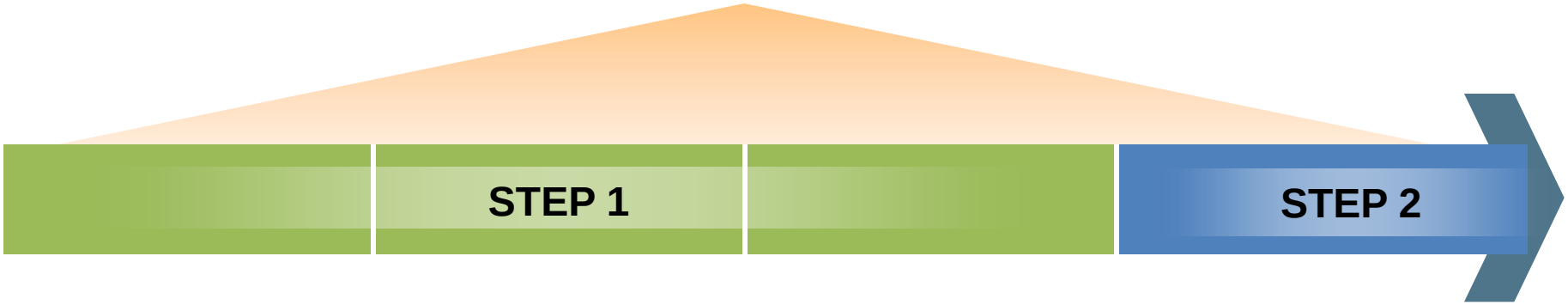


Guiding objectives drive long-term independent EIM

Prompt & direct input

Adaptable structure

Promote successful implementation



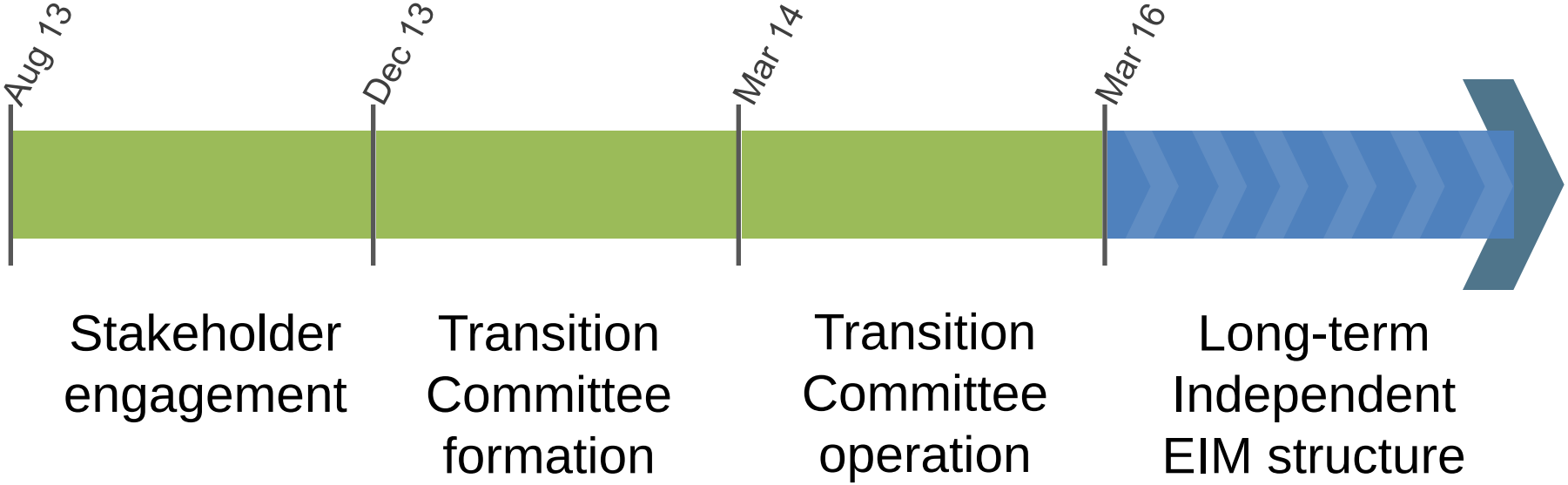
Stakeholder Transition Committee

Roles:

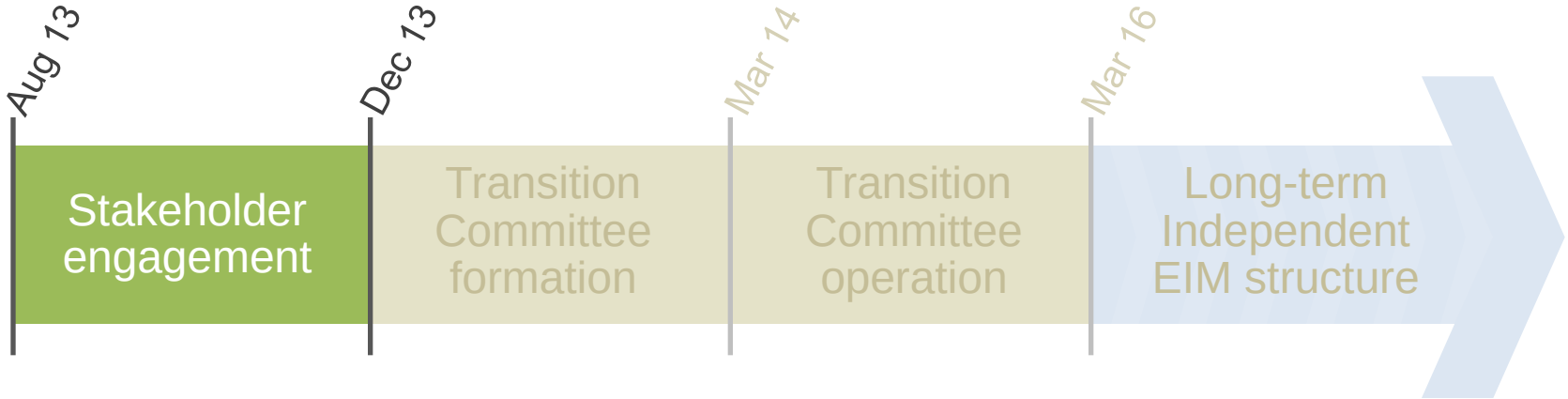
- Advise on EIM matters
- Propose independent EIM structure

