Regional Integration California Greenhouse Gas Compliance and EIM Greenhouse Gas Enhancement Straw Proposal

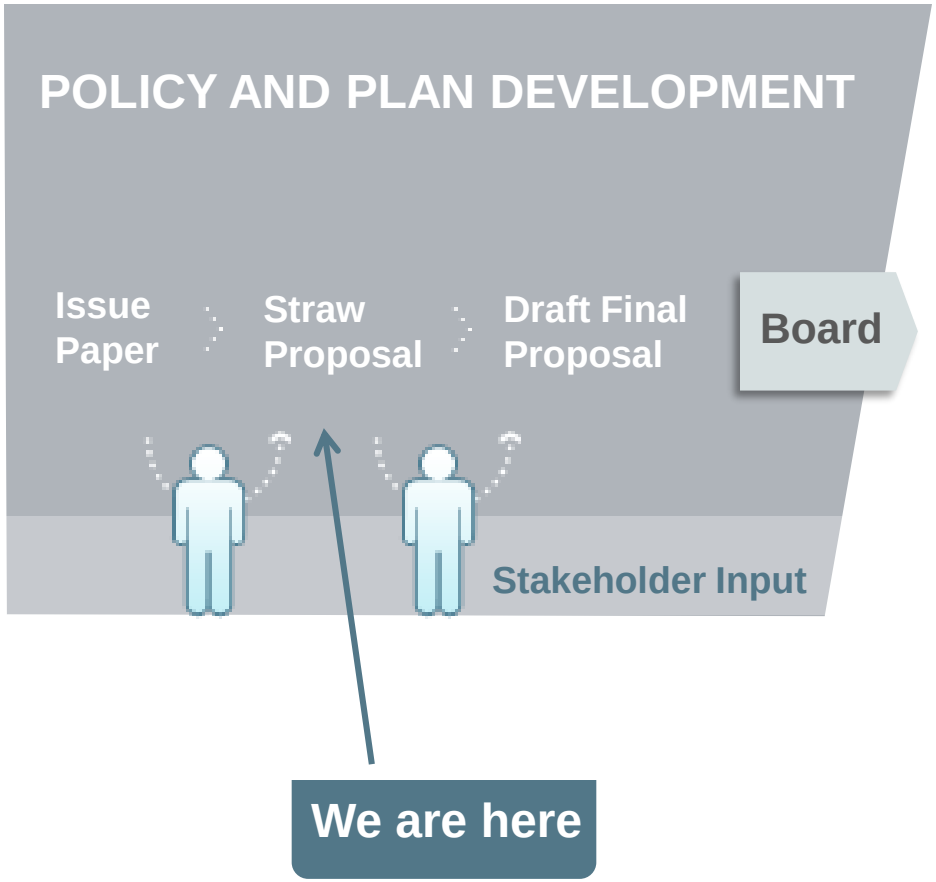
Stakeholder Meeting

December 1, 2016

Agenda

Time	Topic	Presenter
10:00 – 10:10	Introduction	Kristina Osborne
10:10 – 12:00	Proposed GHG Market Design Changes	Don Tretheway
12:00 – 1:00	Lunch	
1:00 – 2:30	Discuss Illustrative Examples	George Angelides
2:30 – 2:50	Multi-State BAA Implications	Don Tretheway
2:50 – 3:00	Next Steps	Kristina Osborne

ISO Policy Initiative Stakeholder Process



Why have the regional integration and EIM design changes merged?

- Concerns raised by California Air Resources Board (ARB) regarding attribution of EIM transfers pertains to EIM design as well as regional integration
  - Current paradigm that ISO BAA = California is no longer valid
  - Requires determining “California” supply when running first pass
    - “California” supply includes generators located in California, imports and EIM participating resources contracted to California load

- Regional integration will extend the enhanced GHG design to day-ahead market
  - The two pass solution can be more easily implemented in the day-ahead market

All of these can contribute to optimal dispatch across the EIM footprint

1. EIM BAA load
2. EIM non-participating resources
3. EIM participating resources w/o a GHG bid
4. EIM participating resources w/ GHG
5. ISO load
6. ISO resources

