Energy+Environmental Economics

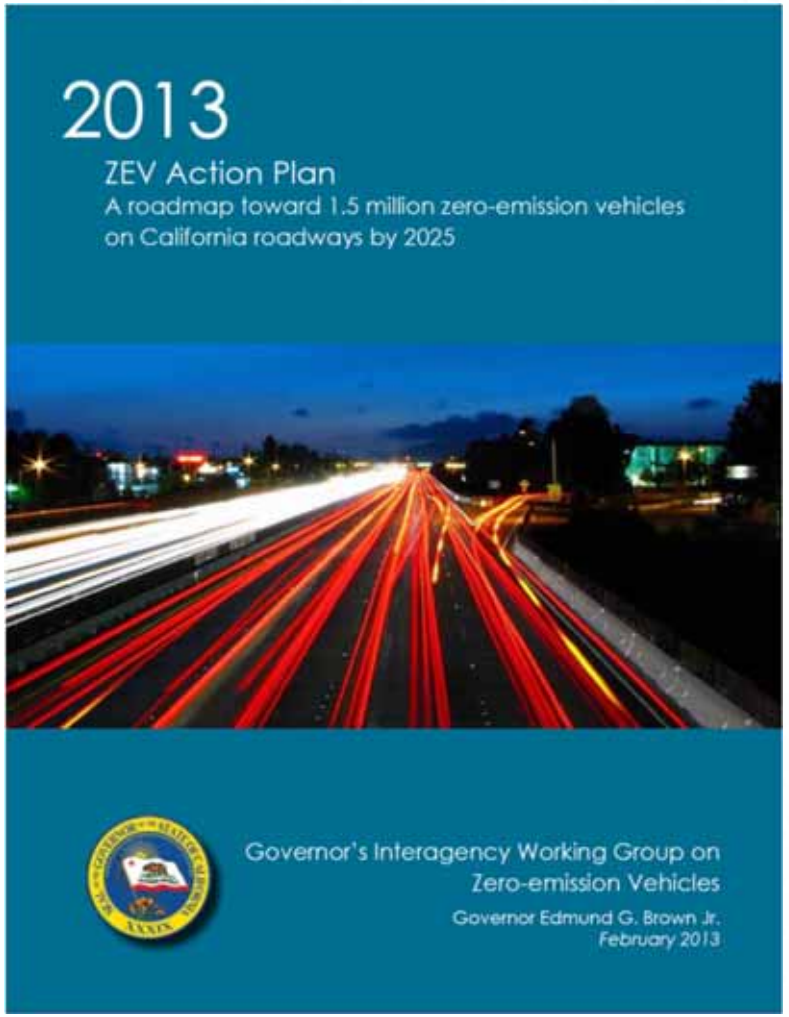
Promoting Plug-in Vehicles

Reduce GHG and electric rates

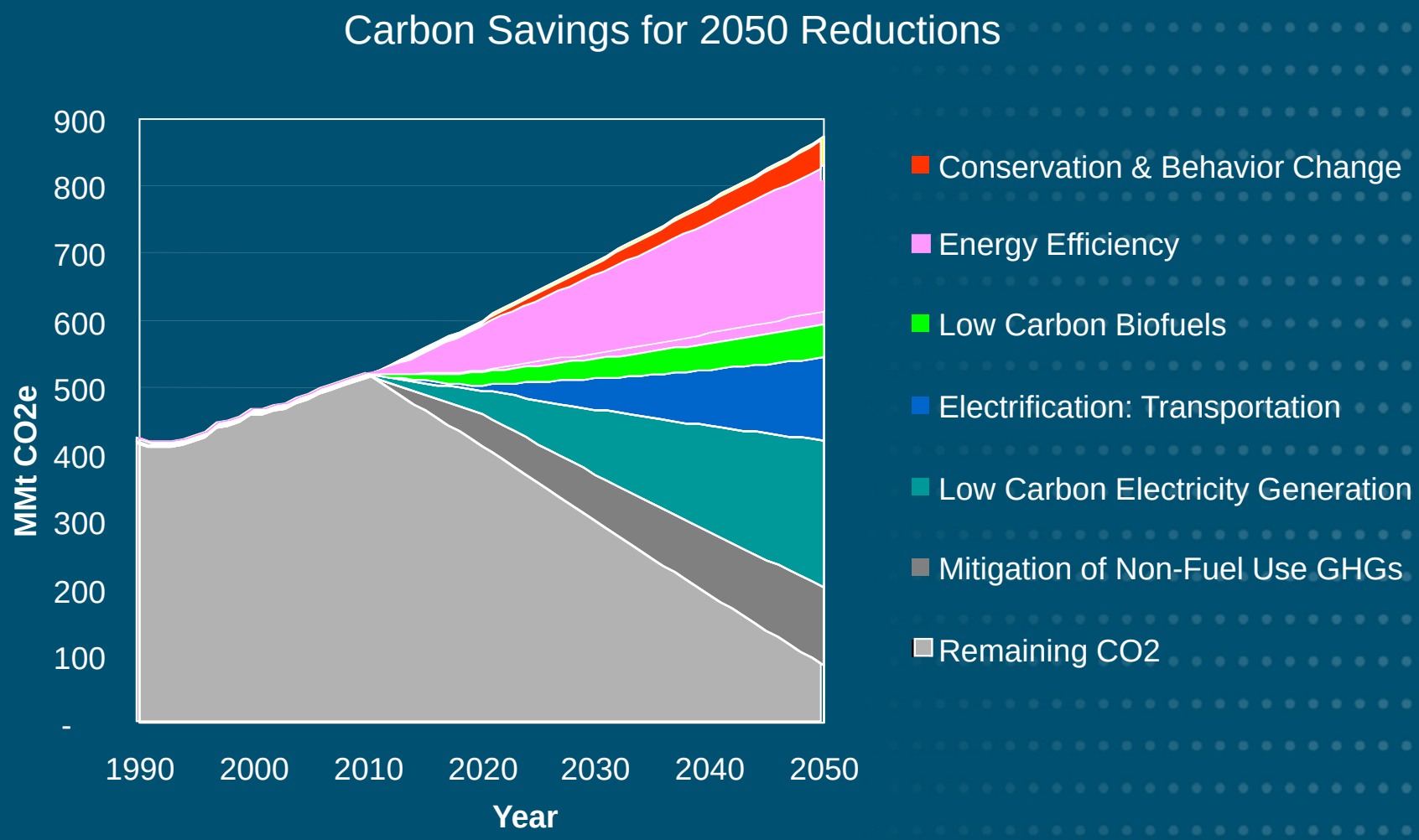
Snuller Price, Partner
Eric Cutter, Senior Consultant