Independent EIM structure

EIM governance approach

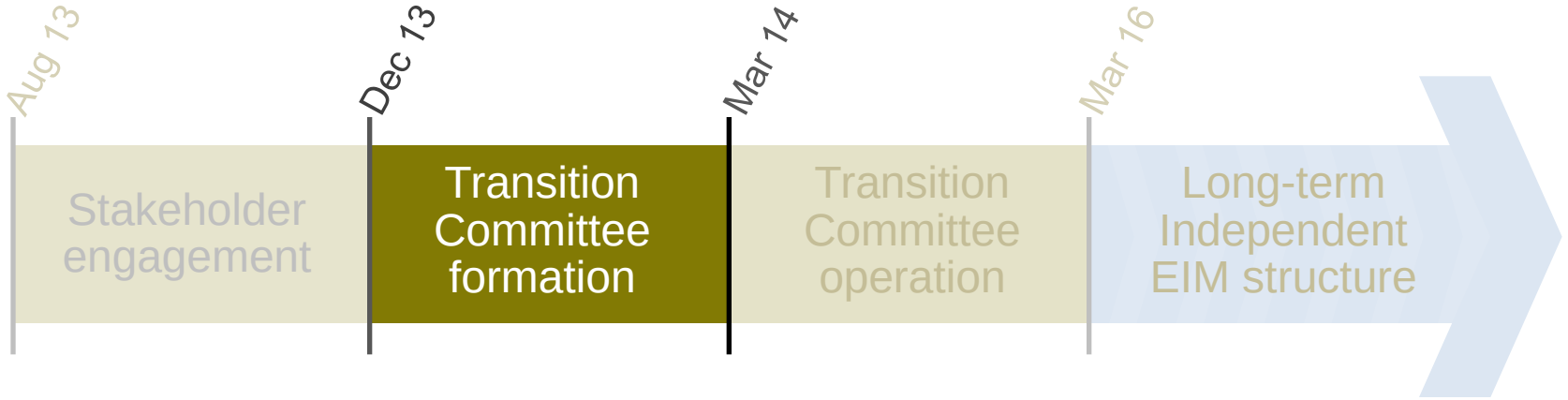


Stakeholder engagement schedule



Aug 20	Portland Stakeholder meeting
Sep 6	Stakeholder comments due
Oct 4	Revised proposal and draft charter published
Oct 11	Stakeholder conference call
Oct 25	Stakeholder comments due
Nov 7 – 25	Revised proposal/charter published, call and comments
Dec 18	Seek ISO Board approval of committee and charter

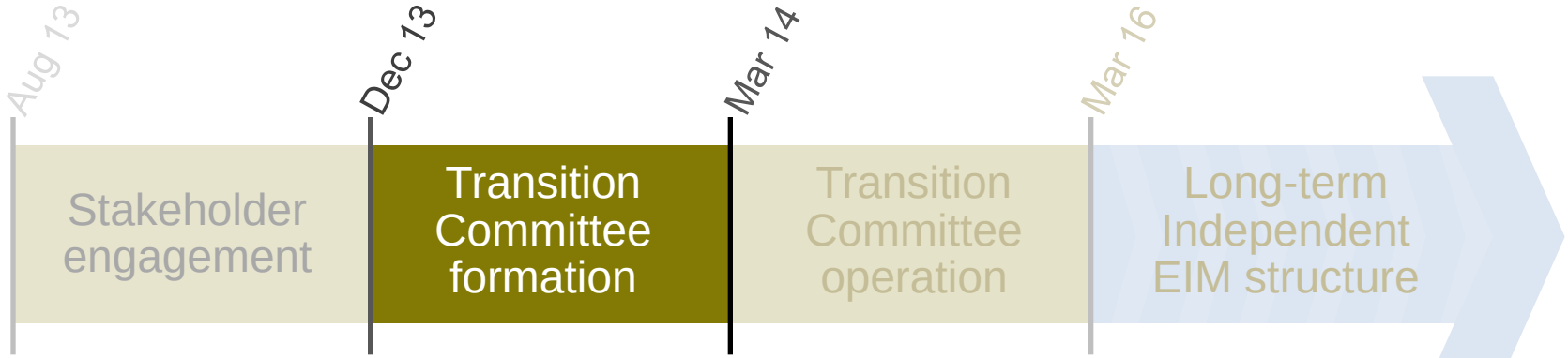
Transition Committee formation



Structure

- Stakeholder advisory committee
- 7 members including an EIM entity
- Possible growth to 9 members with additional EIM entities
- Term – 2 years
- Charter – proposed charter on Oct 4

Nomination and ranking process



Self nominate

Sector nomination

Candidate list

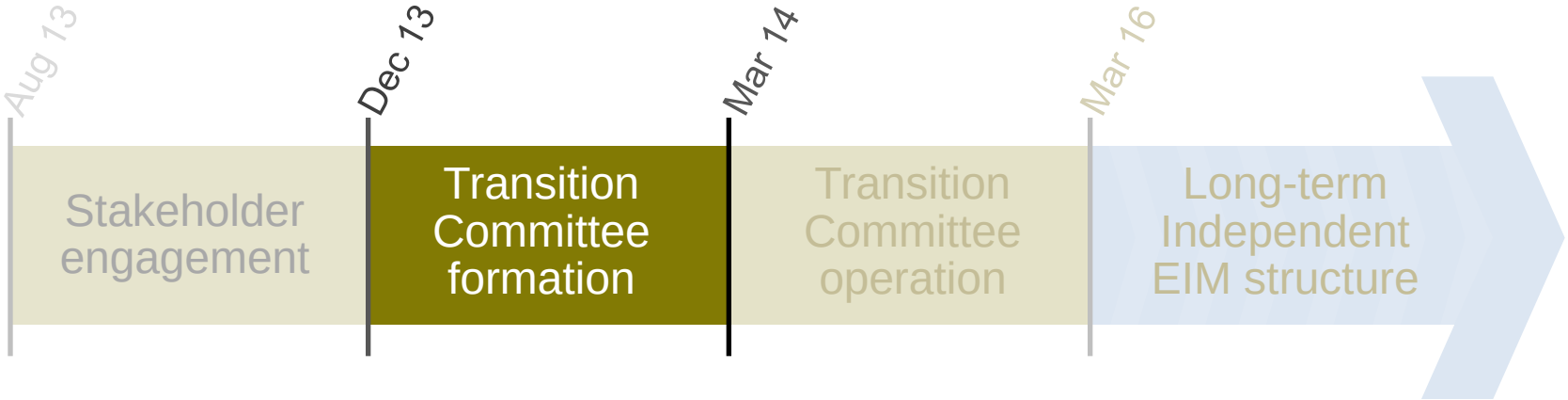
Ranking by sectors

ISO Board approval

Qualifying criteria:

