

<b>DOCKETED</b>	
<b>Docket Number:</b>	18-MISC-04
<b>Project Title:</b>	Vehicle Grid Integration Roadmap Update
<b>TN #:</b>	225132
<b>Document Title:</b>	E3 Presentation - Quantifying Value of VGI
<b>Description:</b>	By Eric Cutter of E3 (Energy+Environmental Economics)
<b>Filer:</b>	System
<b>Organization:</b>	E3/Eric Cutter
<b>Submitter Role:</b>	Public
<b>Submission Date:</b>	10/29/2018 12:57:29 PM
<b>Docketed Date:</b>	10/29/2018

*Comment Received From: Eric Cutter*  
*Submitted On: 10/29/2018*  
*Docket Number: 18-MISC-04*

**Updated E3 Quantifying Value of VGI Presentation**

*Additional submitted attachment is included below.*



Energy+Environmental Economics

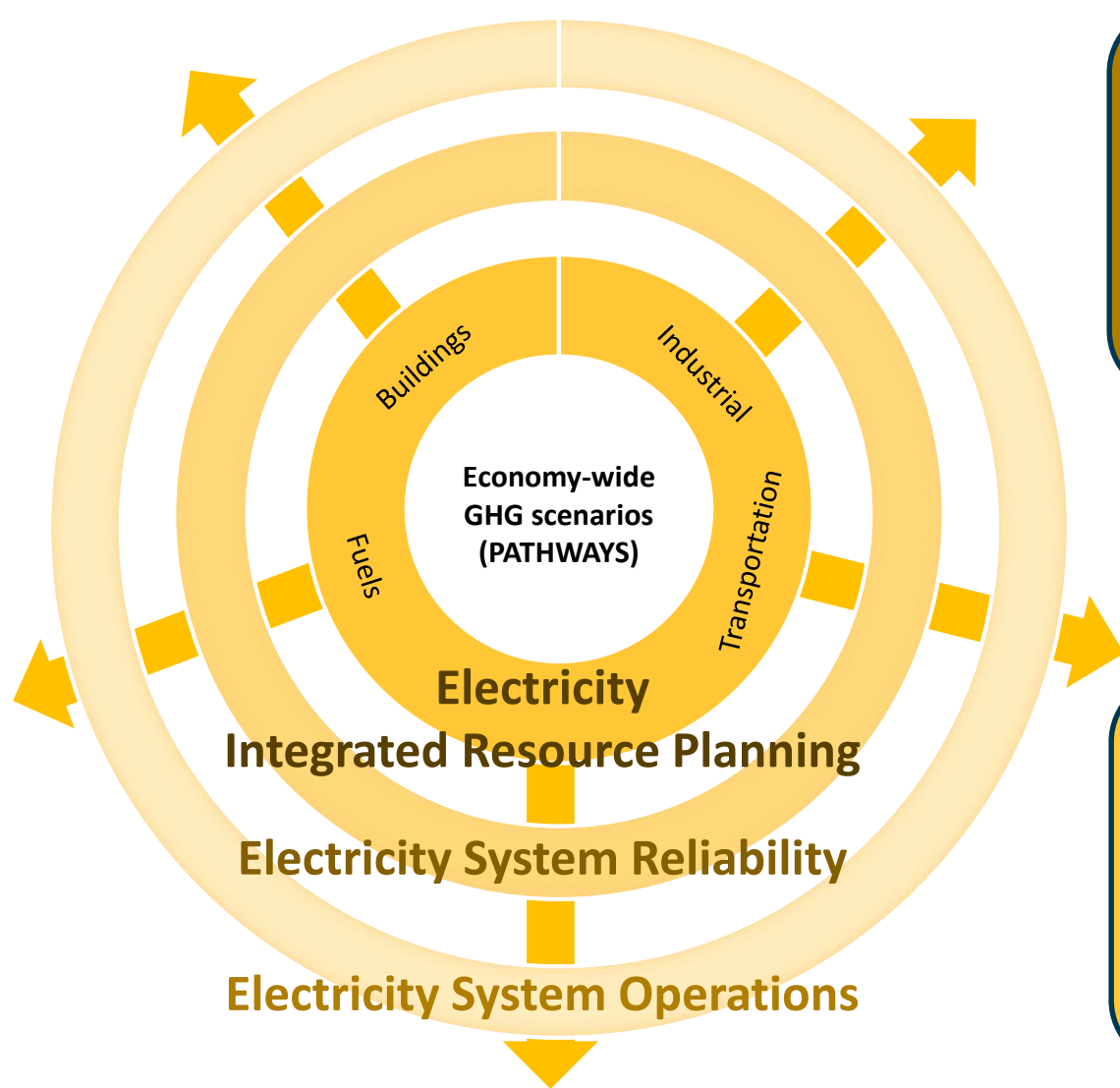
# Quantifying Value of VGI

CEC Vehicle Grid Integration  
Roadmap Update  
October 29, 2018

Eric Cutter, Director  
415-391-5100  
[eric@ethree.com](mailto:eric@ethree.com)



# Economy-wide 2050 GHG Pathways Analysis



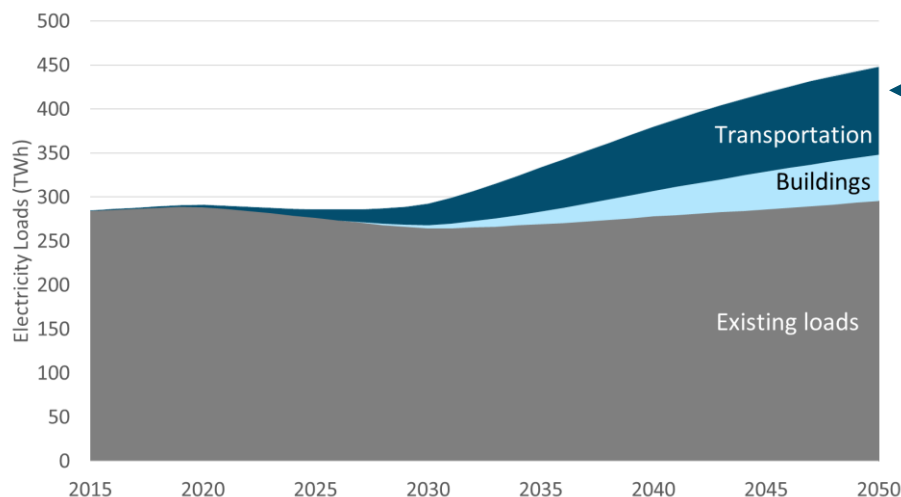
2050 Economy-wide Pathways Scenarios provide direction...

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



# Pathway to 2050 begins with transportation electrification and VGI

California PATHWAYS  
High Electrification with No Hydrogen Scenario



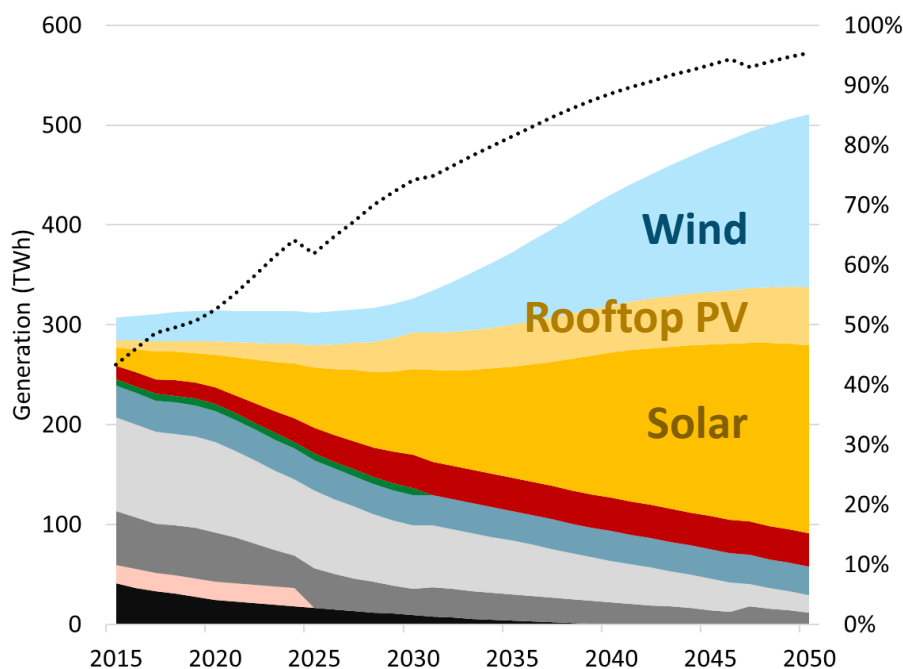
Transportation is first, new flexible load in pathways portfolio...