The EIM extends ISO's real-time market to other balancing authority area

- EIM re-dispatches all resources in the combined ISO and EIM entity BAA footprint
- Current market optimization balances total supply and total demand, not incremental changes
- Market optimization minimizes total production cost while resolving congestion

Observations of EIM dispatch optimization

- Least cost dispatch can have effect of sending low emitting resources to ISO, while not accounting for secondary dispatch of other resources to serve external demand

- Least cost dispatch can result in avoided curtailment of ISO renewables by displacing emitting resources to serve external demand

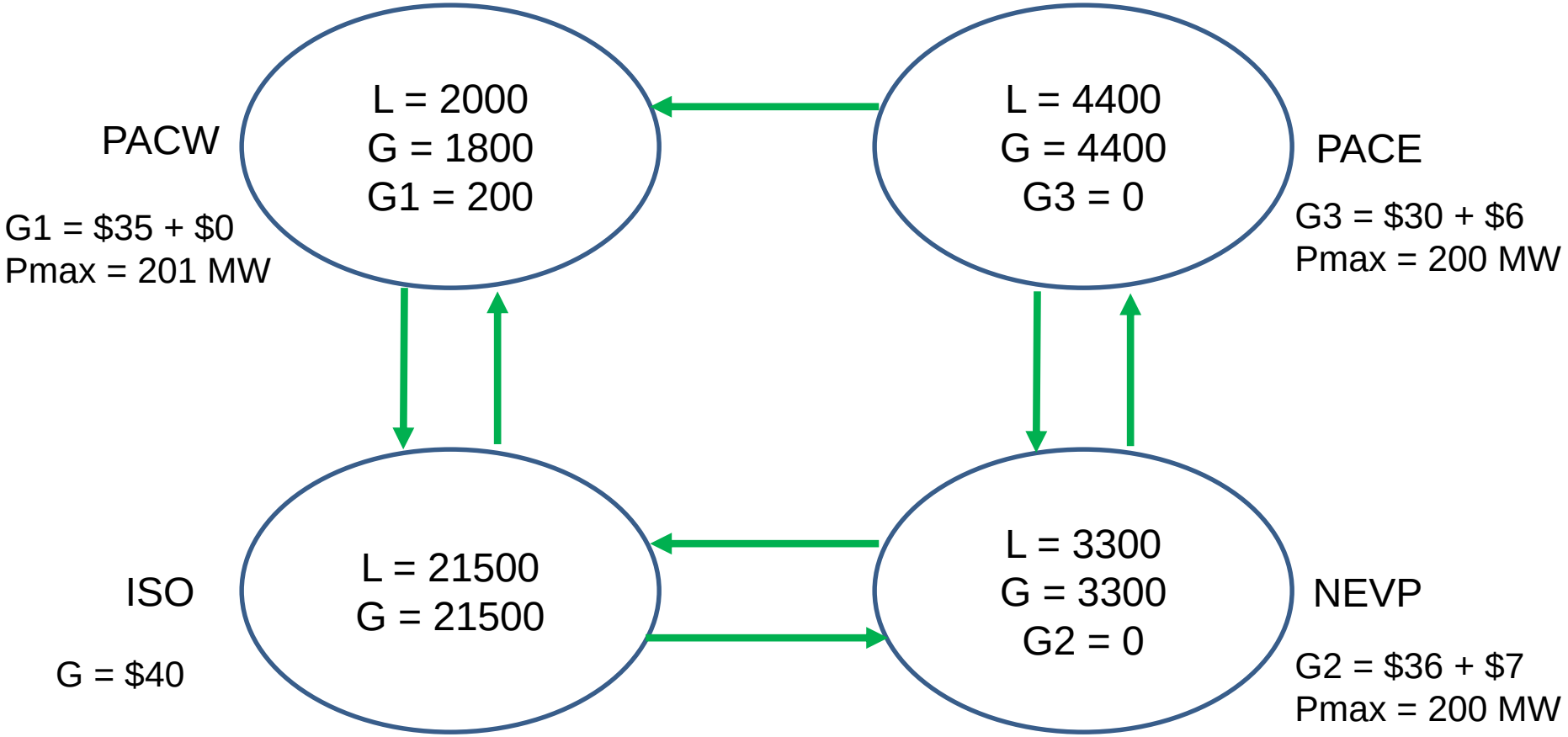
ISO is working with ARB to address concern with whether GHG attribution captures the atmospheric effects of EIM least cost dispatch

Atmospheric effect is not always apparent when GHG attributed to a base schedule

- If the attributed resource would have generated anyways, then another resource's emissions may be higher

- But, if the attributed resource would not have generated to serve non-ISO demand, then the resource's emissions are correct atmospheric effect.

