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# GHG Value of EE for a Zero Carbon Electric Grid

## IEPR Commissioner Workshop on the Role of Energy Efficiency in Building Decarbonization

August 24, 2021

Energy+Environmental Economics

Eric Cutter
Sr. Director – Distributed Energy Resources

# Electrification and Doubling of EE Goal

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# Electrification and EE are key pillars to meet long-term economy-wide carbon goals

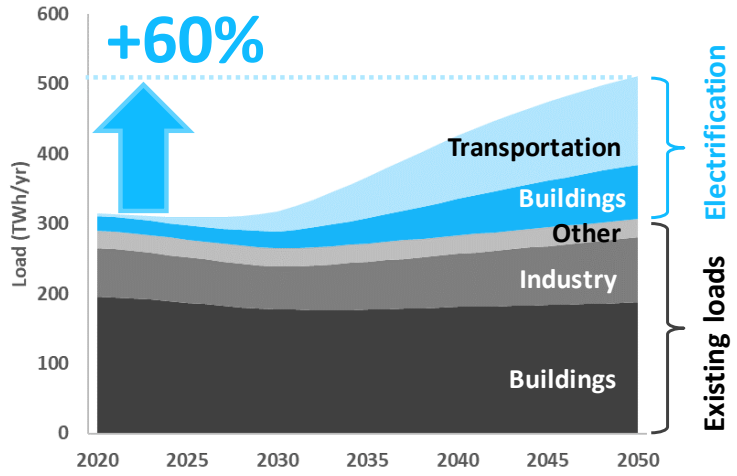
**Energy efficiency & conservation**

**Electrification**

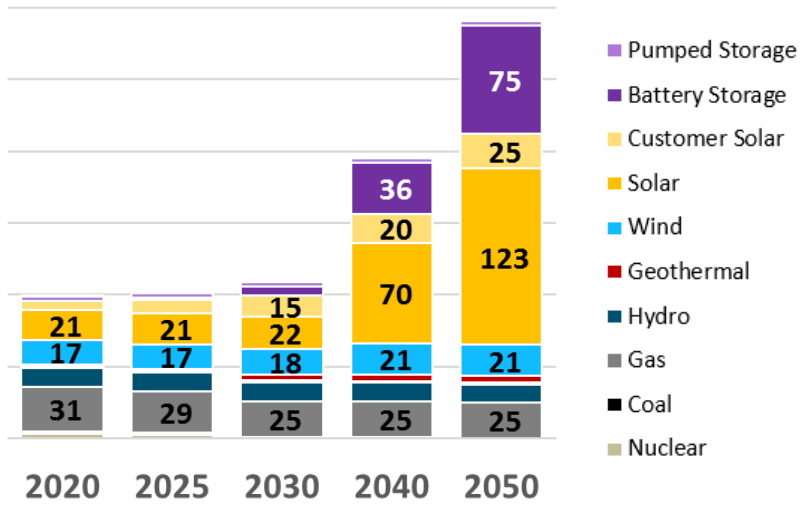
**Low carbon electricity**

**Low carbon fuels**

California Electric Loads under Deep Carbon Reductions