...establishing business models for flexible building loads to follow...



...enabling increase in variable renewable generation

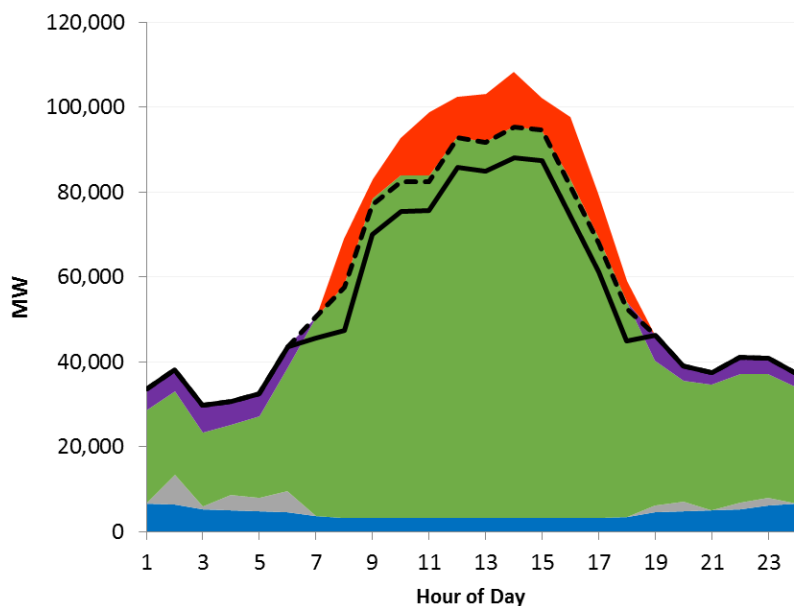




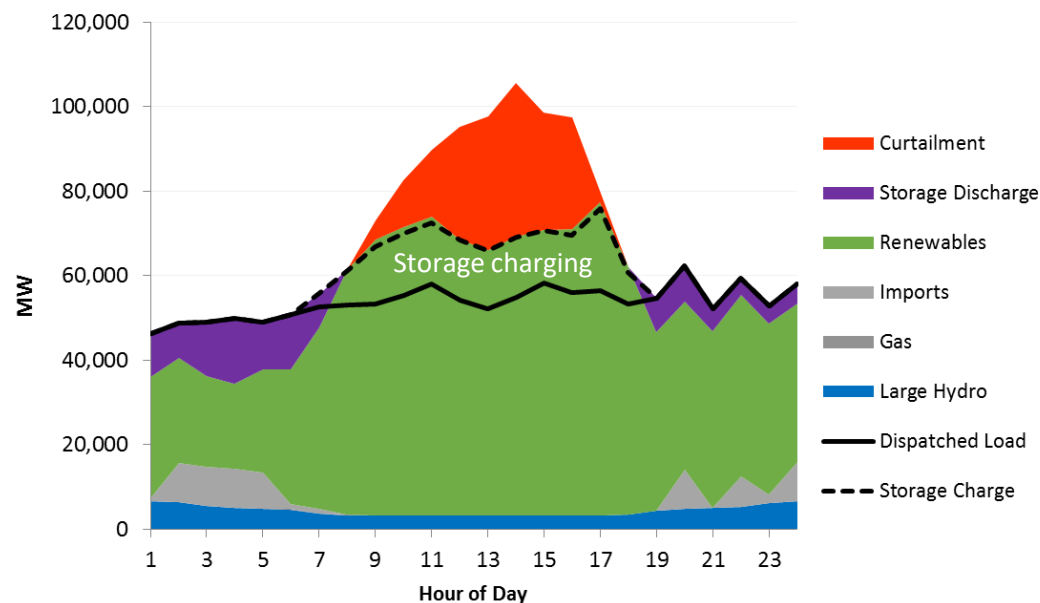
# Flexible loads reduce costs of achieving GHG reductions

