

# Energy and GHG Accounting Framework Illustration

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# Presentation Outline

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- Ensuring Accurate Accounting
- Residual Market Supply Concept
- Accounting for Excess Designated Energy
- Treatment of Null Power
- Energy Storage Accounting
- LSEs in GHG Pricing Areas
- Excel Illustration

# Recap

- Objective is a comprehensive and accurate tracking mechanism and reporting system for all energy and emissions in footprint that
  - Enables assignment of energy from specific resources and associated emissions to individual market participants (load-serving entities and energy users) in support of state regulatory programs and voluntary goals
  - Prevents double-counting of claims/attribution of energy & under or overcounting of emissions
  - Does not impose costs or tracking requirements on states or entities without GHG Reduction or Clean Energy targets or goals
- Components
  - Mechanism to register market participants' designated resources (pre-market run)
  - Database to track dispatched MW & associated GHG for market participants and the residual market supply (post market run)
  - Reporting system/interface for entity specific information and publication of non-confidential market data
  - Rules to assign MW & GHG to market for calculation of residual emission factor

# How do we know if we have Accurate GHG Accounting?

- All MWs & GHGs within the market footprint are designated to a single market participant (LSE or Energy User)
  - Avoids double counting of MWs
  - Avoids over or under counting of GHGs
- Total assigned emissions equals total generation associated for each interval and when rolled up emissions over time
  - Market accounting is not necessarily the same as compliance accounting under regulatory programs
  - But can provide better data for regulatory and voluntary programs to use

# Residual Market Supply Concept & Emission Factor

- Market Supply:
  - Energy from IPP-owned resources not designated to specific LSE or energy users, or attributed to GHG regulation areas
  - Energy dedicated to specific LSEs or energy users that is in excess of that entity's load in that interval
  - Market supply is a *residual* mix in that it represents energy that is NOT designated to specific entities or GHG pricing states
- Residual emission rate for market supply:

$$\left( \frac{\sum \text{GHG associated with dispatch of non-designated resources} + \sum \text{sum of emissions associated with excess LSE assigned energy}}{\sum \text{MWh of non-designated resources} + \sum \text{MWh of excess LSE assigned energy}} \right)$$

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$$\left( \frac{\sum \text{MWh of non-designated resources} + \sum \text{MWh of excess LSE assigned energy}}{\sum \text{MWh of non-designated resources} + \sum \text{MWh of excess LSE assigned energy}} \right)$$

# Accounting for Dedicated Energy in Excess of Entity Load

- Rules needed for how MW & GHG are assigned to residual market supply
  - Due to differences in state regulations and types of voluntary goals, likely not possible to establish a 'one size fits all' approach
- Instead, the framework can accommodate different ways of assigning MW & GHGs to the residual market supply, e.g.
  - Using the entity's portfolio average emission rate
  - Assigning MW & GHGs from specific resources, such as gas, to the residual market supply first
  - Other?
- A default approach is needed for LSEs that do not elect a method
  - Suggest portfolio approach (owned resources only)

# Different Methods of Calculating Contribution of Excess Energy

	LSE 1		LSE2	
	Assigned Energy		Assigned Energy	
	MW	GHG	MW	GHG
Gas	600	270	600	270
Hydro	400	0	400	0
Renewable	200	0	200	0
Total Assigned Energy	1200	270	1200	270
Load	1000		1000	--
Portfolio Emission Factor	--	0.23	--	0.23
Elected contribution Method	Portfolio		Gas First	
Net Contribution to Market Supply	200	45	200	90
<b>Total Energy and Emissions</b>	<b>800</b>	<b>225</b>	<b>800</b>	<b>180</b>

Footprint accounting accuracy maintained regardless of LSE method elected for designating excess energy to market

# Treatment of 'Null Power'

- Concern regarding “Null Power” in market residual supply  
Dedicated clean energy in excess of entity’s load that will be claimed under RPS or Clean Energy Program
  - Could also be claimed under voluntary corporate goal
- Assigned emissions to this energy in calculation of residual EF would result in avoid overcounting of GHGs
- Instead, suggest that CAISO calculate two EFs for the residual market supply
  - One that accurately reflects all MW and GHGs in the residual market supply, and
  - One that removes the null power MWs from the market supply
    - This EF will be higher than the first

# Null Power in Market Residual EF

	LSE 1		LSE2	
	Assigned Energy		Assigned Energy	
	MW	GHG	MW	GHG
Gas	600	270	600	270
Hydro	400	0	400	0
Renewable	200	0	200	0
Total Assigned Energy	1200	270	1200	270
Load	1000	--	1000	--
Portfolio Emission Factor	--	0.23	--	0.23
Elected contribution Method	Portfolio		Gas First	
Net Contribution to Market Supply	200	45	200	90
<b>Total Energy and Emissions</b>	<b>800</b>	<b>225</b>	<b>800</b>	<b>180</b>
Energy claimed for RPS/CEP	200	--	200	--
RPS/CEP % of portfolio	0.17	--	0.17	--
Null power in Contribution	33	--	0	--

Residual Emission Factor Calculations		
	MW	GHG
Market Residual Supply	1000	350
Residual Emission Factor (350/1000)		0.35
Null power adjusted residual MW	967	350
<b>Null power adjusted residual EF (350/967)</b>		<b>0.36</b>

Adjusted residual EF is higher than unadjusted due to few MW in denominator.