- Industry and market experience and excellence
- Geographical diversity

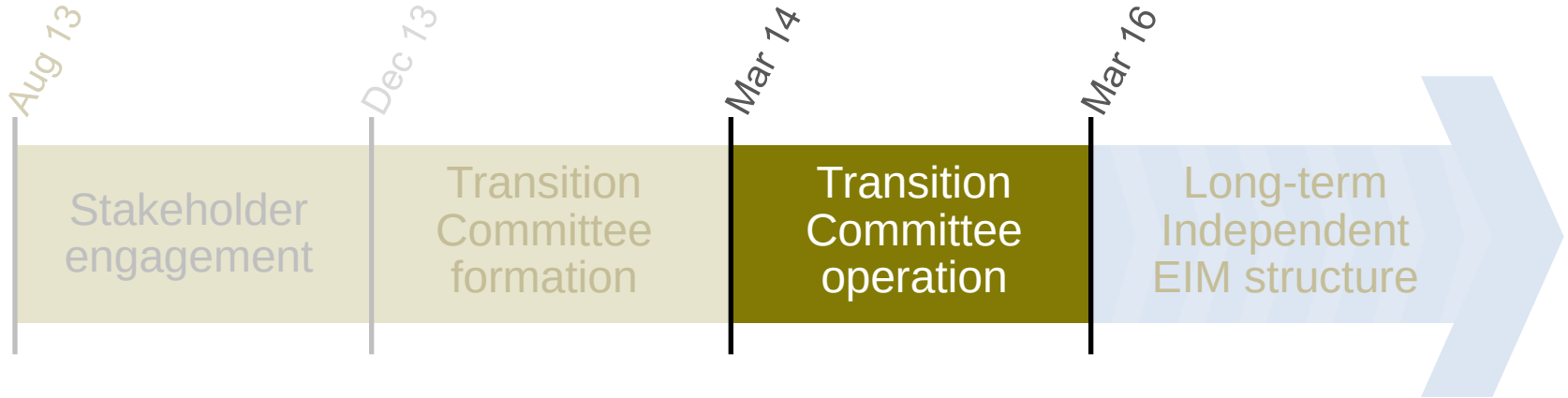
Nomination and ranking process



Sectors

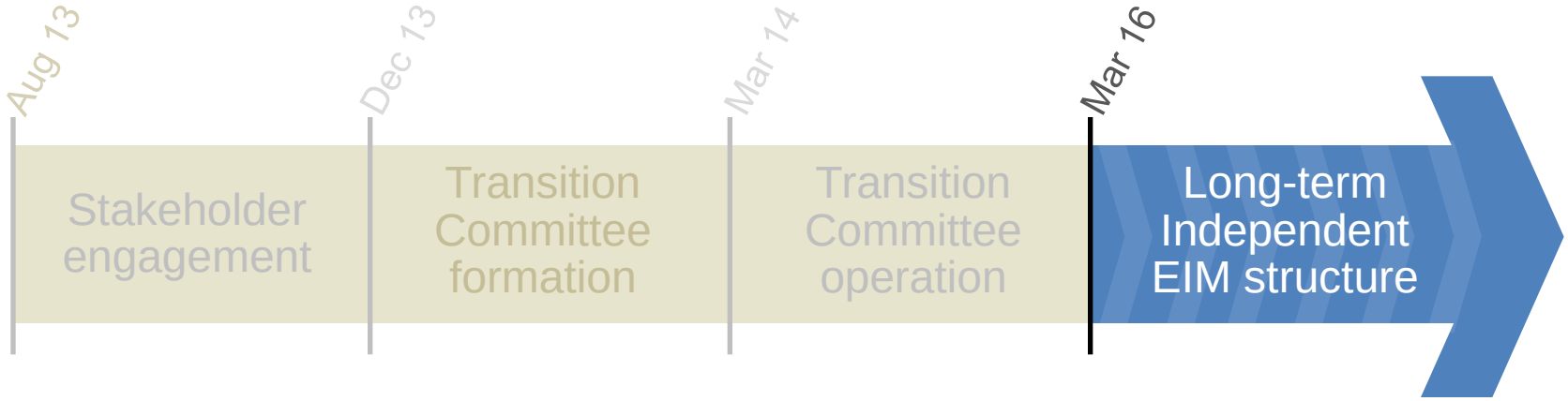
- Investor owned utilities
- Publicly owned utilities
- Generators and marketers
- Alternative energy providers
- EIM participants
- Government agencies and public interest entities

Transition Committee operation



- Roles
  - Advise on EIM matters
  - Develop and propose long-term independent EIM structure
- General Operation
  - Open meetings
  - ISO staff support
  - No compensation or reimbursement

Long-term independent EIM structure



- Independent membership
- Specific delegated authority
  - FERC approval
- Transition committee will propose details of:
  - Structure
  - Number & qualifications of members
  - Membership term
  - Selection process
  - Decision process

Questions

California ISO
Shaping a Renewed Future

Energy Imbalance Market
3rd Revised Straw Proposal

Don Tretheway
Lead Market Design and Policy Specialist

Stakeholder Meeting
August 20, 2013

Defined terms (1 of 5)

- **Energy Imbalance Market (EIM)** is operation of the ISO's real-time market to manage transmission congestion and optimize procurement of energy to balance supply and demand for the combined ISO and EIM footprint.

- **Market Operator** is the ISO.

Defined terms (2 of 5)

- **EIM Entity** is a balancing authority and transmission service provider that enters into the pro forma EIM Entity Agreement to enable the EIM to occur in its balancing authority area (BAA). By enabling the EIM, real-time load and generation imbalances within its BAA will be settled through the EIM. The EIM Entity determines which resource types and transmission service is required to be eligible to participate in the EIM within the EIM Entity BAA. For example, an EIM Entity could determine that 15-minute economic bids for imports/exports would not be supported within the EIM Entity BAA even though this functionality is supported by the EIM.

Defined terms (3 of 5)

- **EIM Entity Scheduling Coordinator** is the EIM Entity, or a third-party designated by the EIM Entity, that is certified by the ISO and that enters into the pro forma EIM Entity Scheduling Coordinator Agreement. The EIM Entity Scheduling Coordinator is responsible for compiling and submitting balanced schedules for the EIM Entity BAA to the Market Operator, for imbalance energy settlement of resources not participating in EIM, and for distributing costs or revenues from uplift allocations to the EIM Entity BAA.

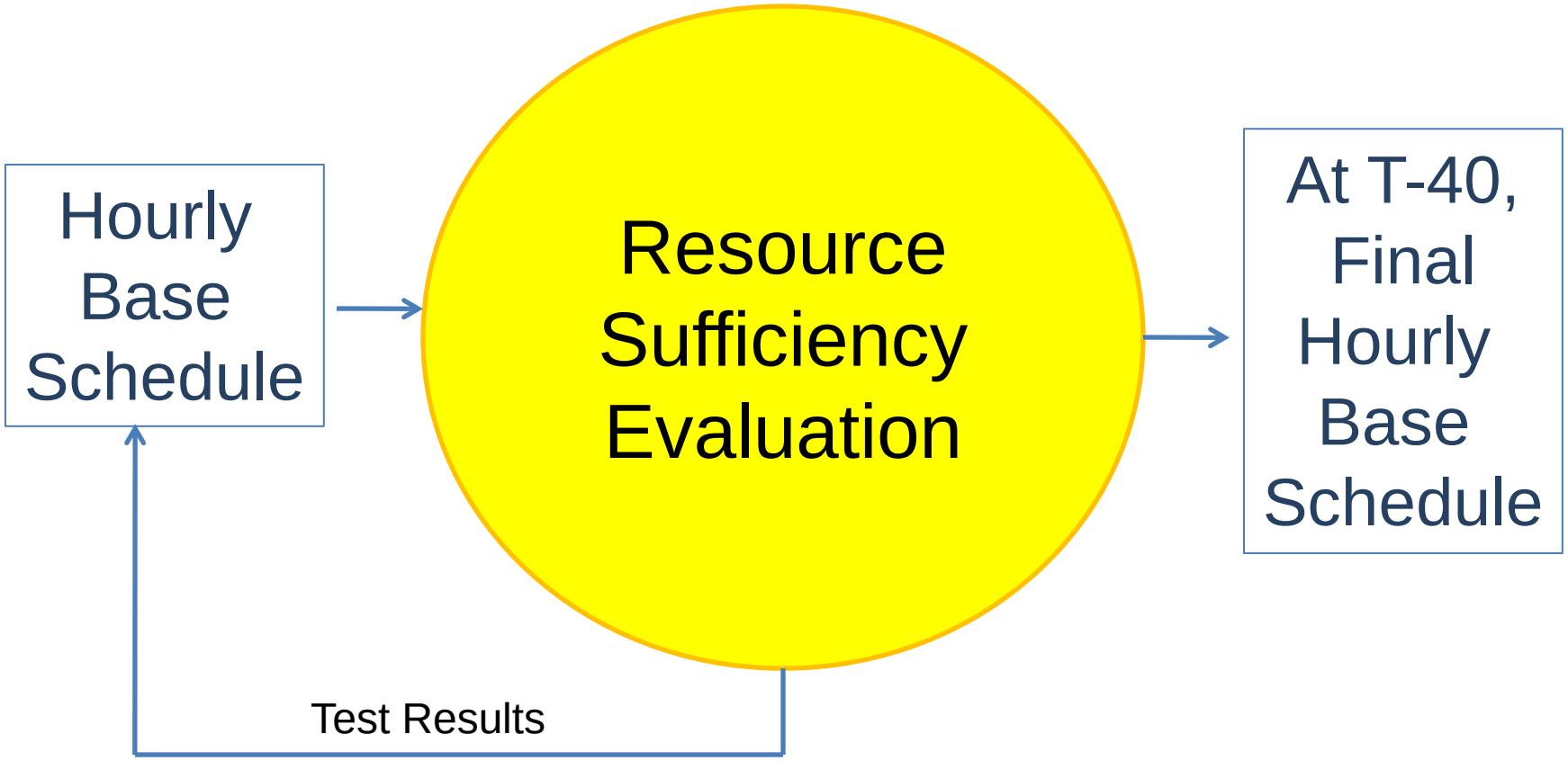
Defined terms (4 of 5)