California Electric Resources under Deep Carbon Reductions

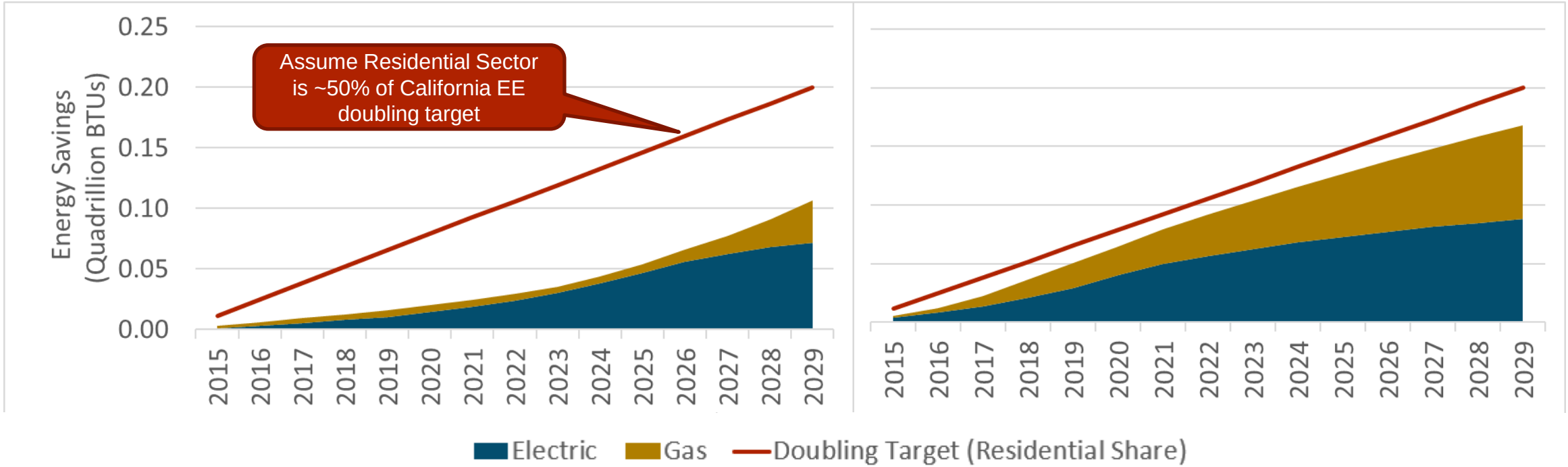



***Electrification and EE play a key role in meeting societal carbon goals in all scenarios!***

# Two Goals: Residential building electrification compared to doubling of EE – Near Term

High Electrification Scenario for Residential Buildings

2019 EE Action Plan for Residential Sector




Illustrative comparison: Residential building electrification energy savings is roughly 60% of aggressive EE portfolio and half of doubling target by 2030

https://www.ethree.com/e3-quantifies-the-consumer-and-emissions-impacts-of-electrifying-california-homes/

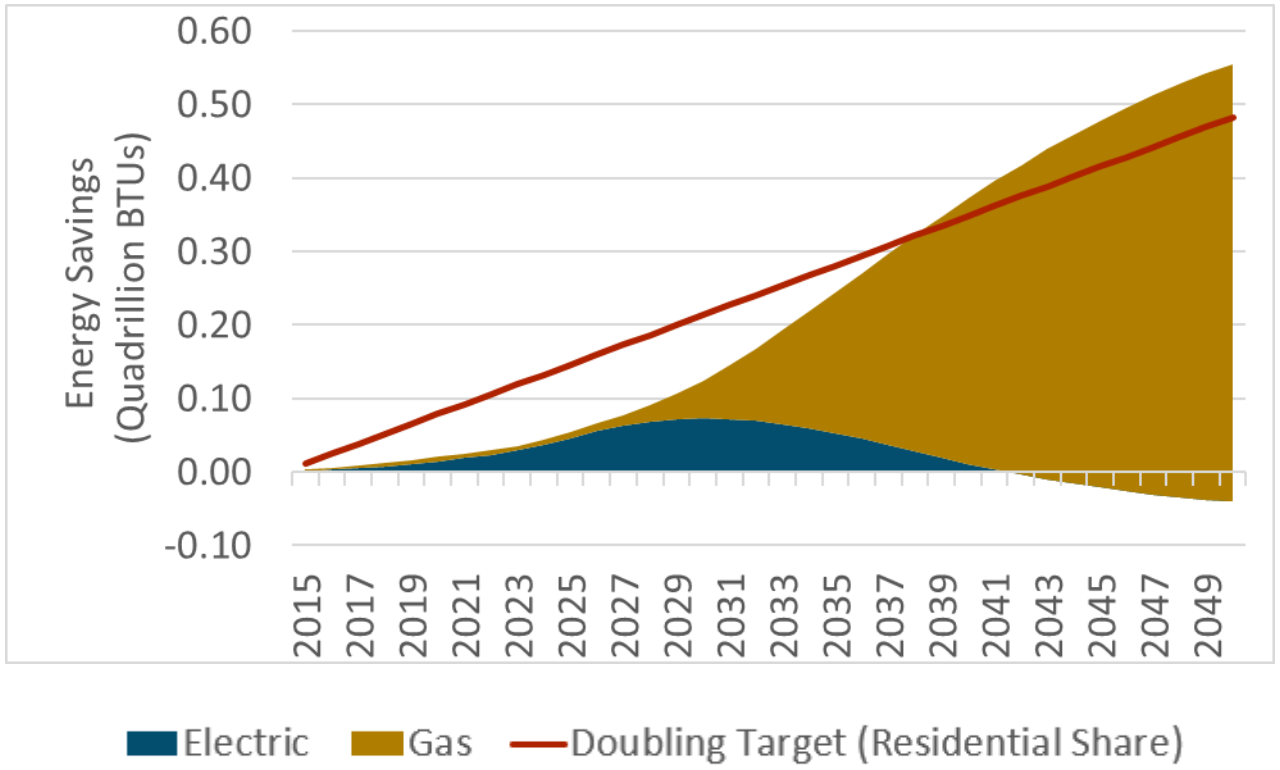
https://www.energy.ca.gov/programs-and-topics/programs/energy-efficiency-existing-buildings