# Energy Storage Accounting

- Charging and discharging of energy storage time-shifts both MW and GHG associated with charging
- Storage resources dedicated to LSE should modify entity's load
  - No need for separate tracking of emissions
- For non-dedicated 'market' storage resources
  - Emissions assigned to *charged* MW at residual EF for that interval;
  - When discharged, emissions associated with *charging* are added to numerator of residual EF calculation and *discharged* MW are added to the denominator
    - This accounts for roundtrip efficiency losses
- Specific generating resources could be dedicated to individual market storage resources
  - Emissions would then be attribute to charged MW at generating resource's EF rather than at the residual market EF

# Accounting for Energy Storage Across Time – Entity Level

	Hour 1		Hour 2	
	Assigned Energy		Assigned Energy	
	MW	GHG	MW	GHG
Gas	400	180	400	180
Hydro	400	0	400	0
Renewable	200	0	200	0
Total Assigned Energy	1000	180	1000	180
Storage Charging	80	--	--	--
Storage Discharging	--	--	68	--
Portfolio Emission Factor	--	0.18	--	0.17
Retail Load	1000	--	1000	--
Total load	1080	--	932	--
Net Residual Market Supply	80	28	-68	-11.5
Market Residual EF	0.35			
<b>Total Energy &amp; Emissions</b>	<b>1080</b>	<b>208</b>	<b>932</b>	<b>169</b>

Charging and discharging MW results in modification of entity total load. Same accounting applies for assigning GHG to load, and excess to market.

# Accounting for Energy Storage Across Time – Market Residual

	Hour 1		Hour 2	
	Market Supply		Market Supply	
	MW	GHG	MW	GHG
Gas	400	180	600	270
Hydro	600	0	400	0
Total Market Energy	1000	180	1000	270
Residual EF	--	0.18	--	0.27
Storage Charging	150	27	--	--
Storage Discharging	--	--	128	27
Adjusted Residual EF	--	0.18	--	0.26

- Charging of market storage resources results in higher dispatch of generating resources across footprint
  - No adjustment to residual EF
  - GHG associated with charging are not attributed in the hour, but carried over to when resources are discharged
- Discharge of market storage resources increases MW & GHG in the discharge interval
  - GHGs assigned based on charging in previous interval

# Accounting for MW & GHGs for LSEs inside GHG Pricing Areas

- If an LSE inside the GHG pricing area has excess designated energy in an interval, those MW and associated GHG should be assigned to any other LSE inside the pricing area that is short dedicated energy before any assignment to/from the residual market supply
  - Otherwise, any GHG costs from these resources would impact LMPs outside the GHG pricing area
- Surplus clean energy that is attributed to a GHG pricing area should be assigned on a pro-rata basis to LSEs in the GHG area
  - Should consider whether/how any RECs associated with these MW could be transferred to LSEs to facilitate entity compliance with RPS/Clean Energy programs

# Accounting for MW & GHGs for LSEs inside GHG Pricing Areas

	GHG Pricing Zone			
	LSE1		LSE2	
	Assigned Energy		Assigned Energy	
	MW	GHG	MW	GHG
Gas	0	0	600	270
Hydro	200	0	300	0
RE	200	0	100	0
<b>Total Assigned Energy</b>	<b>400</b>	<b>0</b>	<b>1000</b>	<b>270</b>
Average EF	--	0	--	0.27
Retail Load	1000	--	900	--
<b>Total Load</b>	<b>1000</b>	<b>--</b>	<b>900</b>	<b>--</b>
Net Dedicated Energy	600	--	-100	--
Intra GHG Pricing Zone Adjustment	<b>100</b>	<b>27</b>	<b>-100</b>	<b>-27</b>
Subtotal	500	--	0	--
Surplus Attribution	500	225	0	0
<b>Total Energy &amp; Emissions</b>	<b>1000</b>	<b>252</b>	<b>900</b>	<b>243</b>

# Excel Illustration (in workshop materials)

- Set-up
  - 5 LSEs who wish to account for MW & GHG associated with serving load, 2 inside GHG Pricing zone
    - Assume that MWs/GHG are designated for these LSEs based on ownership and contracts
  - Non-GHG area, encompassing LSEs without regulatory or voluntary GHG or clean energy targets
    - Assumes that MWs/GHG are designated to these LSEs based on ownership only
  - Residual Market Supply
    - IPP-owned resources that are not designated to particular LSEs
  - 3 intervals and roll-up across all intervals
    - User-defined values for generation, storage charging/discharging, and designation to LSEs and non-GHG area, loads and 'null power' amounts
  - More complex examples of specific issues described here

**Framework appears to accurately account for MW & GHG, for each interval and across time**

# Terminology

- Assignment: Designation of committed energy to market participants (LSEs & energy users)
- Attribution: Designation by the dispatch engine of energy to a GHG Regulation Area
- Designation: Collective term for assignment and attribution of dispatched energy
- Committed Energy: Energy dispatched from resources that are owned by or contracted to an LSE or energy user
- GHG Reduction Area: Market participants subject to state regulations or voluntary goals formulated as load-based GHG targets relative to historic baseline (e.g., Oregon and Colorado programs)
- GHG Regulation Area: Jurisdiction subject to GHG Pricing (cap and trade)
- Clean Energy Areas: Market participants subject to state regulations or voluntary goals formulated as clean energy procurement targets set as percentage of load (e.g., New Mexico, Washington CETA)
- Residual Market Supply: Energy not committed to market participants or attributed to GHG Regulation Areas
- Non GHG area: Market participants not subject to state GHG pricing, GHGs reduction or Clean Energy procurement regulations, or voluntary GHG or Clean Energy goals
- Residual emission rate: Dispatch-weighted average emission rate of the residual market supply