# DOE Grid Impacts Workshop

## March 13, 2007


## Dean Taylor

## Southern California Edison



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# SCE leadership

- Operate nation's largest and most successful EV fleet
  - 14 million EV miles – almost 300 EVs
- Prototype testing (light duty PHEV Sprinter, medium duty PHEV bucket truck, heavy duty HEV bucket truck, Hydrogen & Fuel Cell vehicle program)
- 2003 – built first "proof-of-concept" heavy duty PHEV utility "boom truck"
- Proactive fleet (on & non-road) deployment of alt-fuel vehicles for compliance with the EPAct fleet mandates
  - Meeting the majority of future compliance with "electro-drive"
- Operate nationally renowned EV Technical Center – including testing EVs for DOE throughout 80s and 90s.
- PR, community outreach, Tech Center tours, Conferences, etc
- Co-founder of ET programs at EPRI, EDTA, and CalETC
- Peak load shifting programs


ELECTRICITY... SUSTAINING OUR TRANSPORTATION FUTURE

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# Overview

- We don’t see major grid issues because
  - Expect mostly 120 V  PHEVs  at 1.2 to 1.4 kW
  - This is similar to other appliances
  - PHEV adoption rate is expected to allow utilities to add PHEVs to our normal distribution planning process. (5/10 year plan done annually)

- While there could be significant peak loads with millions of PHEVs, this can be mitigated
  - Many tools are available today to handle peak load issues
  - Smart meters and other tools available in future.

- Potentially many benefits to the grid or the home
  - Increasing use of off-peak power plants
  - Ability to use nighttime wind
  - Short-term  - up-to-the-meter benefits  (e.g. emergency back-up power, interfacing with solar, and peak shaving for the home)
  - Long-term  - past-the-meter  (G2V  and V2G )
    - doubtful value at 1.2 kW per PHEV  (cost for interface and communication)