Base assumptions for example to show allocation to base schedule correctly reflect atmospheric effect

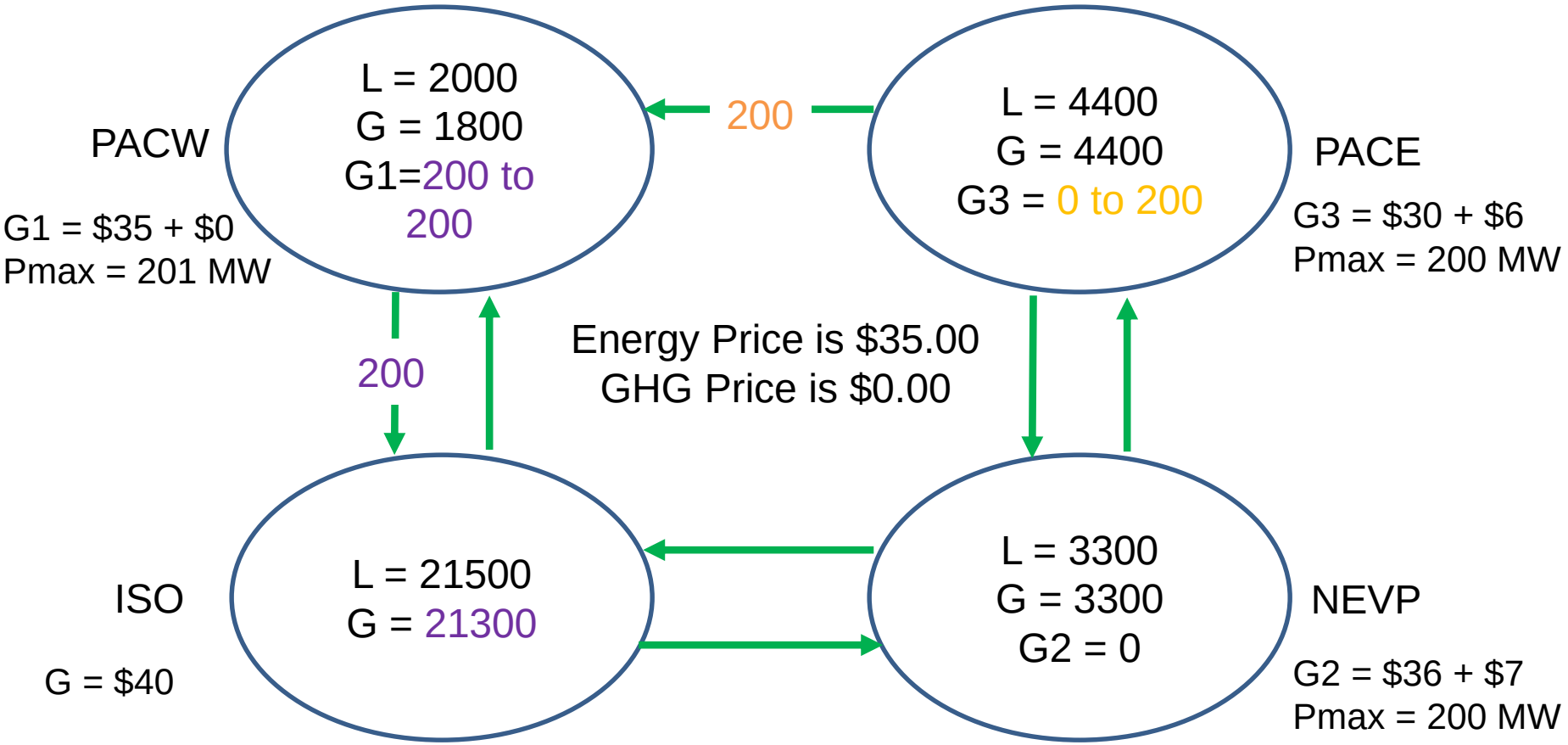


Maximum reduction in ISO supply is 200 MW