- **EIM Participating Resource** is a resource located within the EIM Entity BAA that is eligible and elects to participate in the EIM and that enters into the pro forma EIM Participating Resource Agreement, under which it is responsible for meeting the requirements specified in Tariff Section 29. In the 5-minute market, eligible resources are those that can deliver energy, curtailable demand, demand response services or other similar services under the ISO Tariff provided they are enabled by the EIM Entity under its requirements for the delivery of energy or other similar services within its BAA, and may include Generating Units, Physical Scheduling Plants, Participating Loads, Proxy Demand Resources, Non-Generator Resources and Dynamic Transfers. In the 15-minute market, imports and exports that can be scheduled on a 15-minute basis are eligible to participate in addition to all resources eligible to participate in the 5-minute market.

Defined terms (5 of 5)

- **EIM Participating Resource Scheduling Coordinator** is the resource, or a third-party designated by the resource, that is certified by the ISO and enters into the pro forma EIM Participating Resource Scheduling Coordinator Agreement, under which it is responsible for meeting the requirements specified in Tariff Section 29 on behalf of the resource. The EIM Participating Resource Scheduling Coordinator interfaces with the Market Operator on behalf of resources in an EIM Entity BAA that voluntarily elect to economically participate in the EIM.

Energy Imbalance Market Overview



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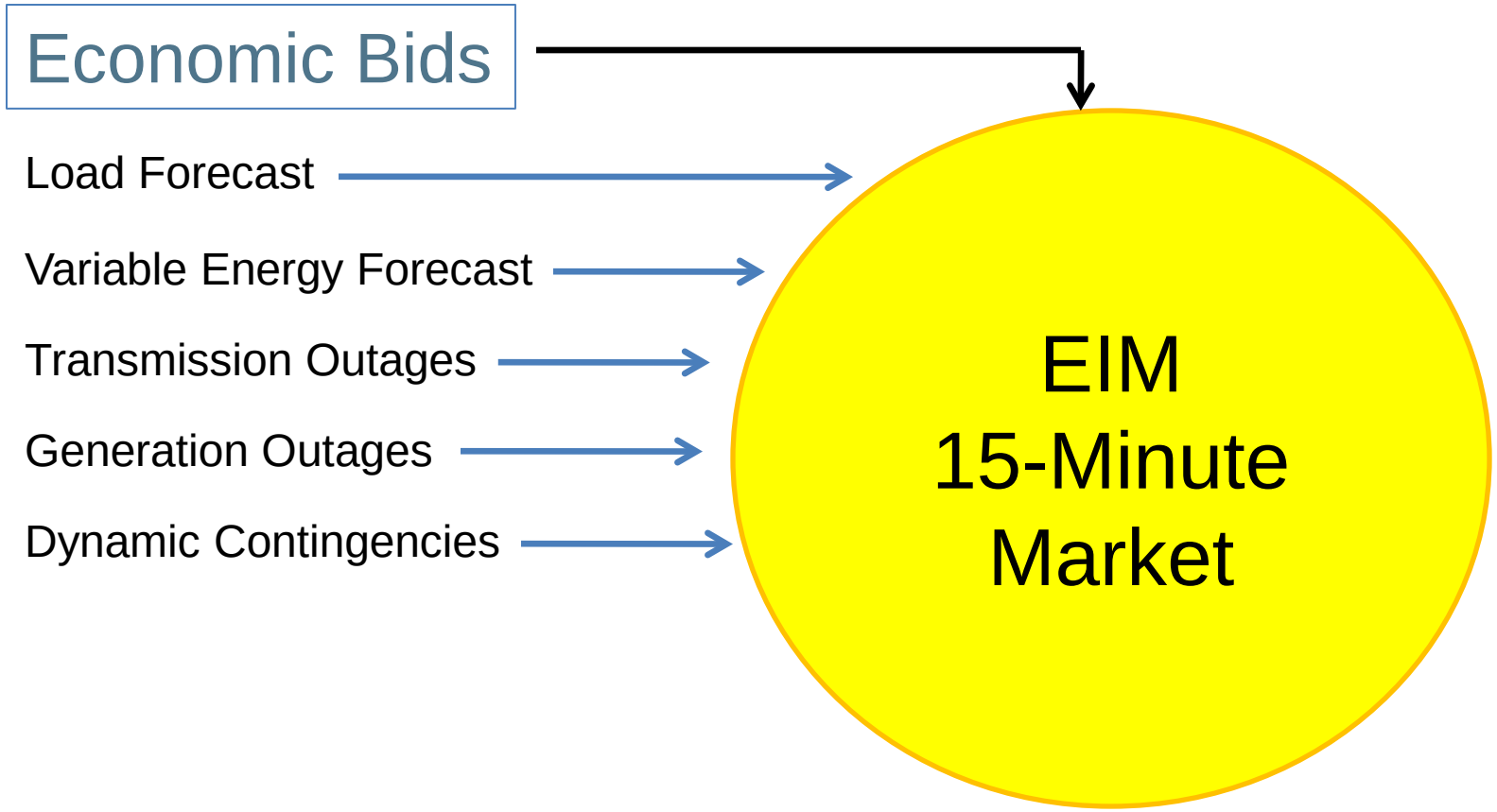