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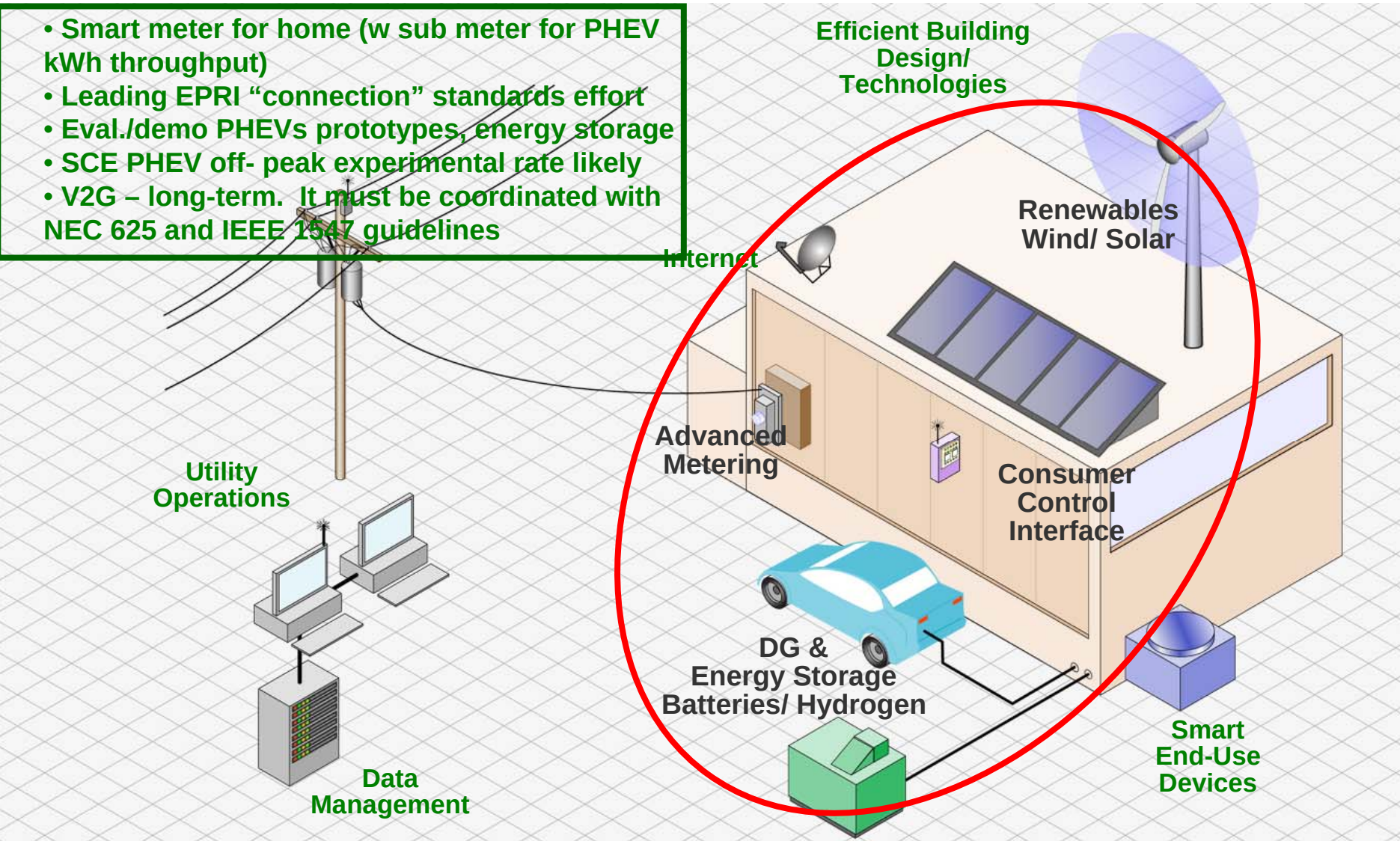
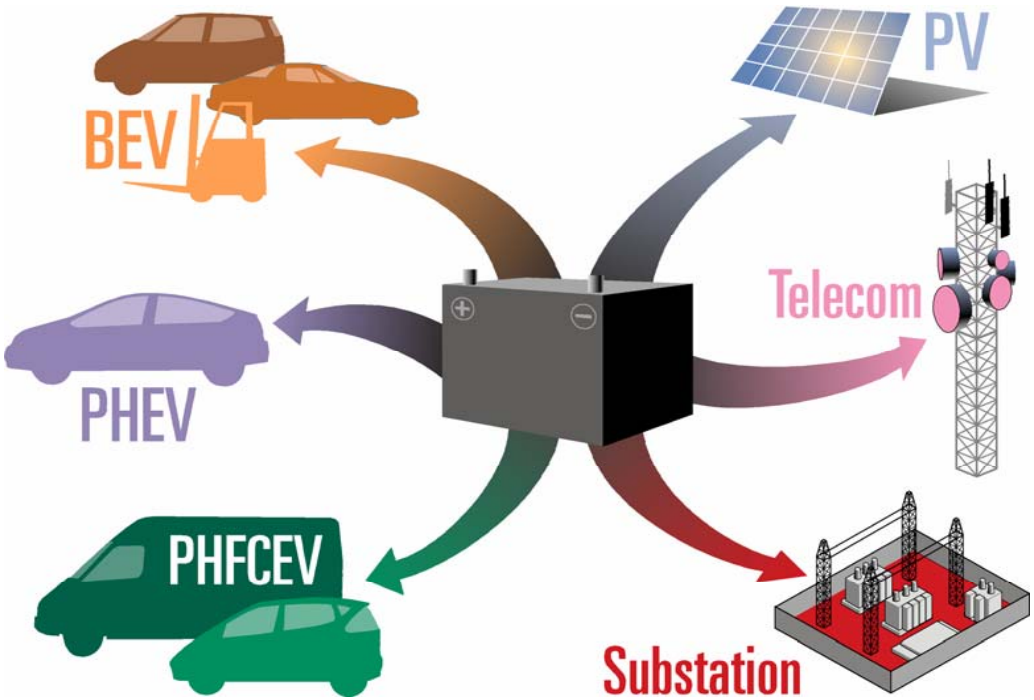
# SCE - Focus Today- PHEV – Home Connection