EIM Generator = Energy Bid + GHG Bid

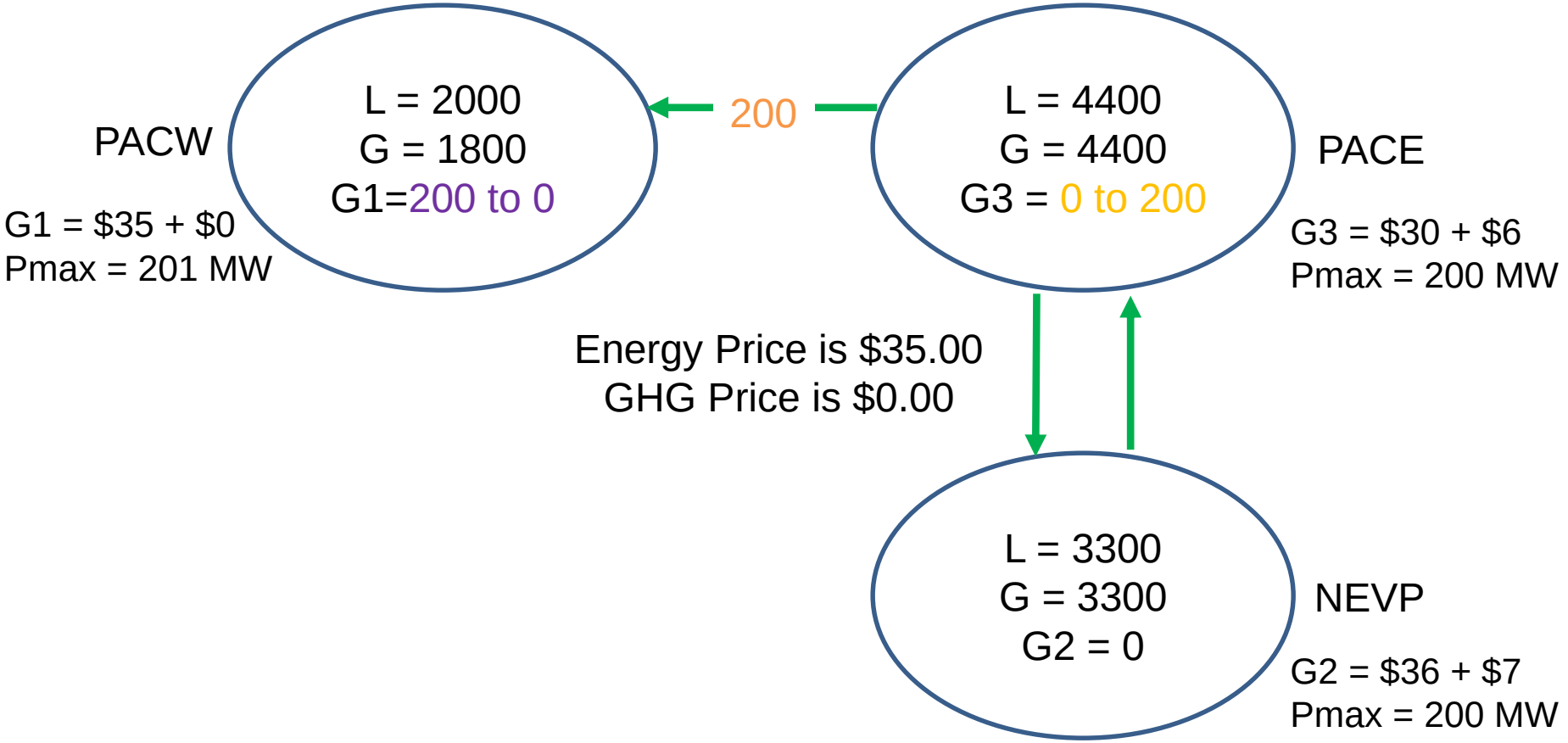
G1-G3 PMin 0 MW
GHG MW for all is 200 MW
Transfer limit into ISO is 201 MW