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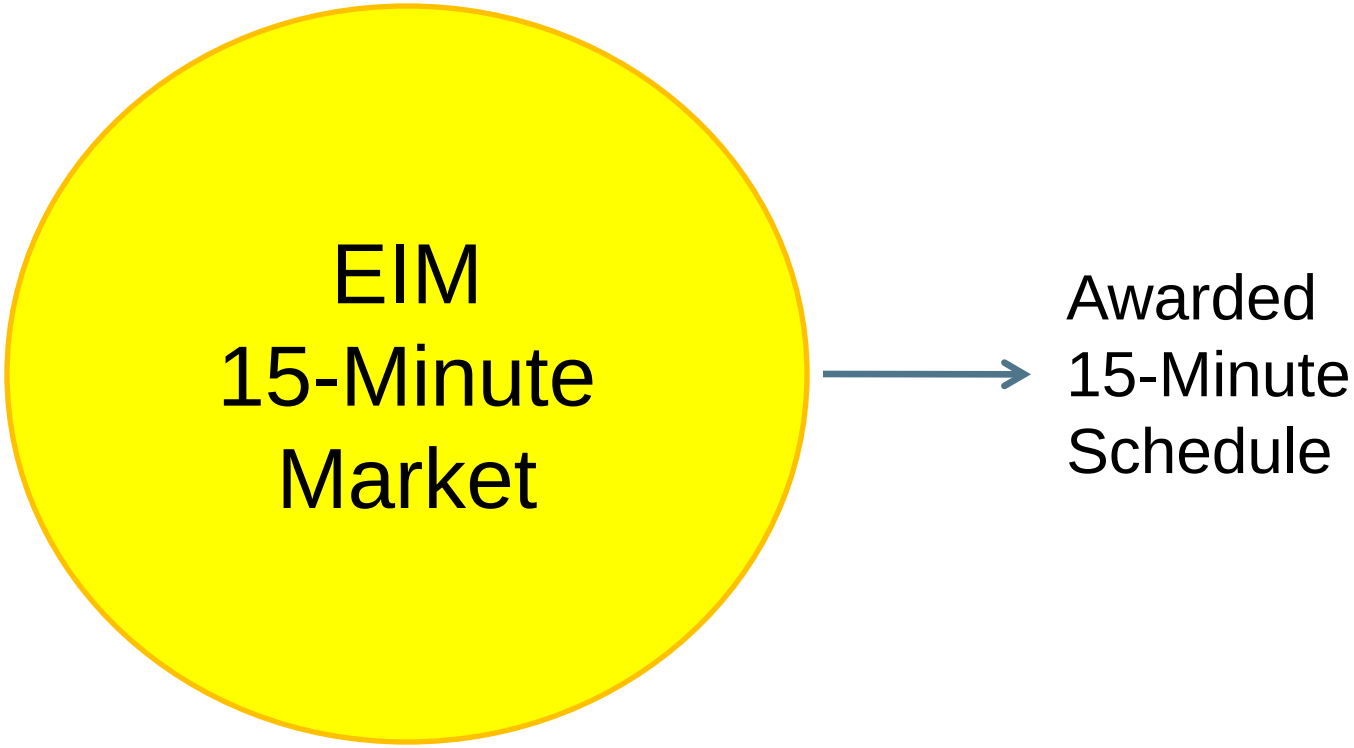

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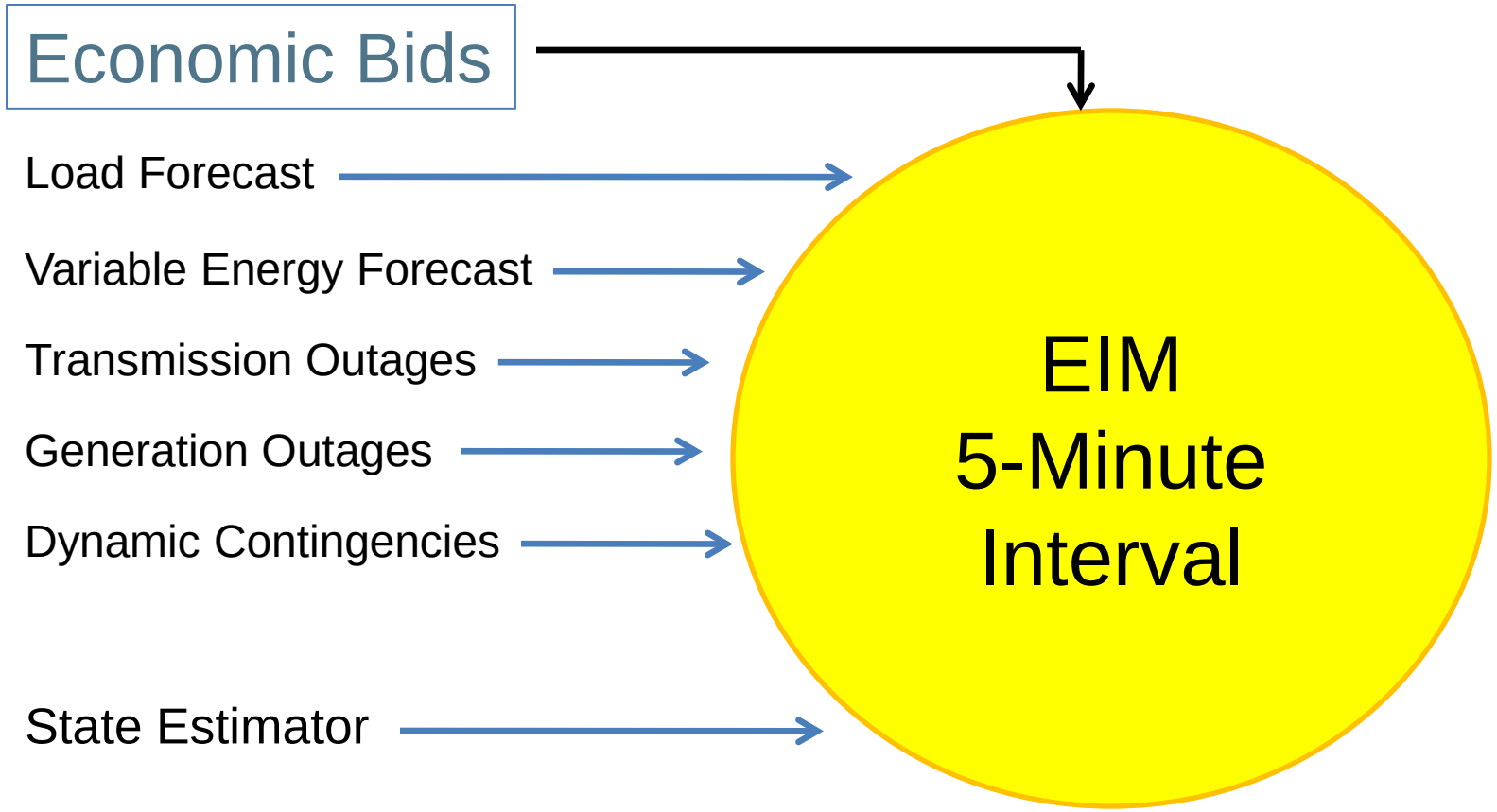

