Report on Proposed EIM Greenhouse Gas Enhancements

November 17, 2017

Agenda

Time	Topic	Presenter
10:00 – 10:10	Introduction	Don Tretheway
10:10 – 10:55	ISO GHG Two Pass Solution Analysis	Abhishek Hundiwale
10:55 – 11:40	Brattle Two Pass Demonstration	The Brattle Group
11:40 – 11:55	Issues Identified with Two Pass Solution	Don Tretheway
11:55 – 12:00	Next Steps	Don Tretheway

Introduction

Don Tretheway
Sr. Advisor, Market Design Policy

November 17, 2017

Proposed GHG enhancement is to perform two step process to more accurately determine GHG attribution for EIM transfers to serve ISO load

1. Optimize schedules without EIM transfers to ISO to establish reference point to measure upward dispatch capability of EIM participating resources

2. Optimize schedule allowing EIM transfers to ISO while limiting the GHG bid quantity to the remaining upward dispatch capability quantified in step 1

Numerical example of two pass process

EIM Participating Resource	Submits Bid for 100 MW at $40 and submits $5 GHG Bid for 100 MW quantity
Optimization Pass 1	Clears 80 MW to serve EIM area load
Attribution limit for EIM transfers to serve ISO load	Reduced from 100 MW to 20 MW
Optimization Pass 2	Clears 90 MW; attributes 20 MW to serve ISO load and 70 MW attributed to serve EIM load
Secondary dispatch emissions	Two pass optimization does not capture secondary emissions associated with 10 MW of output to serve ISO load

ISO GHG Two Pass Solution Analysis

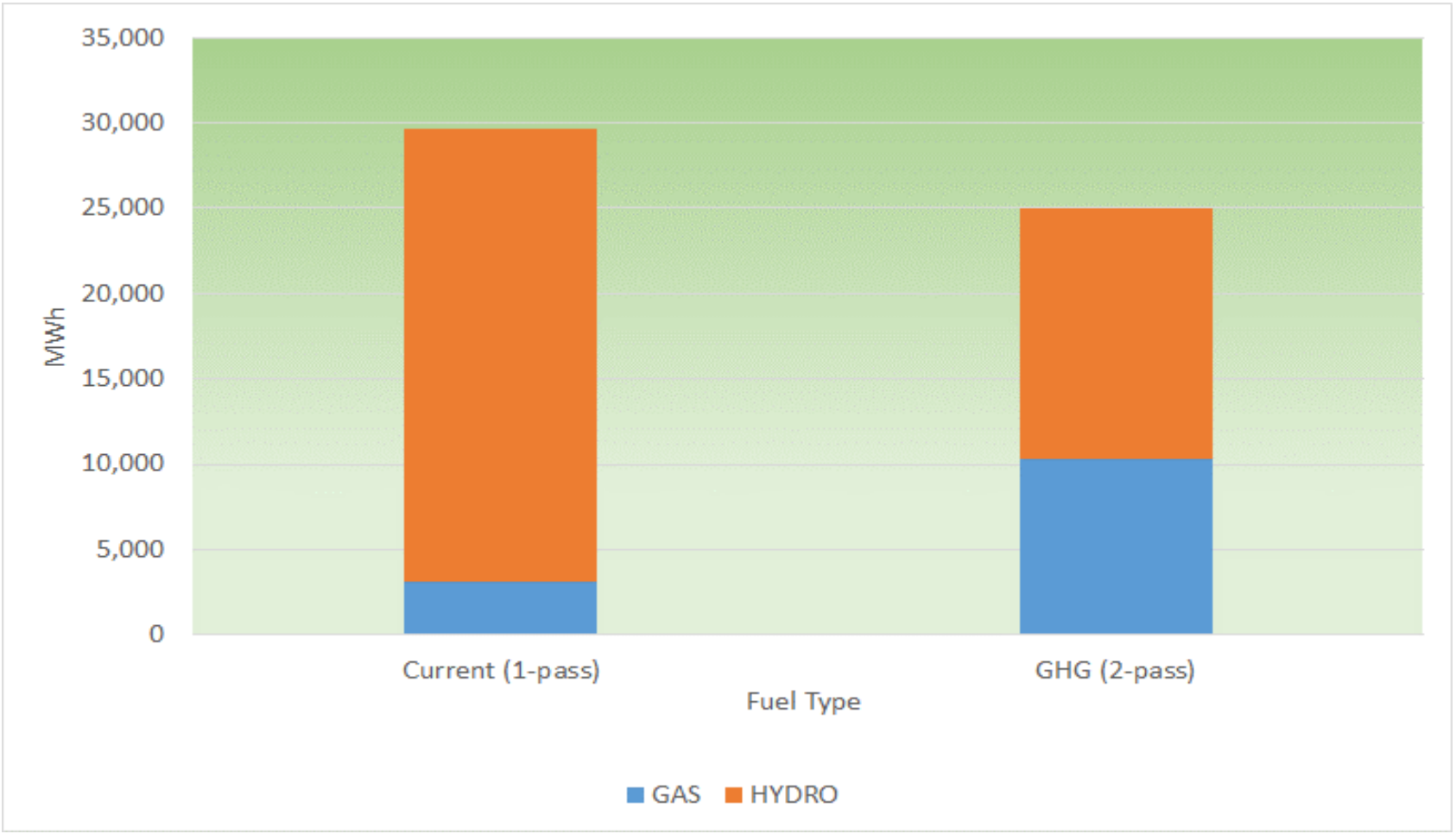
Abhishek Hundiwale
Lead Engineering Specialist
Market Quality and Renewable Integration