# Two Goals: High electrification can exceed doubling of EE target in long term

**Residential electrification saves electricity in the near term and much more natural gas in the long term**

**By 2040 electrification can exceed doubling of EE target**

**This level of electrification would require additional funding and support for market transformation**

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# Value of Electrification and EE in Zero Carbon Planning

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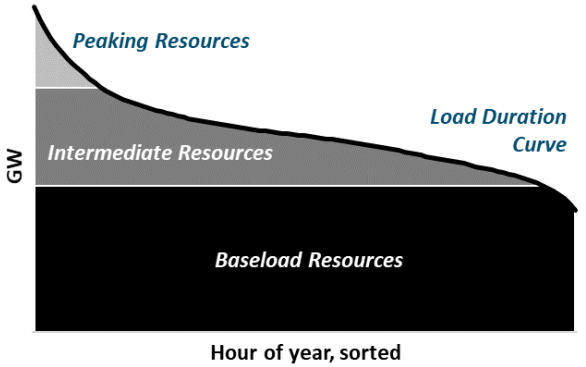
# New planning paradigm

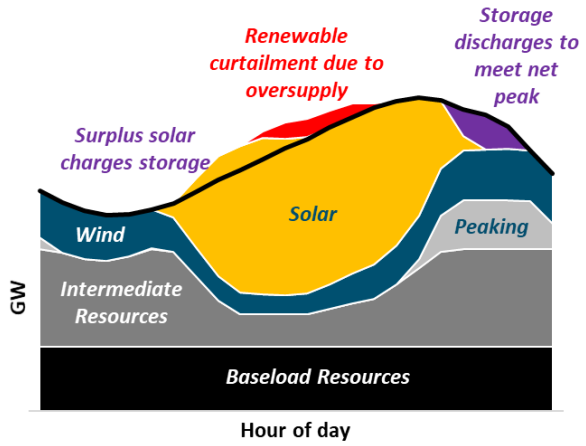
## + Old Paradigm: CCGT/CT is marginal resource

- ~ 60% Variable
- Planning grid for peak capacity
- Focus on efficient grid dispatch
- **Value of EE is reduced marginal cost and emissions of fossil generation**




## + New Paradigm: Solar and storage is marginal resource

- ~ 90% fixed cost
- Planning grid for to meet a given GHG target
- Focus on efficient capital investment and reliable grid operation with renewables and DER
- **Value of EE is reducing the total portfolio cost to meet a given GHG target**

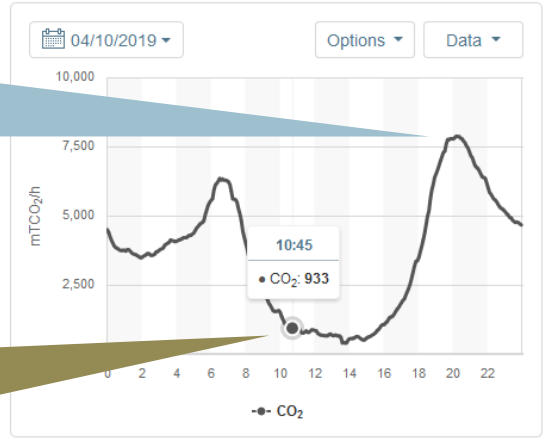



EE can avoid investment in solar and storage

# GHG emissions framework for EE and electrification

## Marginal emissions

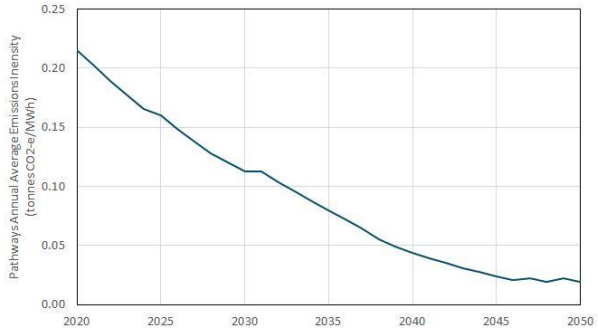
Load shape matters, saving energy on-peak…