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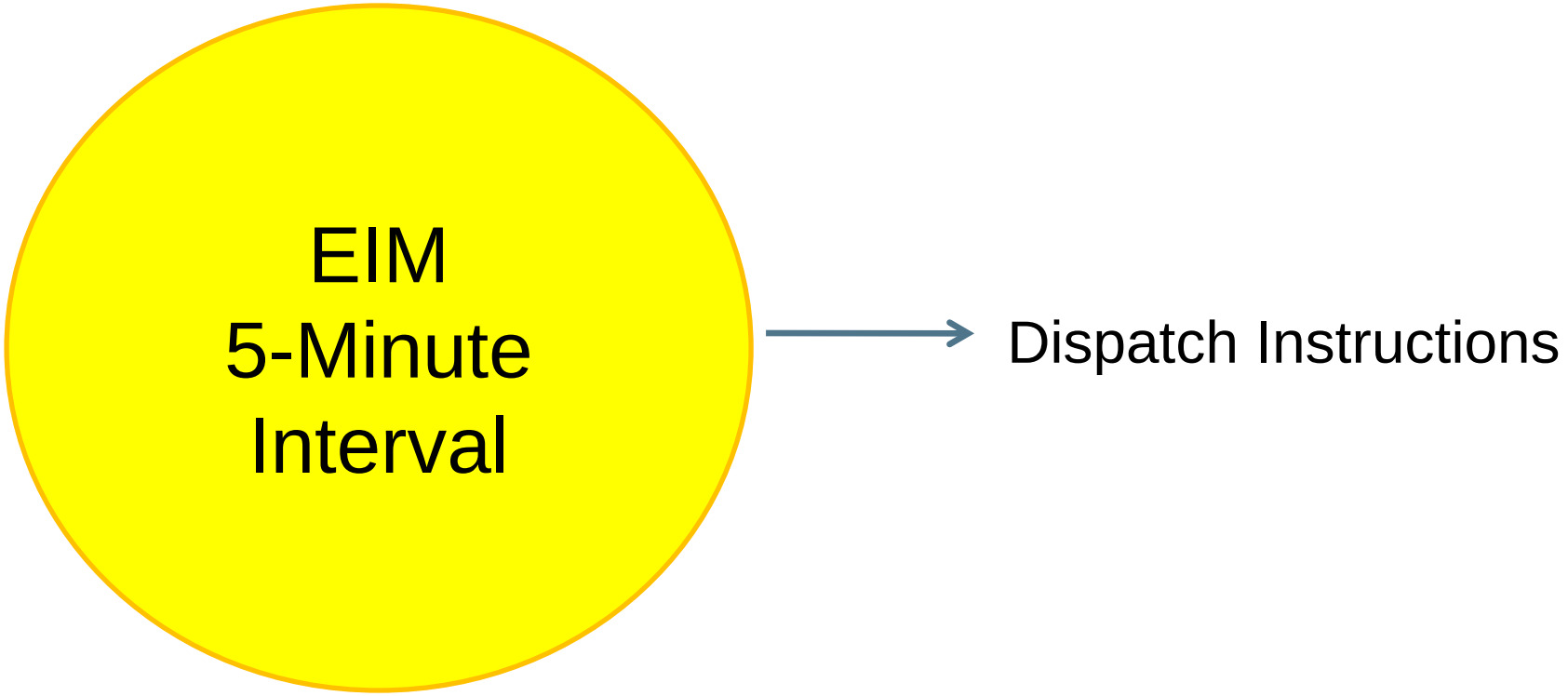
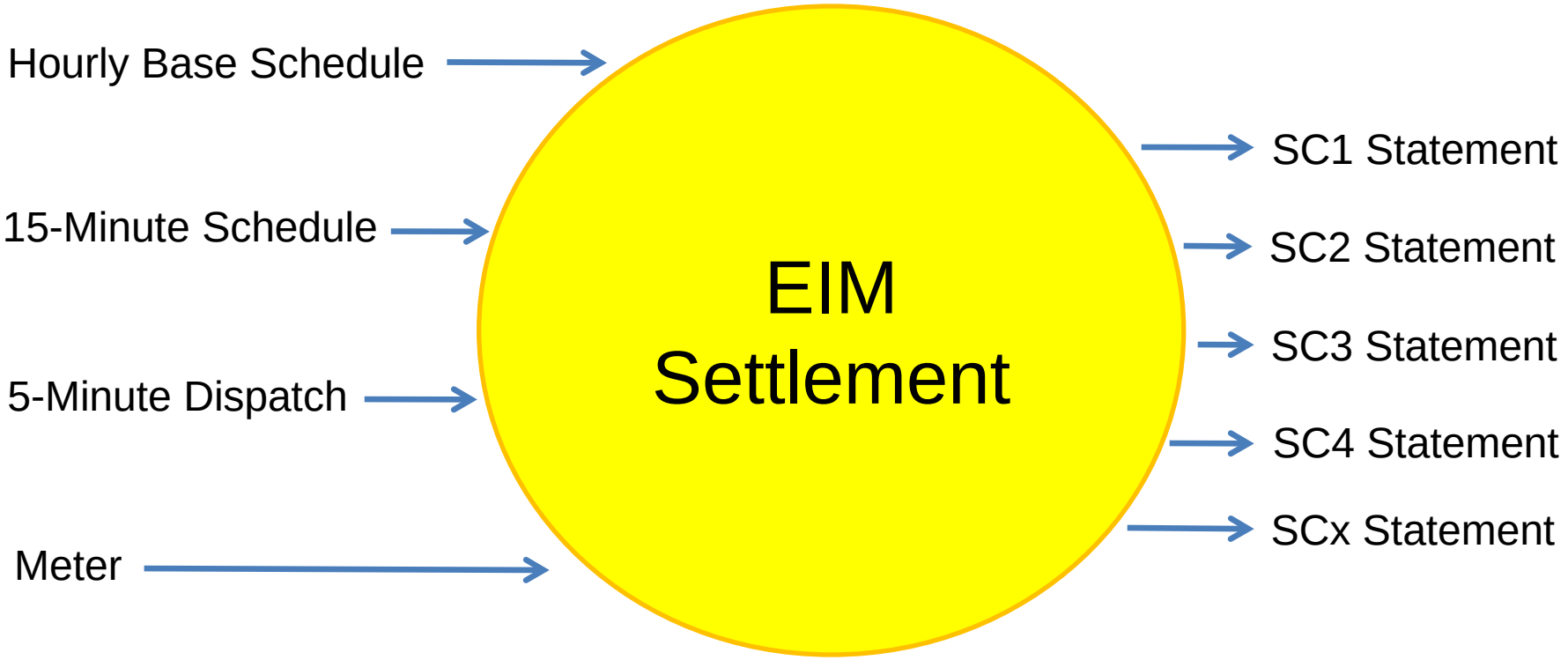


Energy Imbalance Market Overview



Changes made in 3rd Revised Straw Proposal (1 of 4)

- Clarifies that the EIM Entity shall determine which resources within its BAA are eligible to participate in the EIM.

- Eliminates the minimum shift optimization and concept of adjusted base schedules.

- Removes the option for the EIM Entity Scheduling Coordinator to submit base schedules every 15-minutes with 15-minute granularity. All base schedules will be hourly with hourly granularity for load, generation, imports and exports.

Changes made in 3rd Revised Straw Proposal (2 of 4)

- Discusses how diversity benefits will be included in the flexible ramping constraint sufficiency test and provides additional discussion on how the flexible ramping constraint requirement is met through the market optimization.

- Refines and provides additional detail of the calculation of real-time market neutrality accounts.

- Modifies the real-time congestion settlement of Convergence Bids on EIM Entity BAA constraints.