2050 Spring Day

High Electrification Scenario



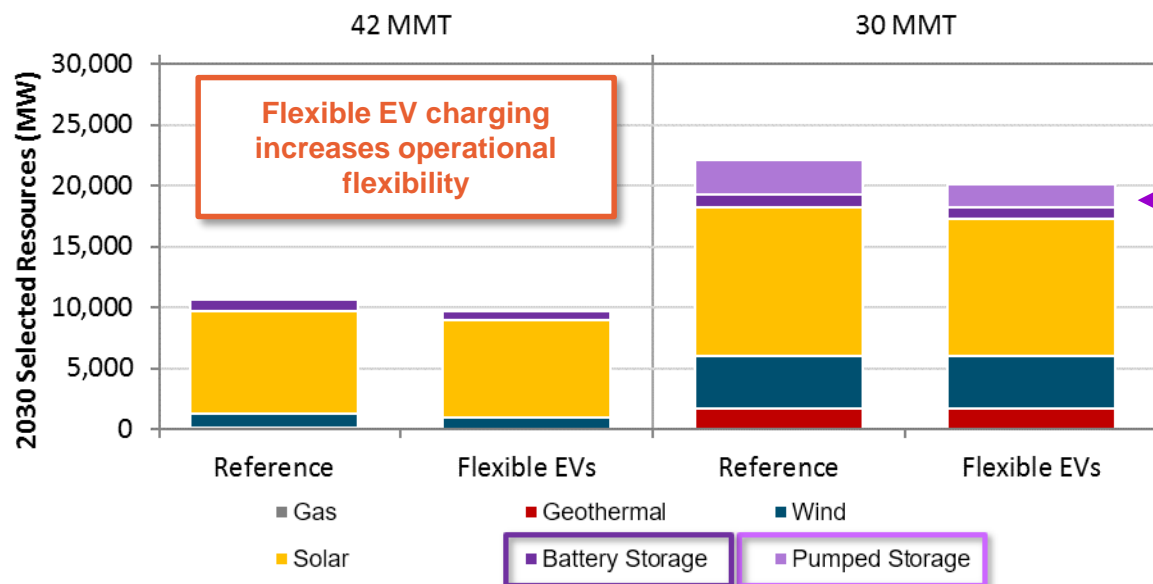
Low Flexibility Scenario



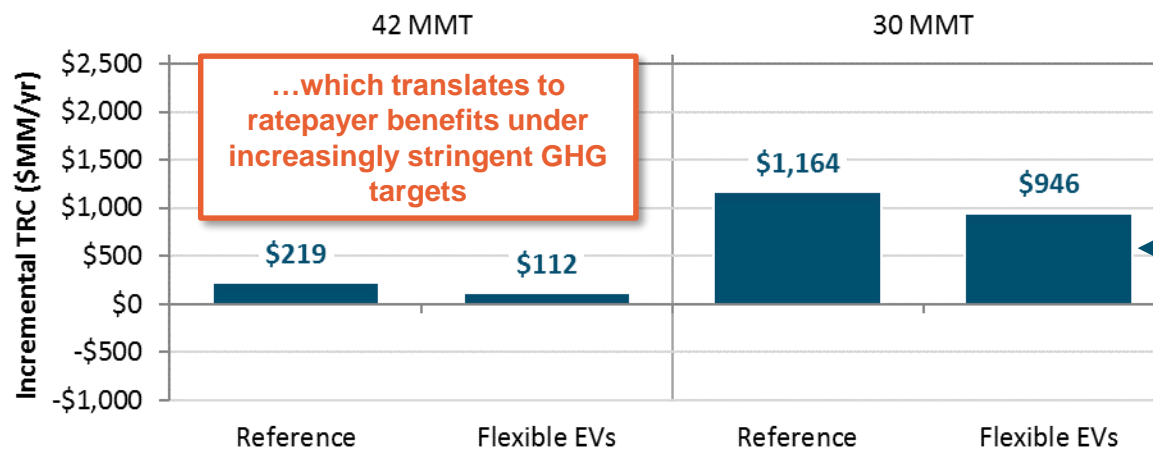
Flexible loads reduce need for energy storage and renewable overbuild