Let's solve the market for the EIM footprint



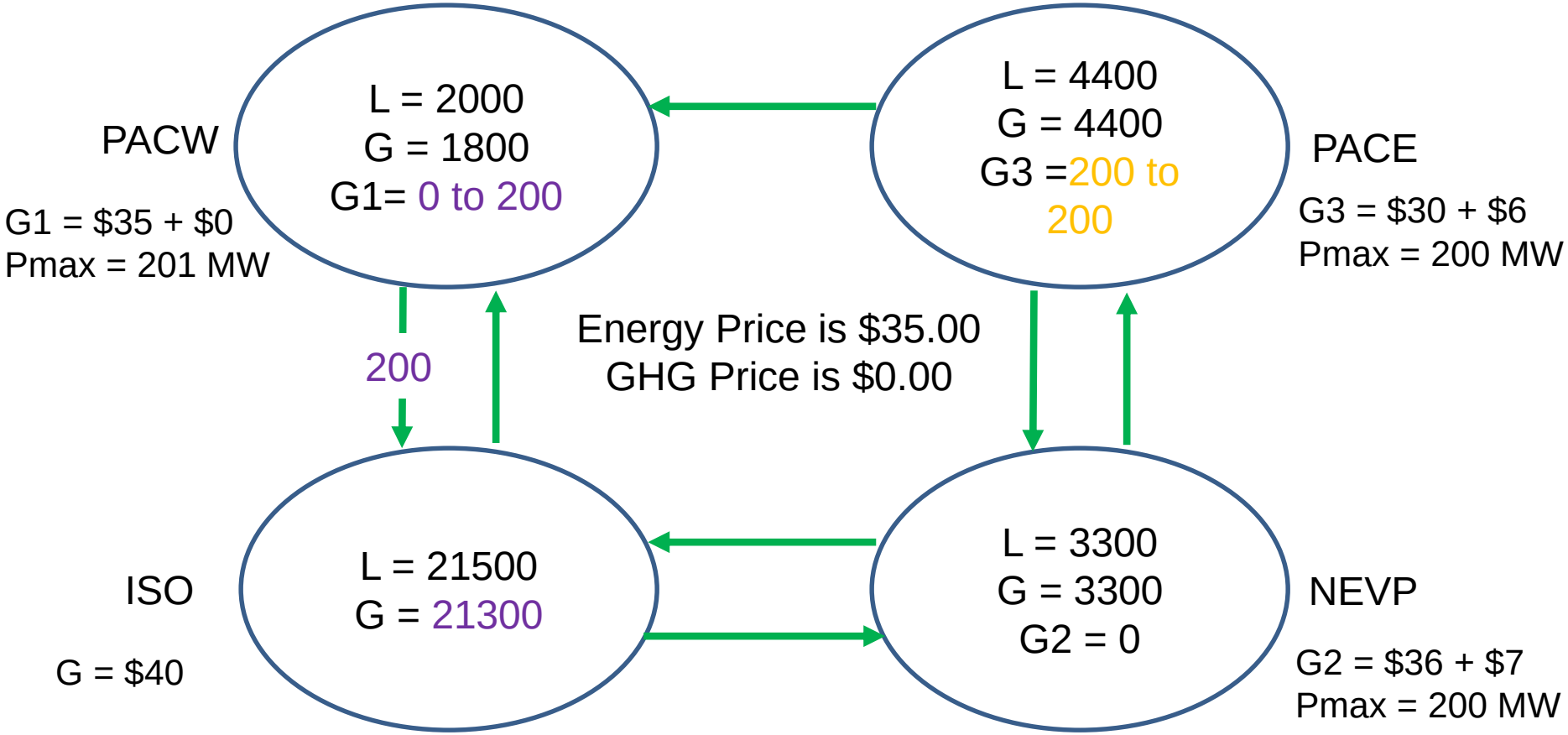
Is this an example of "secondary dispatch" because the base schedule of G1 is attributed to ISO?

Now let's assume the EIM entities optimized their base schedules before including the ISO



G3 increases its output and G1 reduces its output because G3 is lower cost than G1.
LMP outside ISO is $35

Now let's optimize from the prior slide's starting point and include the ISO



This is the same dispatch level, but there is no secondary dispatch.