… saves more GHG than in the middle of the day

+ **Implementing EE reduces short-run marginal grid emissions**

## Emissions intensity




+ **Over long-run grid emission intensity declines to meet GHG goal**

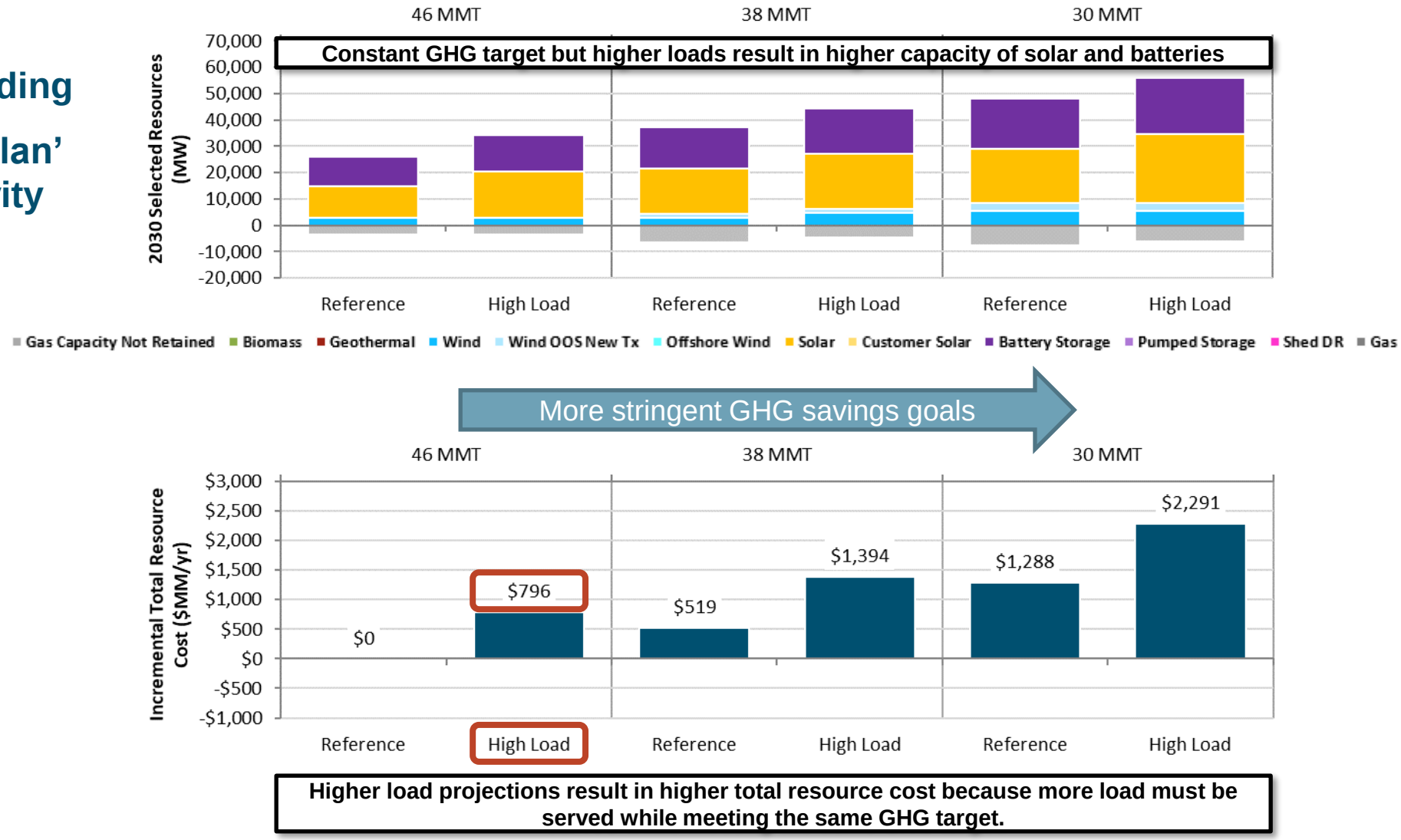
## Portfolio rebalancing

+ **Planned resource portfolio rebalanced regularly to meet grid emissions intensity target**