- Smart meter for home (w sub meter for PHEV kWh throughput)
- Leading EPRI “connection” standards effort
- Eval./demo PHEVs prototypes, energy storage
- SCE PHEV off- peak experimental rate likely
- V2G – long-term. It must be coordinated with NEC 625 and IEEE 1547 guidelines



# SCE's Vision- Near Term Energy Batteries




- Integral to "Energy System" of future (mobile & stationary)
- Address incumbent shortcomings (size, weight, thermal management, maintenance etc)
- Remote monitoring/ communication capabilities
- "Power" batteries today exceed performance/life expectations
- "Energy" battery challenges (PHEV duty cycle, calendar life)

Note – potential for both new and "used" batteries.
Separate issues surrounding both.

# Role for DOE – National Lab Research Together with EPRI and the utilities

## Grid impact research needs:

- Population of dwellings with 15 amp vs. 20 amp circuits
- Population of dwellings with 15 amp dedicated vs. 15 amp non-dedicated circuits
- Better understanding of access to an 120VAC outlet at houses, condos, apartments, work and elsewhere
  - HEVWG study consultant estimated based on survey data that 95% of those who live in houses and 60% of those who live in apartments have relatively easy access to a plug.*
  - Other recent studies present other data
- Better understanding of consumer demand for charging at work in the mornings.
- Where are the priority needs for opportunity charging of PHEVs (if any)?

*page 5-5, HEVWG 2001

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# Safety and Power Quality Are Issues to Address

**Safety is going to be an important issue**

- Home ventilation specifications should be developed
- An interlock method similar to that incorporated on pure EVs should be installed to prevent operation while the vehicle is still plugged in to the grid
- State and local fire marshals will need training – (just like 10 years ago with pure EVs
- Emergency response training will be needed

**Power Quality (PQ) is also important**

- PQ is a major factor in the stability and reliability of the national and regional electrical grids.
- Both transients and harmonic distortion can impose detrimental impacts on neighboring customers and the grid.
- The PQ impact is important to understand, especially at aggregated volumes of PHEVs and chargers from a variety of manufacturers.


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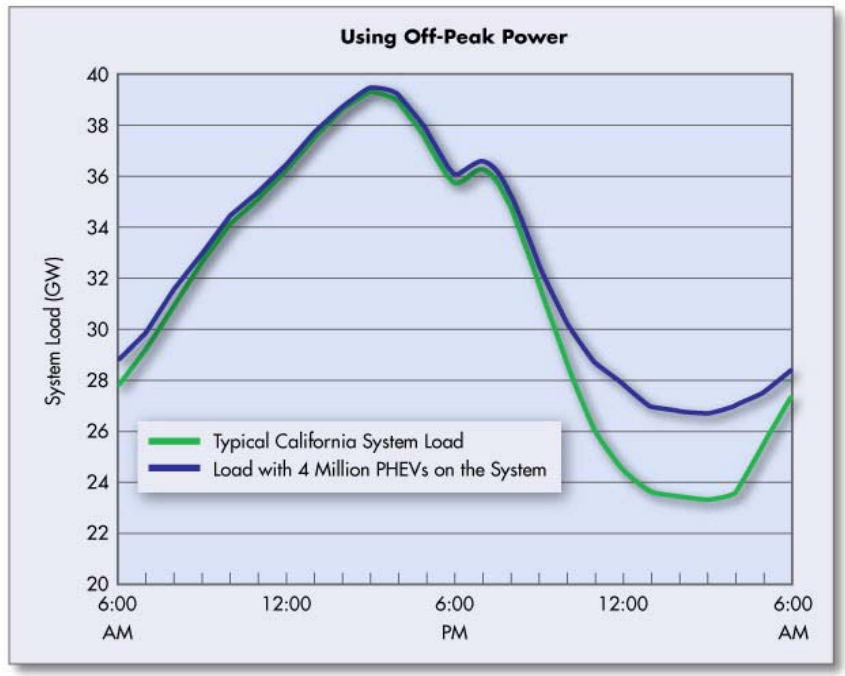
# Benefits Of “Fueling” From The Grid