LMP inside ISO is $35. LMP outside ISO is $35.

EIM transfers to the ISO do not always create a secondary dispatch

- Cannot assume base schedules are optimal before start of the EIM
  - Re-dispatch for economics or congestion independent of meeting a transfer to the ISO
- If a resource would have been dispatched down economically outside of the ISO, it shouldn't be a "secondary dispatch" when then used to meet ISO load
- The current EIM base schedule is not a good reference point to determine atmospheric effect

Three top options have been considered to ensure EIM/regional GHG accounts for secondary dispatch effects

1. Calculate overall GHG impact based on comparison to counter-factual dispatch outside the market optimization

2. Modify ISO optimization, but maintain resource specific cost and attribution

3. Modify ISO optimization, residual emission rate for EIM transfers into ISO. No resource attribution of residual emissions.

At technical workshop, the ISO stated that …

- Option 1 may be inconsistent with ARB regulatory framework
- Option 2 was the best long term solution, but could not be implemented immediately
- Option 3 could be implemented in 2017, but was not an optimal long term solution

Principles the ISO used to determine which option should be pursued (1 of 3)

- Track emissions impacting the atmosphere as a result of generation outside California dispatched by the ISO market to serve California load
- Reflect those emissions in ARB's GHG regulations
- Allow suppliers selling power to serve California load to recover their costs to comply with ARB's greenhouse gas regulations from the ISO market
- Mitigate the impact of the ISO market's GHG tracking mechanism on the ISO market's prices for electricity to serve load outside of California

Principles the ISO used to determine which option should be pursued (2 of 3)

- Ensure solution is scalable to a regional ISO balancing authority area and integrated market, including the day-ahead market
- Resources located outside of California must be able to opt out of supporting EIM or regional transfers to serve California load that would be subject to ARB GHG regulations
- Output from resources located outside of California serving load outside of California cannot be part of a transfer into California and are thus not subject to ARB GHG regulations

Principles the ISO used to determine which option should be pursued (3 of 3)

- If possible, regional and EIM transfers serving California load should be subject to similar regulatory requirements as other electricity supply serving California load. This allows resource specific emission rates to be considered and that scheduling coordinators remain the point of regulation as first delivers.
- If possible, consider how solution may align with GHG regulatory programs in other states/provinces, the extension of the Western Climate Initiative to states or provinces participating in the EIM or regional energy market, or state implementation plans under the Clean Power Plan.

Option 2 - Modify optimization, but maintain resource specific cost and attribution (1 of 2)

- GHG award only if the resource is incrementally dispatched above new “GHG allocation base” to support EIM transfer into ISO
- Submitted base schedules are used for imbalance settlement solely and are not optimized outside of CA
- Requires a two-step process
  - Step 1: optimize schedules outside of CA without transfers to CA in order to determine “GHG allocation base” and not inappropriately impact LMPs and dispatch opportunity outside of CA
  - Step 2: optimize transfers to CA and compare with step one to determine incremental dispatch responsible

Option 2 - Modify optimization, but maintain resource specific cost and attribution (2 of 2)

- Real-time dispatch is used to operate the grid
  - Must solve market optimization within 5-minutes
  - Solving the market twice to add GHG accounting functionality
  - Current computational power would require simplifying (less accurate) first pass to ensure RTD successfully completes

- GHG accounting accuracy is significantly improved, small "leakage" can still occur when starting with optimized (or not perfect) external schedules
  - Simplifying assumption needed to reduce solve time of first pass
  - Can't let the perfect be the enemy of the good

Based on stakeholder comments to technical workshop, the ISO has focused efforts on option 2

- Cannot be implemented in 2017 to support ARB compliance year 2018

- Evaluating how to quickly determine the GHG allocation base for resources outside ISO

A bridge solution may be necessary until two pass solution can be implemented

Approaches to minimize solve time of first pass

- Avoid full unit commitment by using prior unit commitment from second pass
- Relax the ramp constraints between the binding and advisory intervals
- Calculate advisory interval GHG allocation base without network constraints
- Stagger market runs so that when the second pass is completed, the first pass for the next market starts immediately

Real-time market enhancements initiative from roadmap would improve renewable integration

- Integrate FMM and RTD into single market optimization
- 5-minute unit commitment
- 5-minute ancillary service procurement
- 5-minute market power mitigation (implement in 2017)

Functionality for GHG attribution must work with renewable integration enhancements

How should ISO treat an external resource under contract as ISO load serving entity?