# VGI reduces need for storage



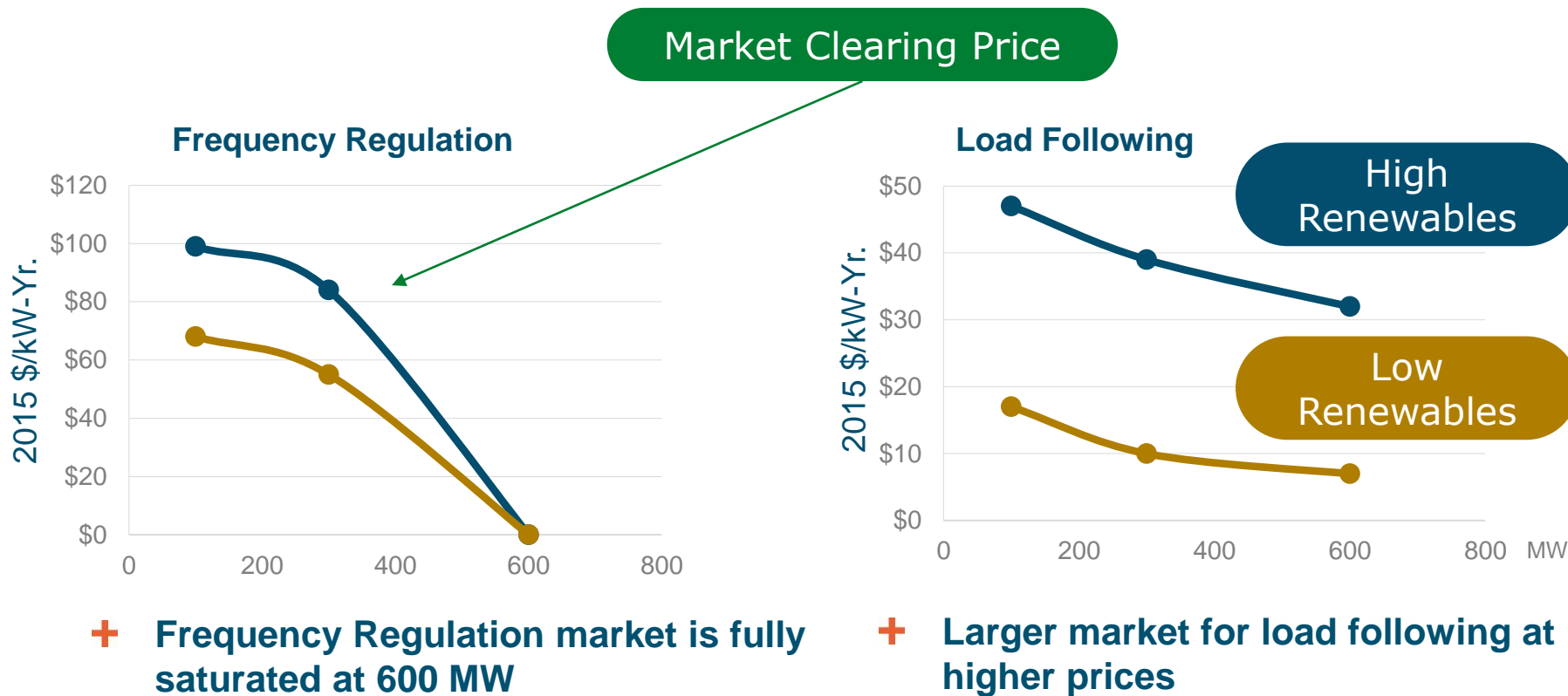
More flexible resources needed for low carbon planning scenarios