**Energy Security/Environment**

- Domestic, petroleum free
- Existing excess capacity off peak (typically)
- 30-50% cost of a gallon gasoline equivalent (gge)
- Generation cleaner over time

**Utility**

- Asset utilization (efficiency and filling in night time valley)
- Increased utilization of renewables
- Downward pressure on rates? (fixed costs over more customers)

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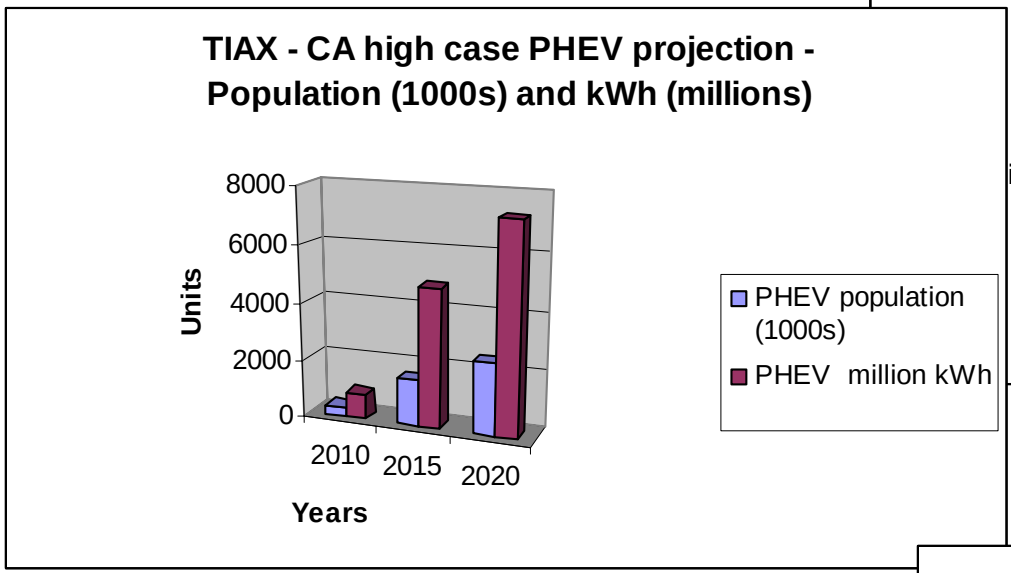
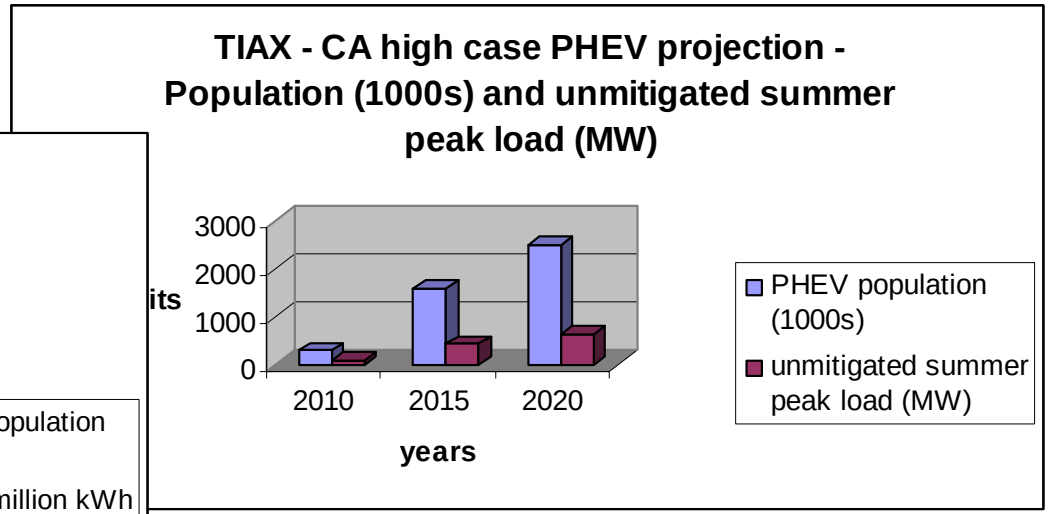
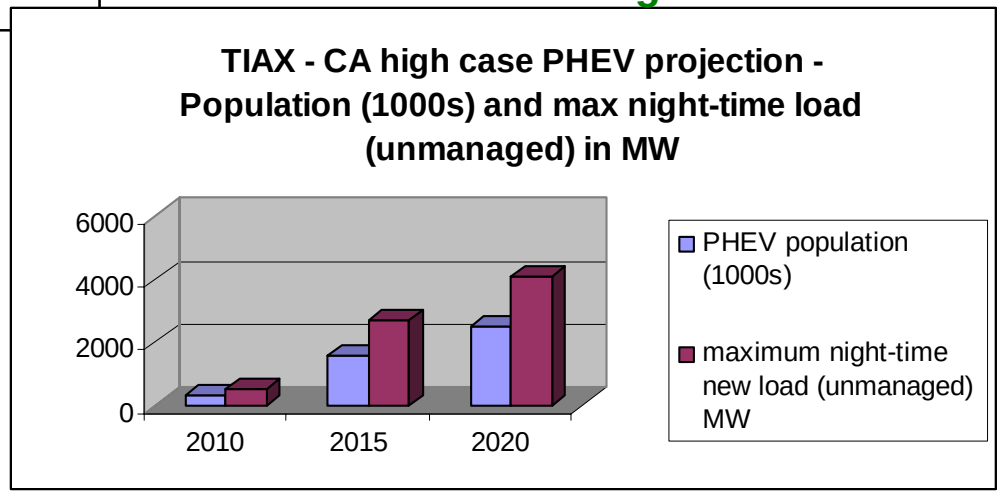
# Technology can prevent a worst-case 600 MW summer peak load for PHEVs in CA