November 17, 2017

Introduction

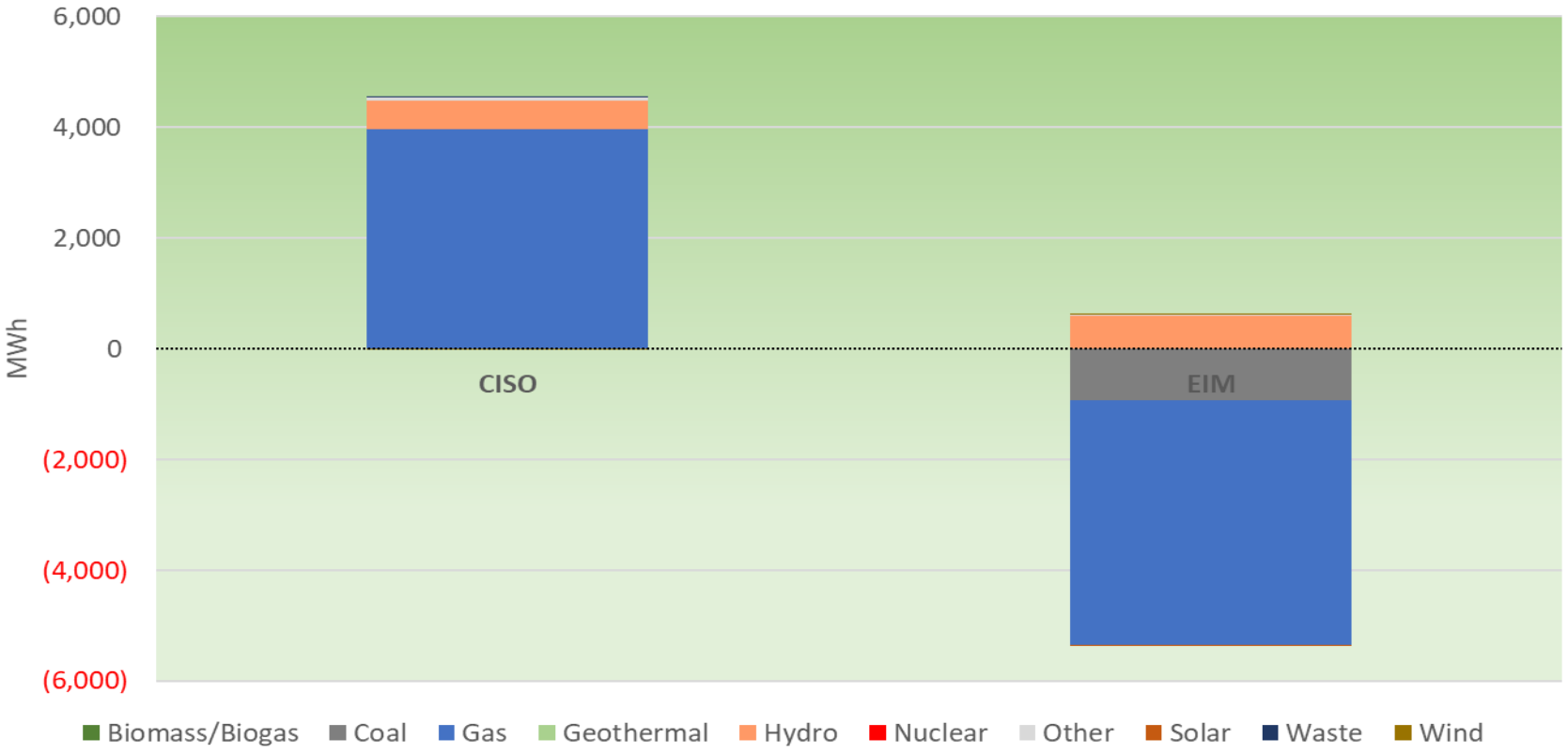
- GHG Rerun Cases –
  - Production Savecase
    1. Rerun in Stage environment
    2. For Analysis – Term used as Current (1-pass)
    3. 1-pass level results
  - GHG Two Pass
    4. Turn ON GHG Feature for the Production case in (1) above in Stage Environment
    5. Rerun GHG Pass 1 and GHG Pass 2
- Approximately 1500 RTD (five minute) cases rerun with GHG Two Pass feature.
- EIM region based on participants :PACE, PACW, PSEI, NVE, AZPS and PGE