- Assume a California load serving entity has contracted with a wind resource in Oregon which bids $0.00 / MWh
- Using location only for the first pass, the Oregon unit could be used to back down a gas unit outside of California
- This would set the “GHG allocation base” of the wind resource to its forecast, thus this resource cannot be incrementally dispatched
- Therefore, the transfer can only be supported by incrementing a gas unit and incurring the GHG expense

Regional integration GHG issue paper highlighted similar issue

Need to identify which supply is included in the first pass to determine the GHG allocation base for resource outside of California

- When setting up a resource, the scheduling coordinator identifies if the resource is California supply in Masterfile
  - ISO supports multiple resource ids at same location
- All supply located outside the California state boundary will bid a separate GHG component
  - As is done today, if a resource meets its ISO must offer obligations and is not awarded, its output can be contracted bilaterally with no California GHG obligation
- GHG allocation base equals the base schedule for California supply in EIM entity BAA
  - Addresses double counting base for GHG accounting

Review illustrative examples

- See excel workbook at:

http://www.caiso.com/Documents/IllustrativeModel-CurrentGreenhouseGasDesignComparedtoProposedTwoPassOption.xlsx

- Solver add-in must be active

Additional considerations under regional integration, i.e. becoming a multi-state balancing authority

- Extend two pass solution to day-ahead market
- Imports/exports of multi-state balancing authority area
- GHG regime and convergence bidding
- Supporting multiple GHG regimes

Extending the two pass solution to day-ahead does not have the same performance concerns as RTD

- Since there is no base schedule, the two pass solution is needed to address allocation to non-emitting resources first that are used to serve non-California load

- Will use the same first pass assumptions as RTD to ensure consistency between day-ahead are real-time markets

Under multi-state balancing authority area, treatment of imports/exports will change

- For California cap-and-trade program, currently gross imports have a compliance obligation
- Under new paradigm, only imports that are attributed to support a flow into the California will have a compliance obligation
- Thus, the total compliance obligation will be the greater of California load or dispatch of generators geographically located in California

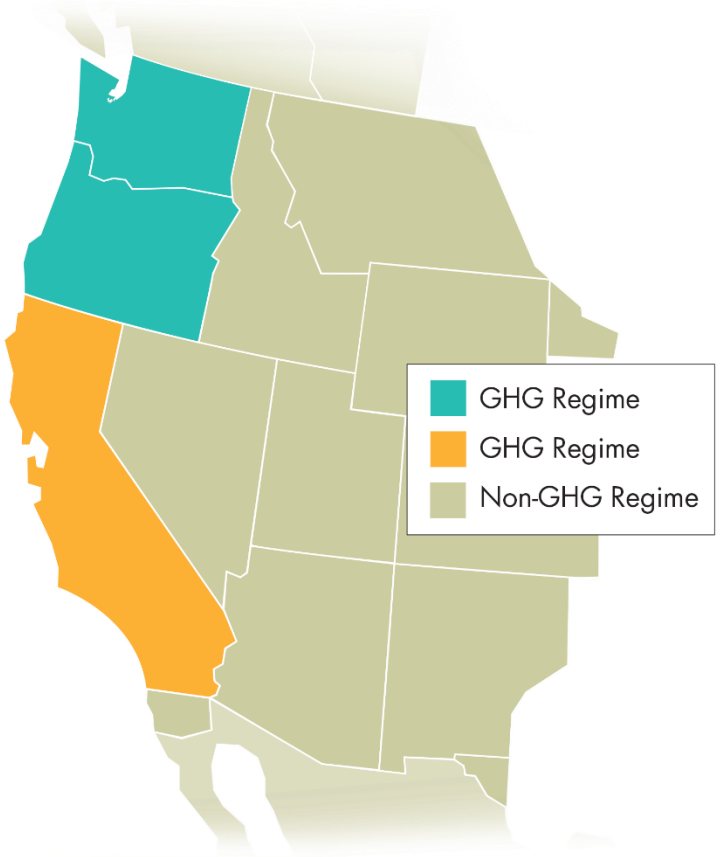
Convergence bids are treated the same as internal generators serving load within a given state