Value of VGI measured in reduced portfolio cost to meet GHG target



# Grid demand for VGI

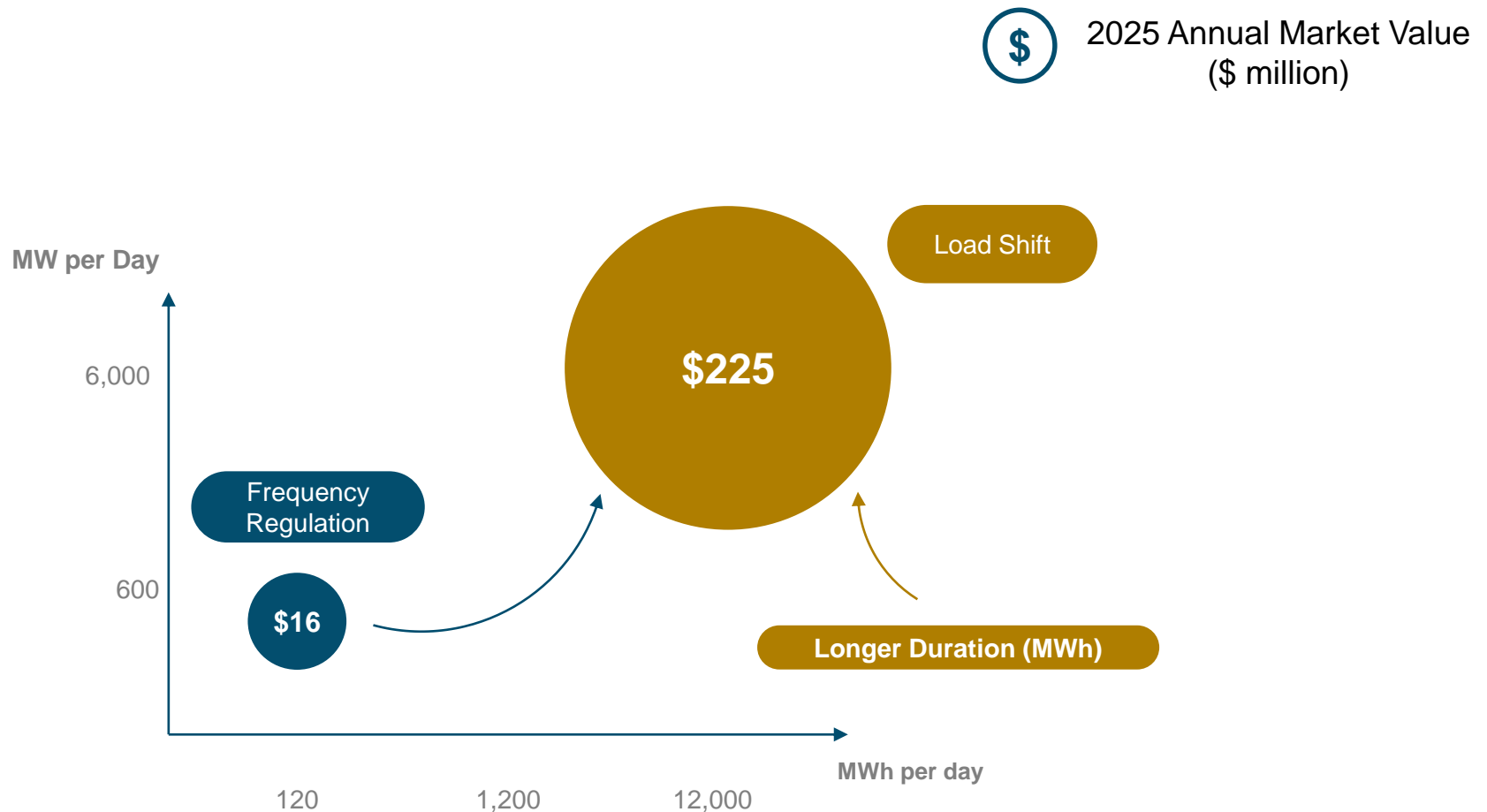


E3 & LBNL modeling for CPUC Advanced DR Potential Study





# Larger market for load shift than for frequency regulation

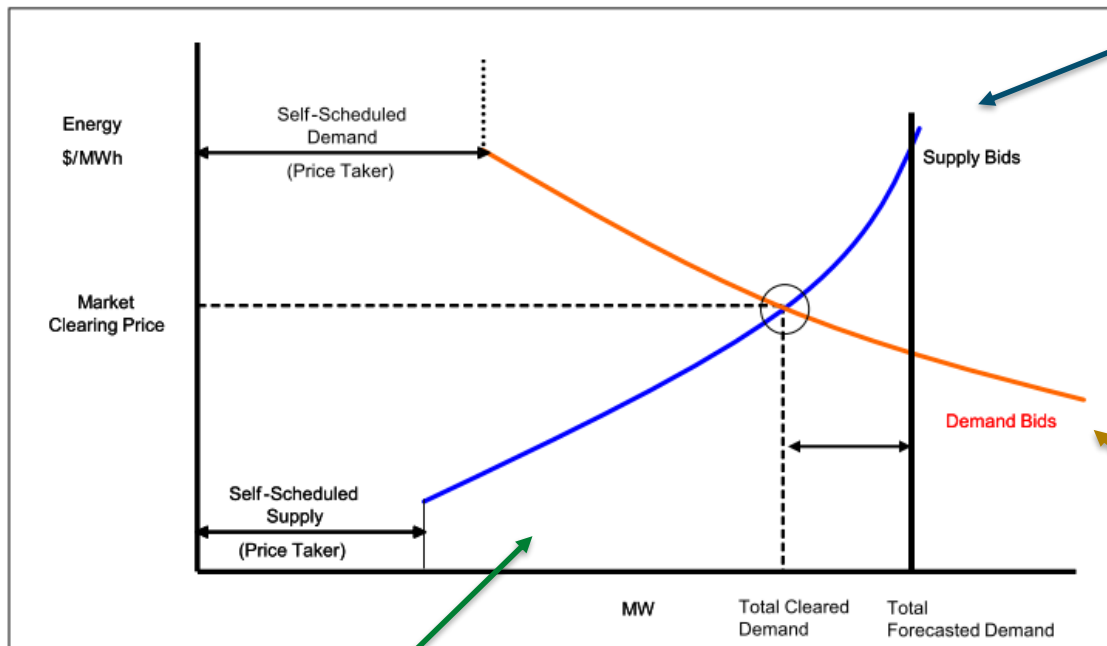