Changes made in 3rd Revised Straw Proposal (3 of 4)

- Further discusses the rationale for the first-year proposal for reciprocity between the ISO and EIM Entities in not applying a transmission access charge to dispatches across the BAA boundaries, and the potential for a longer-term EIM transmission access charge.

- Refines the under-scheduling penalty of load.

- Discusses further the exclusion of over-scheduling penalties of generation.

Changes made in 3rd Revised Straw Proposal (4 of 4)

- Allows EIM Participating Resources to submit a separate bid for the GHG compliance obligation costs. The Market Operator will no longer calculate the emission cost for inclusion in the market optimization.

- Adds a section to address settlement of tax liability, if any, from ISO acting as the Market Operator

- Includes minor edits to improve clarity from 2nd revised straw proposal.

Combined design elements eliminate the need for adjusted base schedule & minimum shift optimization

- Under-scheduling incentivizes balanced base schedules and compensates other LAPs for leaning
- BAA real-time congestion balancing account isolates the cost of infeasible base schedules to the BAA
- Flexible ramping requirement ensures EIM Entity can meet their dispatch requirements independently before start of market optimization across EIM footprint

Resource sufficiency evaluation addresses real-time leaning prior to start of the EIM for the trade hour

- Incentivizes submission of balanced, feasible and independently flexible hourly base schedules
- Addressing day-ahead schedule or bilateral resource sufficiency is not within the scope of the EIM
- Addressing long term capacity requirements is not within the scope of the EIM

Resource sufficiency evaluation prior start of EIM

DA – T-75	Market Operator providing advisory information
T-75	Submit hourly base schedule
T-60	Market Operator publishes results of tests
T-55	Submit updated hourly base schedule if necessary
T-45	Market Operator publishes results of tests
T-40	Submit updated hourly base schedule if necessary
T-37.5	Start of first 15-minute market optimization

Elements of the resource sufficiency evaluation

- The base schedule fails the evaluation if any of the following tests fail:
  - If Load – Supply exceeds 1% threshold, fails balanced test
  - If transmission violations, fails the feasibility test
  - If insufficient ramping, fails the flexible ramping test
- EIM Entity SC has opportunity to resubmit hourly base schedule
  - All tests are performed on resubmitted hourly base schedule
- T-40 base schedule is financially binding for EIM

If T-40 base schedule still fails test …

- Load - Supply delta exceeds 1%
  - Market Operator will set Demand (base load + losses) = Supply
  - If using Market Operator forecast, now subject to under-scheduling penalty process
- Unresolved congestion
  - Uplift may accrue in BAA Real-Time Congestion Balancing Account
- Unable to meet flexible ramping constraint
  - No incremental EIM transfer into EIM Entity BAA

Under-scheduling penalties to incentivize balanced base schedules

- EIM Entity using own load forecast
  - If load imbalance exceeds 5% (but at least 2MW) of LAP, then
    - Price = 125% of the LAP LMP
  - If load imbalance exceeds 10% of LAP, then
    - Price = 200% of the LAP LMP
- EIM Entity using Market Operator forecast
  - If forecast > EIM Entity SC supply by >1%, then
  - Deemed to be using own forecast and subject to penalties above
- The premiums collected over month is allocated to load that has not under-scheduled in the month

BAA Real-Time Congestion Balancing Account calculates cost of infeasible base schedules

- Neutrality account from re-dispatch of generation to resolve RT constraints
  - Charge or credit, but transmission outages can drive up charges
- Isolate neutrality account to each BAA
  - Resources across EIM footprint impact constraints in each BAA
  - To isolate, sum impact on constraint in each BAA separately
- Each BAA bears its own cost of infeasible schedules entering the EIM

Each BAA has a flexible ramping requirement to meet their dispatch independently

- Ensures sufficient ramp capability is committed in RTUC and manages ramp capability in RTD
  - Flexible ramping constraint is only upward
  - Future product is upward and downward

- Flexible ramping requirement for each EIM Entity BAA sufficiency test recognizes diversity benefit
  - Requirement must be met in the base schedule

- Market optimization selects for most efficient resources to meet the system requirement

Flexible ramping requirements determined by … (1 of 2)

- Develop a daily 5-minute granular forecast of gross load, wind and solar production.
- Determine a daily 5-minute net load by netting the gross load by the wind and solar production forecasts
- Develop a series of daily 5-minute net load curves by introducing forecast error uncertainty based on historical forecast error pattern.
- Develop a distribution of the changes in the 5-minute net load by calculating the difference between the net load at time (t+5 minute) by the net load at time (t) for each 5-minute interval of the day and repeat for the series of net load represent forecast error.

Flexible ramping requirements determined by … (2 of 2)

- Analyze the distribution of changes in 5-minute net load and identify the +/-X% confidence level of the distribution. The ISO has proposed a 90%-95% confidence level as the appropriate level for establishing the flexible ramping requirement.

- The above process is be performed individually for each BAA and in aggregate for the combined EIM footprint.

- For the purpose of procurement on a 15-minute basis, the 5-minute requirements can be aggregated into a 15-minute requirement by summing the three 5-minute interval requirements into a 15-minute requirement for each 15-minute RTUC interval.

Flexible ramping sufficiency test considers diversity benefit across EIM footprint

- Performed for each EIM Entity BAA
  - After T−75', T−55', and T−40' for the Trading Hour starting at T
  - Data Used:
    - Initial schedules at T−7.5'
    - EIM resources energy bids and ramp rates
    - 15' flexible ramping requirements
  - Reduced by any diversity benefit up to available import capability
- Cumulative test for meeting requirements for each 15' interval of the hour
  - 15' ramp from T−7.5' to T+7.5' (1st 15' interval)
  - 30' ramp from T−7.5' to T+22.5' (2nd 15' interval)
  - 45' ramp from T−7.5' to T+37.5' (3rd 15' interval)
  - 60' ramp from T−7.5' to T+52.5' (4th 15' interval)

Market optimization constraint formulation uses all available import capability to minimize system cost

- When Flexible Ramping Sufficiency Test Passes
  - Bottom-Up hierarchical constraints for all BAA combinations
  - BAA (w/o diversity benefit) requirement reduced by total available import capability

- When Flexible Ramping Sufficiency Test Fails
  - Failed EIM BAA is excluded from group constraints
  - Net Import Interchange for failed EIM BAA is capped at last schedule for T−7.5‘

ISO convergence bids are not settled for real-time congestion on EIM Entity constraints paid through uplift

- ISO market design includes convergence bidding, EIM Entities do not
  - Virtual supply sells at the DA LMP, buys at 15-min LMP
  - Virtual demand buys at the DA LMP, sells at 15-min LMP
- The schedule change between DA and RT is a change in flow, thus impacts RT congestion balancing account
- The ISO will not settle convergence bids for RT congestion on EIM Entity constraints
  - Using same approach calculating balancing account

Updated convergence bidding settlement allocates congestion uplift cost to convergence bidders

- Assign RT congestion uplift from EIM Entity BAA constraints into virtual bucket and physical bucket
  - In direct proportion to out-of-market congestion revenues received by virtual and physical schedules
- Allocate physical bucket to EIM Entity's RT BAA congestion balancing account
- Allocate virtual bucket to virtual schedules
  - In proportion to each schedule's receipt of the out-of-market revenues
- Approach is only applied where there is an out-of-market charge, no out-of market credits