- Virtual supply does not submit a separate GHG bid adder. Cannot support a transfer to another state
- Virtual demand is not exposed to costs of other state's GHG program when region is exporting
- Since trading hubs and LAPs are eligible bidding nodes, these aggregation are restricted to a single GHG regime

If a GHG regime places a compliance obligation on imported electricity …

- Generators within that GHG regime embed GHG compliance cost in energy bid
- Another separate GHG bid adder for resources outside that GHG regime
- In the first pass, do not allow incremental transfers into the GHG regime from the non-GHG regime area or another GHG regime
- In second pass, allow incremental transfers into the GHG regime from all other areas

Assume three GHG regimes with both the blue and yellow regimes have obligation on external supply



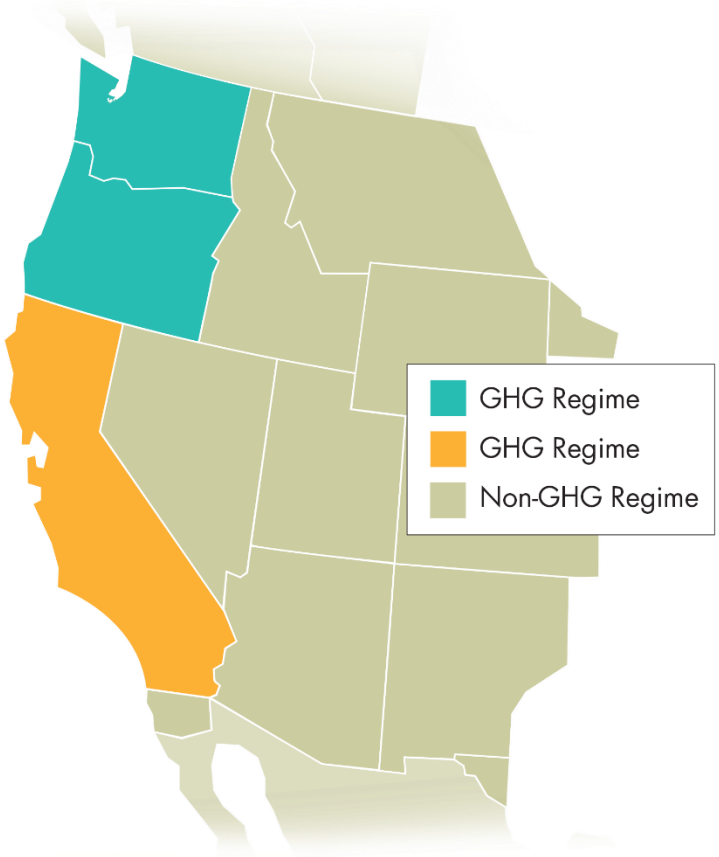
Blue generators
- Include blue GHG cost in energy bid
- Submit separate GHG bid to serve yellow regime load

Yellow generators
- Include yellow GHG cost in energy bid
- Submit separate GHG bid to serve blue regime load

Grey generators
- No GHG cost in energy bid
- Submit separate GHG bid to serve blue regime load
- Submit separate GHG bid to serve yellow regime load

Imports/exports to multi-state balancing authority area
- No GHG cost in energy bid
- Submit separate GHG bid to serve blue regime load
- Submit separate GHG bid to serve yellow regime load

First pass to establish GHG allocation base used in second pass



Blue regime

- No incremental transfers from yellow or grey regime contracted supply

Yellow regime

- No incremental transfers from yellow or grey regime contracted supply

Next Steps

Item	Date
Post Straw Proposal	November 17, 2016
Stakeholder Meeting	December 1, 2016
Stakeholder Comments Due	December 15, 2016
Post Draft Final Proposal	January 5, 2017
Stakeholder Conference Call	January 12, 2017
Stakeholder Comments Due	January 19, 2017
EIM Governing Body	TBD
Board of Governors	TBD

Please submit comments to InitiativeComments@caiso.com