**GHG target will be met, but portfolio cost will be lower with energy efficiency and electrification**

# Value of EE – Lower portfolio cost to meet GHG target

- CPUC 2019 Integrated Resource Plan Proceeding
- Compare 'Reference Plan' with high load sensitivity
- High load increases portfolio cost by $800 Million/year in 46 MMT case



# Impact of Load Shape (illustrated with EVs)

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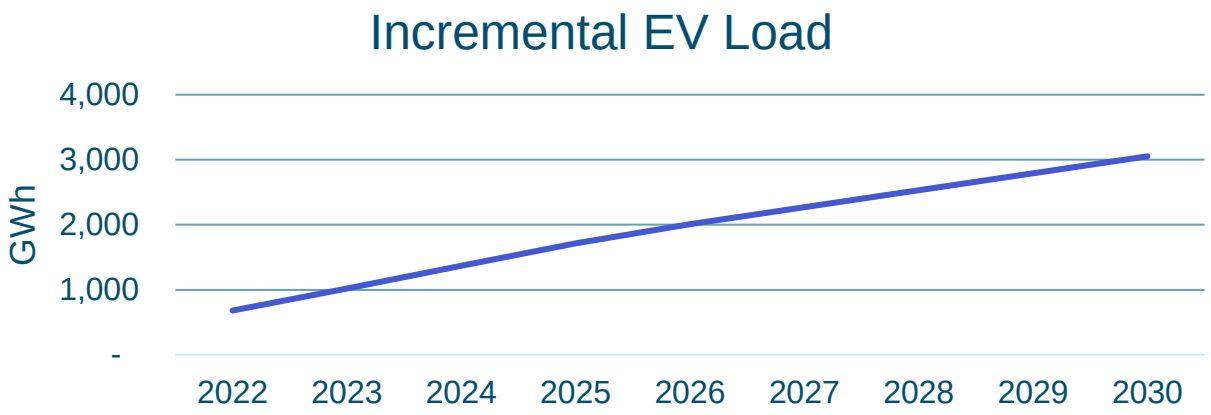
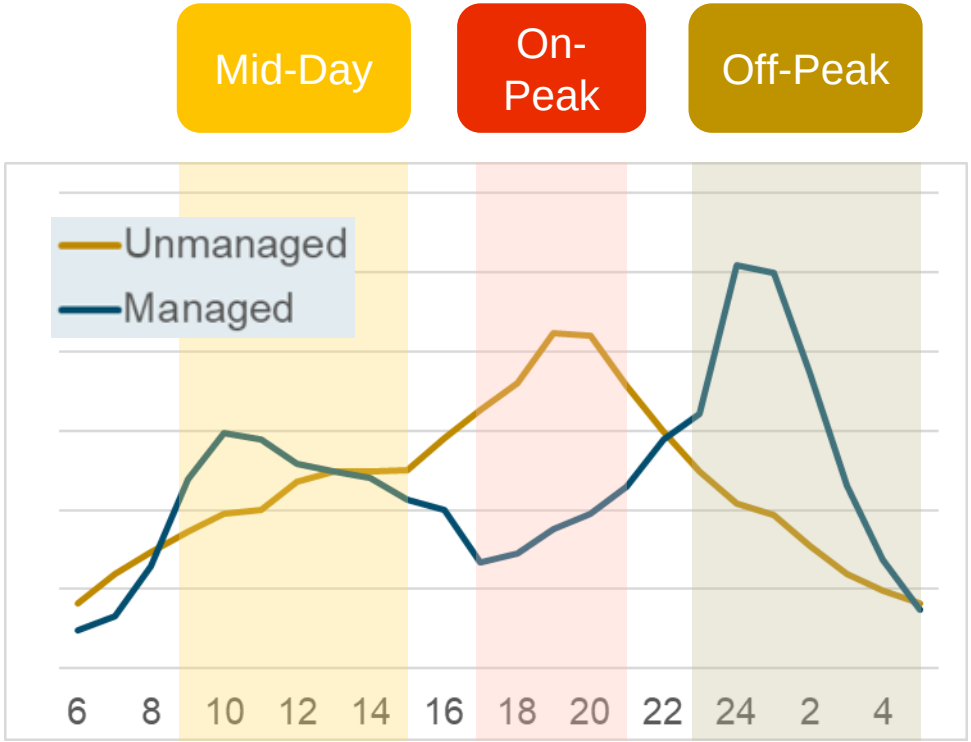
# 2019-2020 CPUC IRP modeling of EV load