GHG Attribution supporting EIM Transfers – Comparison between Current (1-pass) and GHG Pass 2 approach



Change in dispatch between current approach and GHG Pass 2 approach

- Increase in gas – fired and hydro resources internal to ISO
- Decrease in coal and gas fired resources in the EIM balancing area

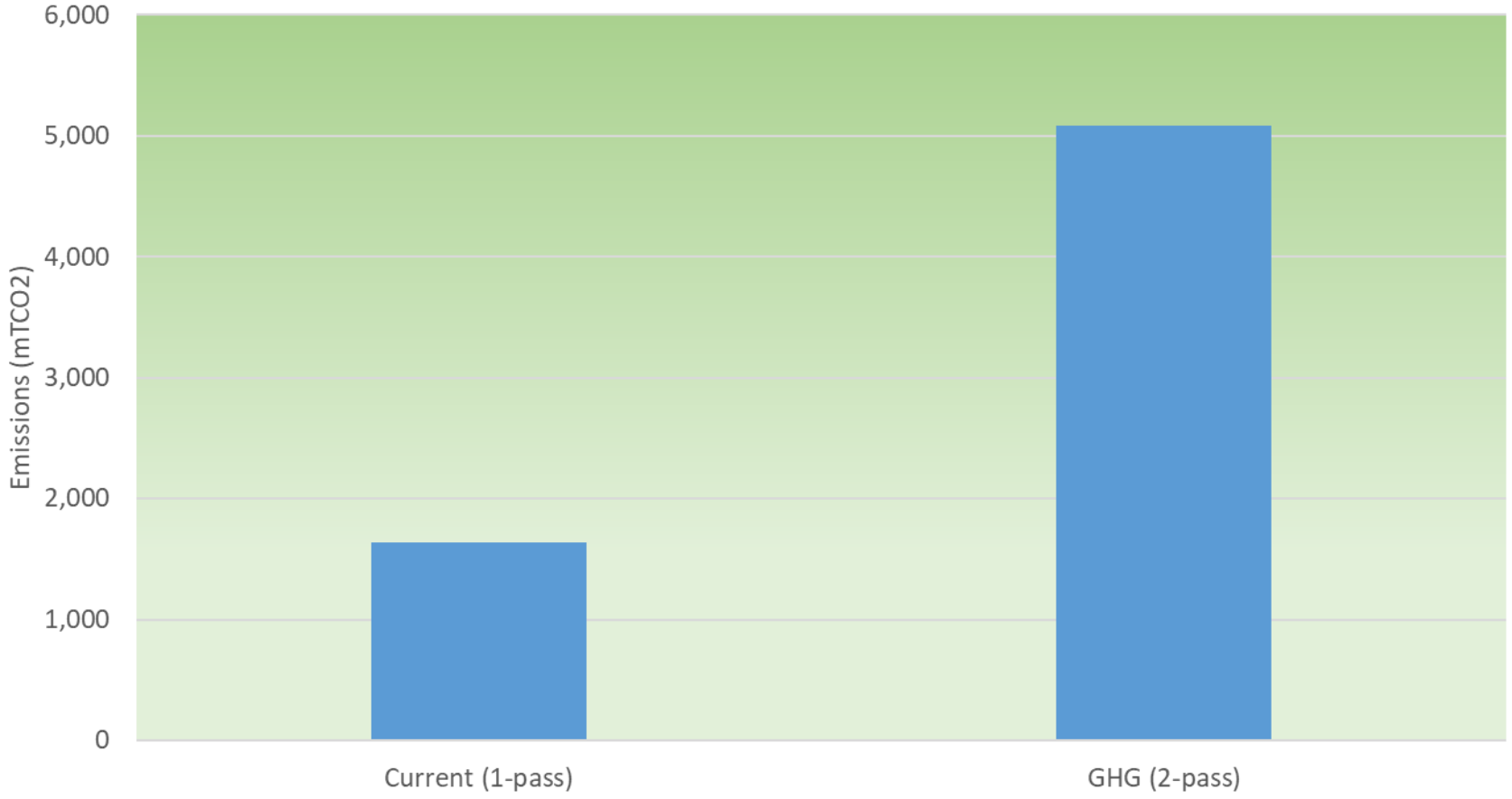


Overall GHG Emissions – ISO and EIM area combined – difference between Current(1-pass) and GHG (2-Pass)

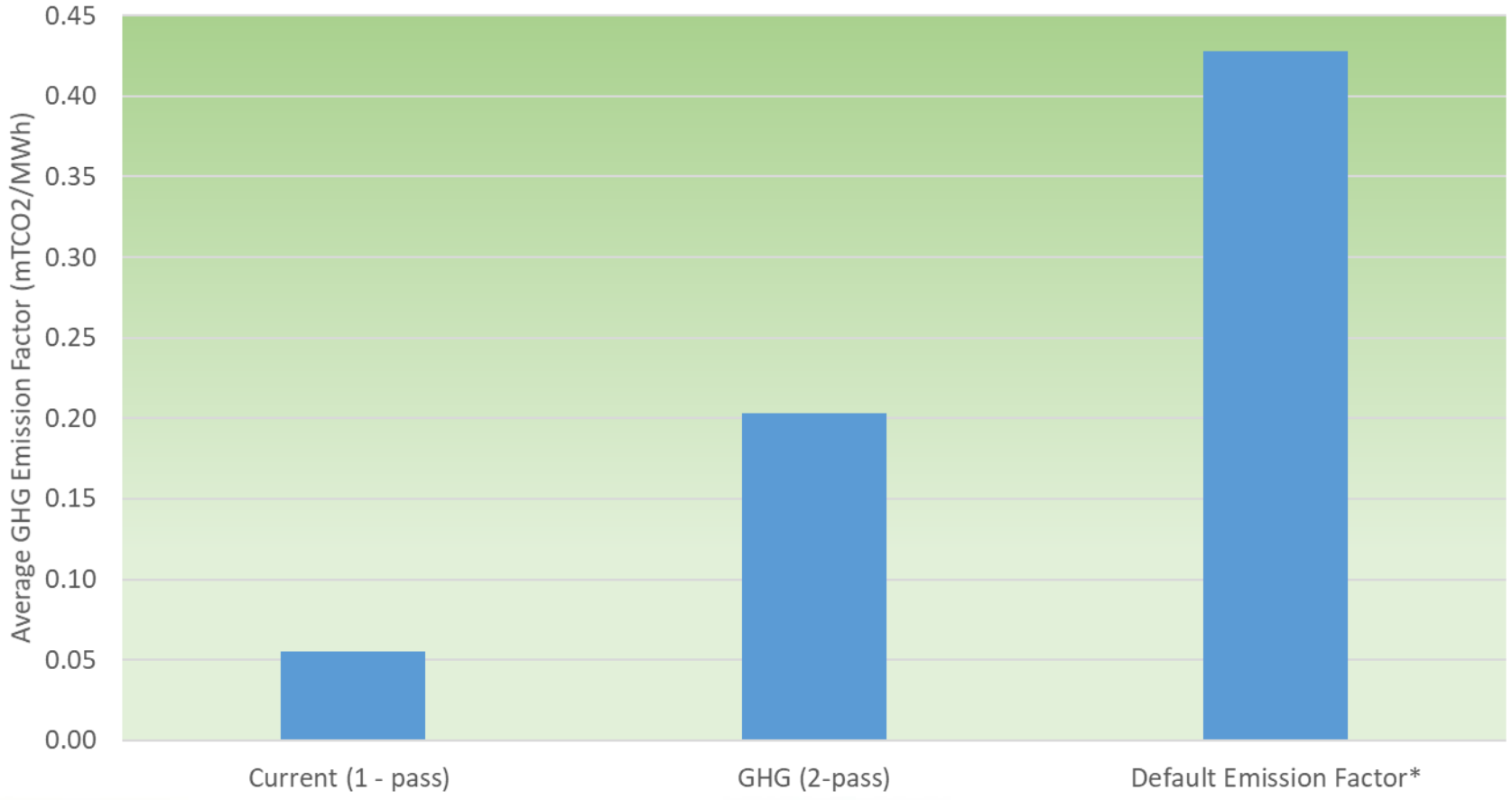
- Overall 1,702 mTCO2 reduction of emissions for all ISO and EIM combined area.
- Represents approximately 0.07% reduction in total GHG emissions