State Interest in EVs

- **2013 ZEV Action Plan**
  - 1.5 million by 2025
- **ZEVs are necessary to meet the 2050 GHG targets**
- **State needs utility support of plug-in vehicle policies**
- **E3 believes there is now an opportunity to really push the plug-in market**
  - Viable PEVs on the market
  - Electricity getting cleaner
  - Utilities need off-peak load



Reducing carbon in 2050



Zero-carbon electricity generation is the dominant energy source in this 2050 economy. The constraints on other low-carbon resources drive low-carbon electricity to be the fuel of choice.

Source: Energy and Environmental Economics, Inc 2009

How do we transform the market?

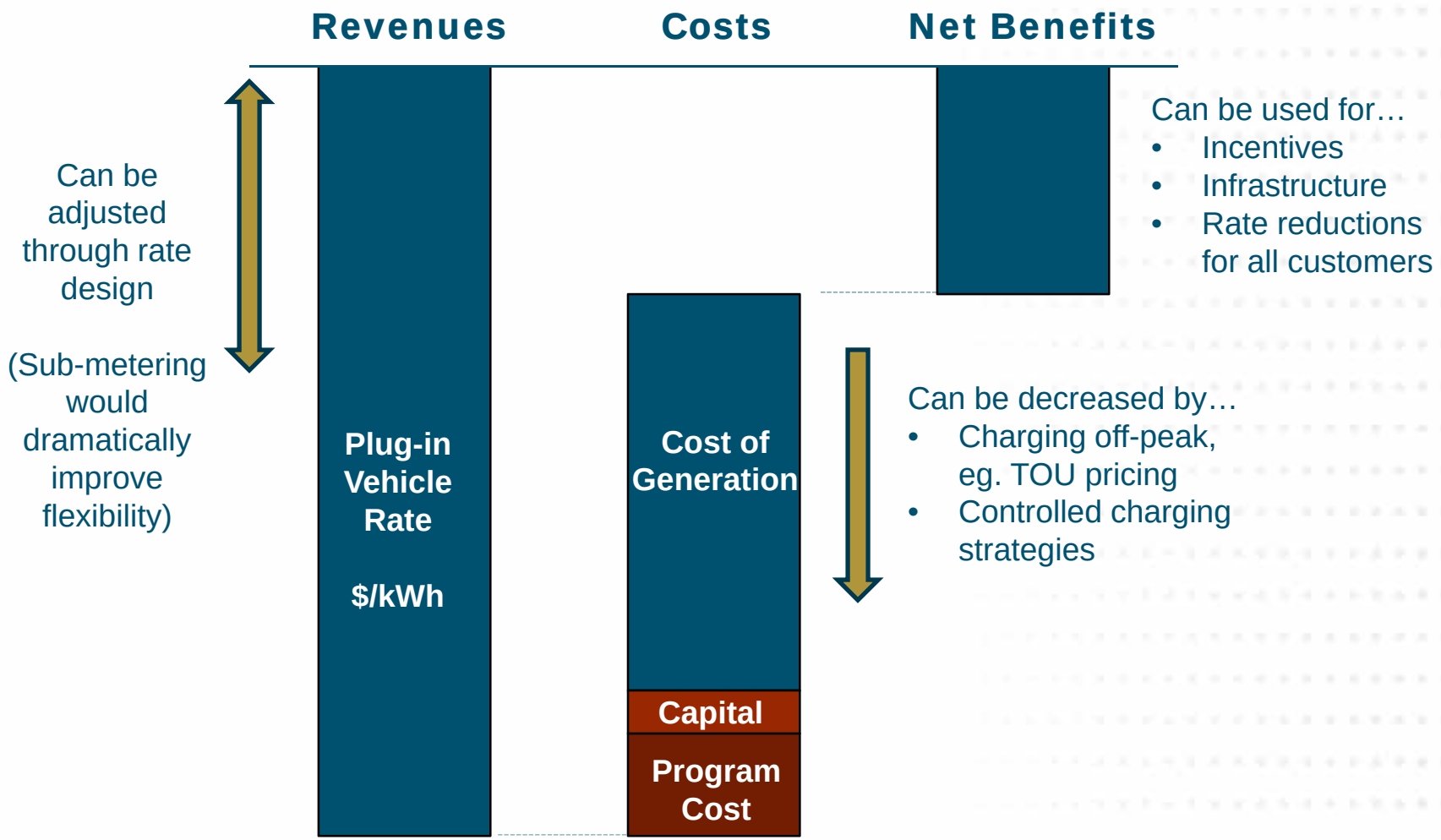
#1 Provide incentives to reduce the upfront cost of the plug-in vehicles to the consumer