- **IRP models least-cost portfolio to meet reliability and clean energy targets**
- **38 MMT Preferred System Plan (PSP) including ~4 Million EVs in 2030**
  - 2020 CEC IEPR Load Forecast
- **Two high EV scenarios (8 million EVs by 2030)**
  - Managed Charging
  - Unmanaged charging



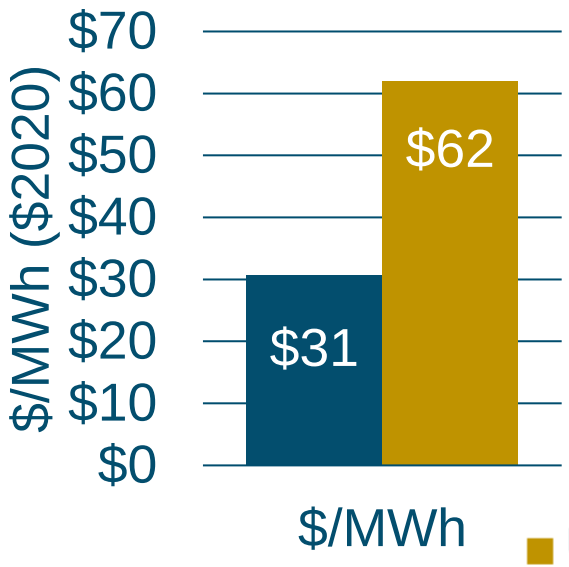

Light Duty Vehicle Charging Shapes



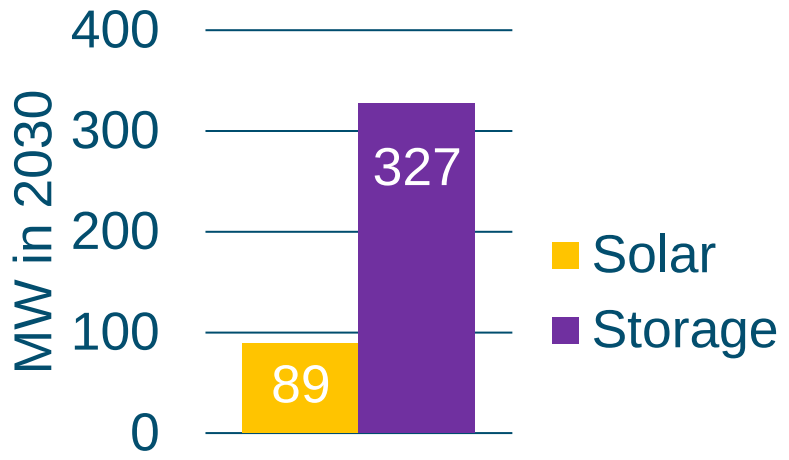

*https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2019-20-irp-events-and-materials*

# CPUC IRP - Incremental cost of high EV scenario

- **Calculate incremental cost of high EV scenario above preferred system plan through 2030 ($2020)**
  - Utility Revenue Requirement (RRQ)
- **With managed load shape, incremental cost is $323 million at a levelized cost of $31/MWh**
- **With unmanged load shape, costs double to $652 million at a levelized cost of $62/MWh**
- **Unmanged load shape requires additional 89 MW of solar and 327 MW of storage in 2030**