Illustrative estimate of market size and value



# VGI competes with other resources to supply grid demand for reserves

## Market Clearing Price for Reserves



## Supply from VGI



PG&E/BMW iChargeForward Pilot

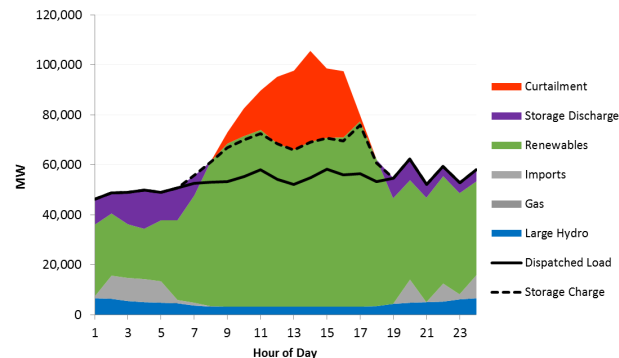
MW  
MWh

## Grid Demand for Reserves

## Supply from other resources



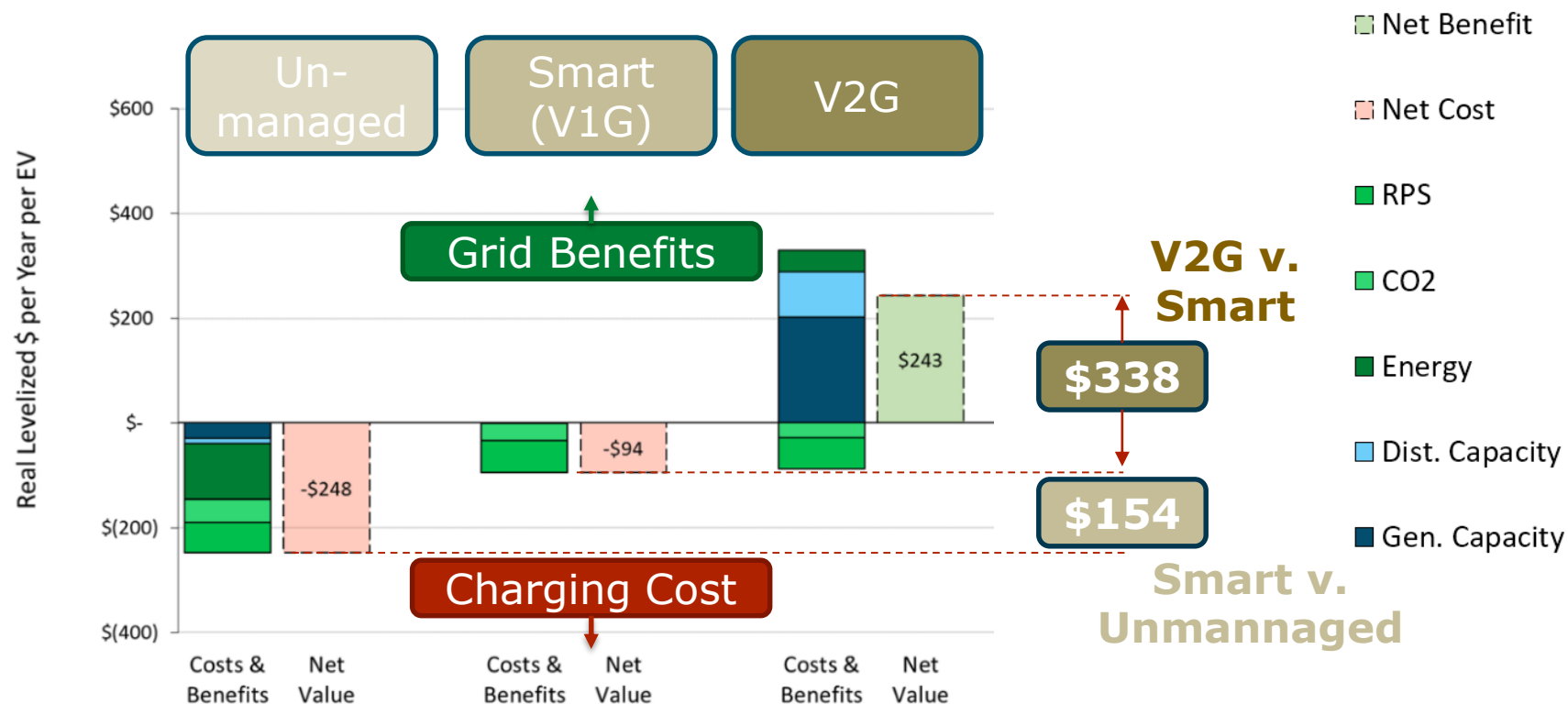
FirstSolar Flexible Solar Dispatch





# Incremental value of VGI

## Incremental grid benefits of V2G (without AS)



EPRI led CEC EPIC "Distribution Aware V2G Demonstration Project"