- Incentives that can be funded by utility ratepayers fall into three categories which can be used in combination
  - Ratepayer benefits (incentive is collected back from grid benefits)
  - Participant funding (upfront incentive is collected back over time in the plug-in vehicle rate)
  - Market transformation subsidies (similar to CSI)

#2 Encourage the availability of charging

- Develop multi-family infrastructure strategy
  - Building standards, incentives to landlords, or utility construction

Benefits of EVs to Ratepayers



Example – NPV of Ratepayer Benefits

- **At plug-in charging rates of $0.10/kWh to $0.20/kWh, revenue neutral ratepayer costs can range from $1,000 to $3,000 per vehicle**
- **At this electricity charging cost, plug-in vehicles still save plug-in owners ~$1,000**

	Low Rate	Med Rate	High Rate
Off-peak Rate $/kWh	$ 0.10	$ 0.12	$ 0.20
Off-peak Cost $/kWh	$ 0.05	$ 0.05	$ 0.05
Difference $/kWh	$ 0.05	$ 0.07	$ 0.15
CTF $/Year	$ 183	$ 256	$ 548
7 year NPV $	$ 950	$ 1,330	$ 2,850
Gasoline Savings	$ 1,579	$ 1,579	$ 1,579
Plug-in Electric Cost	$ 365	$ 438	$ 730
Plug-in Savings	$ 1,214	$ 1,141	$ 849

Assumptions

Discount Rate	8%
Gasoline Cost	$3.75
miles / kWh	3
conventional miles/gal	26
kWh/day	10
kWh/year	3,650

Transformation in Phases

+ Early Path

- Provide ratepayer funded incentive to reduce upfront cost of vehicles to increase adoption, funded by net system benefits
- Use TOU pricing (or a simple load-control signal) to encourage super-off peak charging with simple timers or onboard charge controllers in the vehicles

+ Mid Term

- Expand charging availability for multi-family and workplace charging through (a) new construction standards, (b) incentives and (c) possibly utility 'make ready' construction
- Transition to using system benefits to lower retail electric rates

+ Long term

- Expand charging infrastructure for 'range anxiety' of pure EVs
- Create dynamically controlled charging for additional grid benefits after significant plug-in vehicle penetration is achieved

Plug-in Hybrids in Early Phase

- **In near-term PHEVs ideal transition strategy**
  - No range anxiety
  - Need only level 1 charging
  - Very low cost of infrastructure upgrades with off-peak charging
- **Infrastructure needed for PHEVs**
  - Existing distribution largely can accommodate PHEVs, particularly with night time charging
  - Multi-family charging locations (landlord / tenant problem)
  - Public charging stations helpful, but not as critical for vehicle purchase

Summary

- **Plug-in vehicles are important to achieve California's long-term CO2 goals**
- **Increased use of existing electricity grid in the off-peak produces benefits that can be used to transform the market or reduce rates for all customers**
- **Implementation: Keep it simple**
  - Upfront incentives, TOU pricing and/or simple load control in the near term
  - Expand charging access, in particular in the multi-family segment