Additional solar and storage required in 2030 for unmanaged EV charging shape

# Thank You

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# Translating to $/Ton

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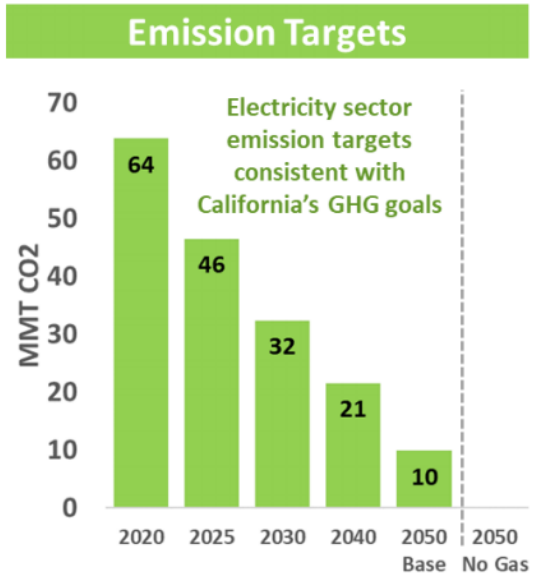
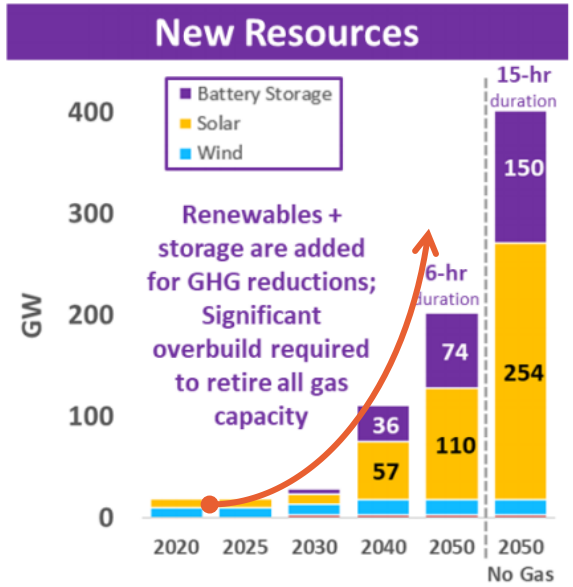
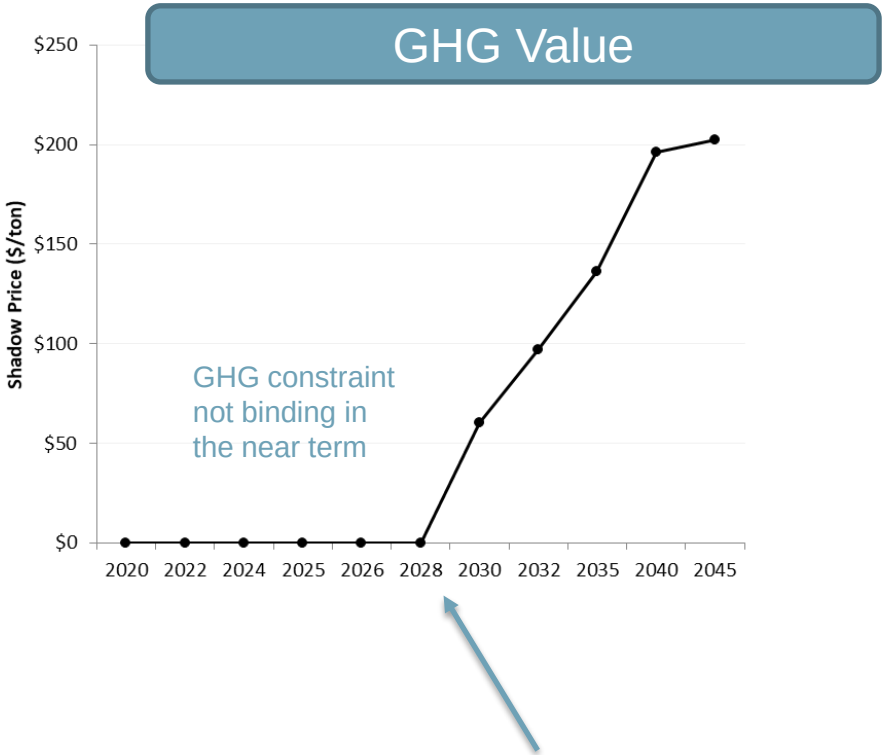
# Translating IRP modeling to $/ton value