FUEL_TYPE	CISO (mTCO2)	EIM (mTCO2)	Total(mTCO2)
Biomass/Biogas	0.0	(0.0)	**0.0**
Coal	10.4	(1,124.2)	**(1,113.8)**
Gas	1,735.2	(2,324.5)	**(589.3)**
Geothermal	0.0	0.0	**0.0**
Other	0.1	(0.0)	**0.1**
Waste	0.0	0.0	**0.0**
Imports	(5.3)	6.7	**1.4**
Grand Total	**1,740.4**	**(3,442.0)**	**(1,701.6)**

GHG Emissions attributed to EIM Transfers – Compare Current and GHG Pass 2



Average GHG intensity of EIM transfers to serve ISO load – Compare the average GHG emission factor in mTCO2/MWh



Conclusion from the Analysis

- GHG Allocation has increased for gas – fired resources and reduced for hydro resources for the 2 – pass results as compared to 1 – pass results.
- Increase in MW output of gas and hydro resources internal to ISO compared to a decrease in coal and gas resources in EIM area with current (1-pass) as the reference.
- The total atmospheric GHG emissions for both ISO and EIM area combined reduced by about 0.07% for the 2 pass results as compared to current approach.

Brattle Two Pass Demonstration

The Brattle Group

See separate presentation

Issues identified with two pass solution

Don Tretheway
Sr. Advisor, Market Design Policy

November 17, 2017

Since Revised Draft Final Proposal additional concerns have been identified

- Concerns discussed at Market Surveillance Committee meeting on 9/8/17

  http://www.caiso.com/Documents/Discussion_EIMGreenhouseGasAttributionEnhancements.pdf

- Hogan 9/28/17 paper identifies issues with two pass solution
  1. Incentivizes clean resources to increase their energy bid in order to not clear pass 1 and collect GHG premium in pass 2
  2. Still allows secondary dispatch since attribution can be made to pass 1 schedule

  https://sites.hks.harvard.edu/fs/whogan/Hogan_EIM_092817.pdf

How could the two step process change bidding incentives for non-emitting resources?

- Non-emitting may attempt to bid energy so as not to clear in the first pass, so that it can be attributed in second pass
- When GHG price is positive and the non-emitting resource receives attribution, the resource is paid for GHG, but does not to procure compliance instruments because it is non-emitting
- Non-emitting resource earns a higher profit than if attributed to serve non-ISO load in first pass

Continuing discussions with ARB and stakeholders needed to address concerns and review options

1. No change to optimization. Use counterfactual to retire allowances for residual emissions.

2. Two pass optimization, but remove ability to influence first pass solution.

3. One pass optimization that uses a hurdle rate to account for residual emissions.

Option 1 – Use counterfactual to calculate the residual emissions

- Bridge starting in 2018 remains, but can use actual emissions versus default emission rate

Option 2 – Remove ability for resource to influence pass 1 solution

a) Use DEBs to determine reference level

b) Use base schedules/self-schedules to determine reference level

Residual secondary dispatch remains

Option 3 – Implement a hurdle rate into current optimization

a) Residual emissions hurdle rate applied to ISO transfers

b) Minimum GHG bid price set at residual emissions rate
   - Clean resources only paid the difference between GHG clearing price and minimum GHG bid price

Need to identify first deliverer to surrender allowances

Next Steps

Item	Date
Post GHG Report	November 17, 2017
Conference Call	December 4, 2017
Stakeholder Comments	December 18, 2017
Additional Stakeholder Discussions	TBD

Please submit comments to InitiativeComments@caiso.com