| DOCKETED | |
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| Project Title: | Vehicle Grid Integration Roadmap Update |
| TN #: | 225124 |
| Document Title: | Quantifying Value of VGI Presentation |
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Quantifying Value of VGI Presentation

Additional submitted attachment is included below.



Energy+Environmental Economics

Quantifying Value of VGI

CEC Vehicle Grid Integration Roadmap Update October 29, 2018

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Economy-wide 2050 GHG Pathways Analysis

Industrial

Transportation

Economy-wide GHG scenarios (PATHWAYS)

Buildings

Fuels

Electricity Integrated Resource Planning

Electricity System Reliability

Electricity System Operations

2050 Economy-wide Pathways Scenarios provide direction...

...for more detailed, implementation analyses in electricity sector

Pathway to 2050 begins with transportation electrification and VGI





Flexible loads reduce need for energy storage and renewable overbuild

VGI reduces need for storage



E3 modeling for CPUC Integrated Resource Planning Proceeding

Grid demand for VGI



 Frequency Regulation market is fully saturated at 600 MW

Larger market for load following at higher prices

E3 & LBNL modeling for CPUC Advanced DR Potential Study



VGI competes with other resources to supply grid demand for reserves Supply from Market Clearing Price for Reserves VGI Self-Scheduled Energy Demand Supply Bids \$/MWh (Price Taker) MW **MWh** Market Clearing Price Demand Bids PG&E/BMW iChargeForward Pilot Self-Scheduled Supply (Price Taker) Grid Demand MW Total Cleared Total Demand Forecasted Demand for Reserves 120,000 100,000 Curtailment 80,000 Storage Discharge Renewables Supply from 60,000 ٨ Imports other resources Gas 40,000 Large Hvdro 20,000 Dispatched Load --- Storage Charge

1 3 5 7 9

11 13 15 17 19 21 23

Hour of Day

FirstSolar Flexible Solar Dispatch



Incremental grid benefits of V2G (without AS)



EPRI led CEC EPIC "Distribution Aware V2G Demonstration Project"