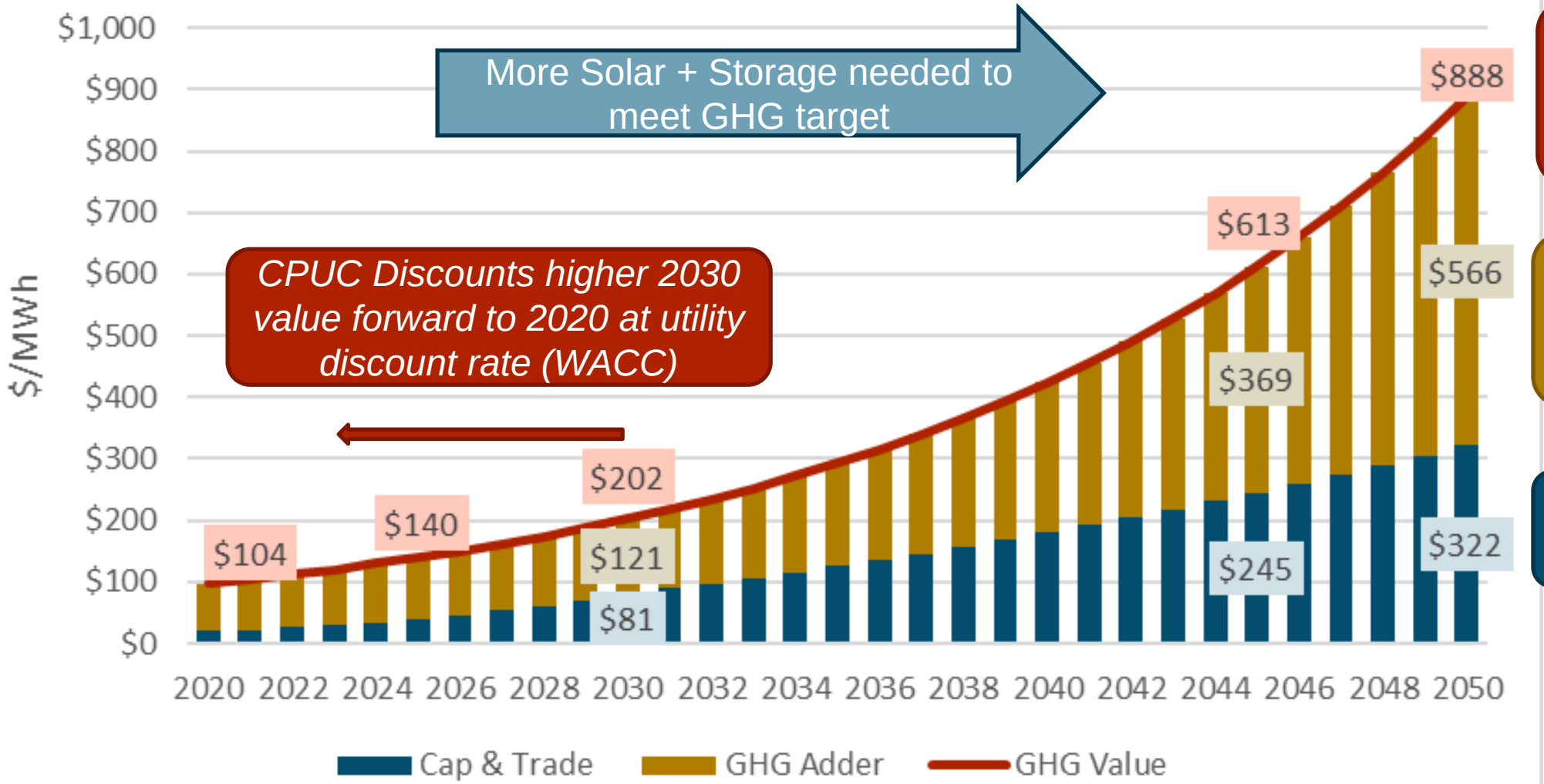



- **Marginal solar + storage resource cost in capacity expansion modeling sets the 'shadow price' for GHG emissions (**When GHG targets are 'binding'**)**
- **Shadow price for GHG tends to be low in near-term because renewables in resource portfolio exceed near-term GHG (and clean energy) targets**

# 2020 CPUC GHG Avoided Cost Value




Electric Sector GHG Abatement Cost

Electric Sector GHG Adder

Economy-wide Cap & Trade