**TIAX also looked at worst-case grid impacts and environmental benefits of 18 other ET technologies**

Unmitigated worst-case: 2020 = 650 MW peak, 4125 MW max off-peak, 7200 million KWh from 2.5 million PHEVs in California




Source: TIAX Oct 2005

# Summary

- **Planning for PHEVs on the utility grid is normal part of our business.**
- **We don't see major grid issues.**
- **Mitigating peak loads is standard practice for SCE**.
  - SCE has demand response and load shifting programs that can shed over 2000 MW.
  - SCE has done this for years for our large customers with non-road EVs
    - For example, in 2002 we implemented over 9 MW in peak load shifting
    - Since then we provided recommendations to over 200 customers resulting in 15 MW of peak load shifting upon implementation.
- **While there could be significant peak loads with millions of PHEVs, this worst case scenario can be prevented.**
- **There are potentially many benefits to the grid.**
- **Utilities should work through EPRI on**
  - Codes, standards and best practices (e.g. National Electrical code changes).
  - Large scale PHEV demonstration programs with auto and truck makers
  - Understanding market trends
  - Emissions studies
  - Developing even better ways of metering, interrupting, or managing the PHEV load.
  - Understanding the grid impact and emissions reduction potential of PHEVs, truck stop electrification, port electrification, and non-road EVs.
  - Advanced batteries in stationary and mobile applications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