EIM dispatch algorithm will include GHG bid adder for EIM Participating Resources that transfer to ISO (1 of 2)

- EIM Entity load will not pay GHG costs for load met by resources outside California
- EIM Entity load indirectly pays GHG costs for transfers from ISO because GHG included in ISO resources' bids
- ISO load pays (reflected in ISO LMPs) GHG costs for transfers from EIM Entity

EIM dispatch algorithm will include GHG bid adder for EIM Participating Resources that transfer to ISO (2 of 2)

- EIM Participating Resources can bid their GHG compliance cost
  - Energy Bid + GHG Compliance Bid <= Bid Cap ($1000)
  - GHG Compliance Bid not subject to LMPM
- No change to market formulation previously proposed
- EIM Participating Resources SC paid the marginal GHG compliance price for transfers to ISO and have a GHG compliance obligation
  - Includes 15-minute imports on EIM Entity BAA boundary

Neutrality accounts needed since not all energy is settled through real-time market

- An excessive rate mitigation measure in the pricing formula for load aggregation points
- Differences between the Load forecast in RTD and actual metered Load
- Uninstructed imbalance energy of generation
- Regulation energy
- Real-time marginal loss surplus
- Unaccounted for energy

Two neutrality accounts needed to keep Market Operator revenue neutral

- Real-Time Market BAA Neutrality Settlement
  - All IIE, UIE, UFE less RT BAA Congestion Balancing Account
  - Portion of neutrality allocated to export transfers to other BAAs
  - Then, neutrality is allocated to the EIM Entity SC

- Real-Time Market System Neutrality Settlement
  - Any residual amounts after transfers of RT Market BAA Neutrality Settlement between BAAs
  - Allocated based on metered demand of EIM Footprint

Neutrality and Bid Cost Recovery Transfers

- On a 5 minute basis, the proportional share of cost is based upon
  - Absolute value of UIE (Supply and Demand) and UFE in BAA
  - 5 minute transfer out of the BAA

- For example*, assume Load UIE = 30 MWh, Supply = -15 MWh, Transfer to EIM Entity #2 = 5 MWh
  - 5 / (30 + 15 + 5) = 10% of neutrality $$ allocated to EIM Entity #2

- Neutrality $$ split performed hourly
- Bid cost recovery $$ split performed daily

* ISO posted settlement spreadsheet

Bid cost recovery ensures participating resources cover costs

- If RT revenues over day < RT costs over day, then generation is paid to difference to make whole.
  - Results in an uplift as it is settled outside the market

- If unit commitment is optional for EIM Entities, then separate BAA costs in (1) energy and (2) commitment costs
  - Energy = Energy, AS, flexible ramping constraint
  - Commitment Costs = Start up and minimum load

- Uplifts for each category calculated for each BAA based upon resources located in that BAA
  - Proportional daily uplift between BAAs based on daily transfers

Example of Bid Cost Recovery

	Energy			Commitment			Combined		
	Cost	Revenue	BCR	Cost	Revenue	BCR	Cost	Revenue	BCR
Gen A	$1,000	$1,200	$ -	$1,200	$1,000	$ 200	$2,200	$2,200	$ -
Gen B	$1,000	$ 700	$ 300	$ 800	$ 600	$ 200	$1,800	$1,300	$ 500
Gen C	$1,000	$2,000	$ -	$1,000	$1,100	$ -	$2,000	$3,100	$ -
Gen D	$1,000	$ 600	$ 400	$ 500	$ 700	$ -	$1,500	$1,300	$ 200
Gen E	$1,000	$1,250	$ -	$ 800	$ 400	$ 400	$1,800	$1,650	$ 150
BAA Total			$ 700			$ 800			$ 850

Transfer of BCR between BAAs

- EIM Entity elects no unit commitment in EIM
  - No proportional transfer of costs from BAAs that allow unit commitment
  - EIM Entity responsible for paying commitment costs within EIM Entity BAA according to its rules

- EIM Entity elects unit commitment in EIM
  - Proportional transfer of costs with BAAs that allow unit commitment
  - EIM Participating Resources compensated for commitment costs through EIM

Benefits of real-time unit commitment of short-start resources within EIM

- RT commitment can be used to meet flexible ramping sufficiency test
- EIM can determine most economically efficient commitment in RT
- RT commitment costs and start up costs to resources are settled through EIM.
  - No separate settlement needed under EIM Entity tariff
- RT commitment is a feature of the ISO real-time market
  - EIM Entities and ISO fully utilize market functionality
- Multi-stage generation model cannot support optimal transitions management without unit commitment

For first year, reciprocity between ISO and PacifiCorp for transmission used for transfers between BAAs in EIM

- The transfer capability of EIM will be based upon the transmission rights PacifiCorp makes available to EIM
- ISO is working with neighboring BAAs on management of dynamic schedules that enable EIM transfers
- Day-ahead imports from PacifiCorp will reduce import transfer capability available for transfers in EIM
  - Assume 100 MW PacifiCorp transmission right
  - If DA import to ISO = 80 MW, only 20 MW is available for incremental transfers into ISO through EIM

Future transmission service proposal will be informed by actual operational experience from first year of EIM

- First year implementation: no transmission costs for transfers between/within EIM Entity BAAs

- 3rd Revised Straw Proposal introduces a fourth alternative based upon stakeholder comments

- Additional stakeholder comments or responses to other stakeholder comments are welcome

Areas of focus for Draft Final Proposal

- Optionality of RT unit commitment in EIM Entity
- Allocation of bid cost recovery
- Over-scheduling penalty
- Facilitation of base schedule submission

Next steps

- ISO will hold additional technical workshops
  - Dates will be communicated via market notice

- Submit comments to EIM@caiso.com on 3rd Revised Straw Proposal by August 30, 2013

- Submit comments to EIM@caiso.com on Governance White Paper by September 6, 2013

Calendar of future EIM activities

Item	Date
Stakeholder Comments Due (3rd Revised Straw Proposal)	August 30, 2013
Stakeholder Comments Due (Governance White Paper)	September 6, 2013
Post Tariff Framework	September 10, 2013
Stakeholder Comments Due (Tariff Framework)	September 20, 2013
Post Draft Final Proposal (DFP)	September 23, 2013
DFP Stakeholder Meeting (Folsom)	September 30, 2013
Tariff Framework Stakeholder Meeting (Folsom)	October 1, 2013
Post Straw Proposal and Charter (Governance)	October 4, 2013
Stakeholder Comments Due (DFP)	October 8, 2013
Stakeholder Conference Call (Governance)	October 11, 2013
Stakeholder Comments Due (Governance)	October 25, 2013
Board Decision (Policy)	November 7-8, 2013
Post Draft Final Proposal and Charter (Governance)	November 7, 2013
Stakeholder Conference Call (Governance)	November 14, 2013
Stakeholder Comments Due (Governance)	November 25, 2013
Post Draft Tariff Language	November 12, 2013
Stakeholder Comments Due (Tariff)	December 5, 2013
Tariff Stakeholder Meeting (Folsom)	December 16, 2013
Board Decision (Governance)	December 18, 2013
Post Revised Tariff Language	January 16, 2014
Stakeholder Comments Due (Tariff)	January 23, 2014
Tariff Stakeholder Meeting (Tariff)	January 30, 2014