Electric Drive Transportation Markets

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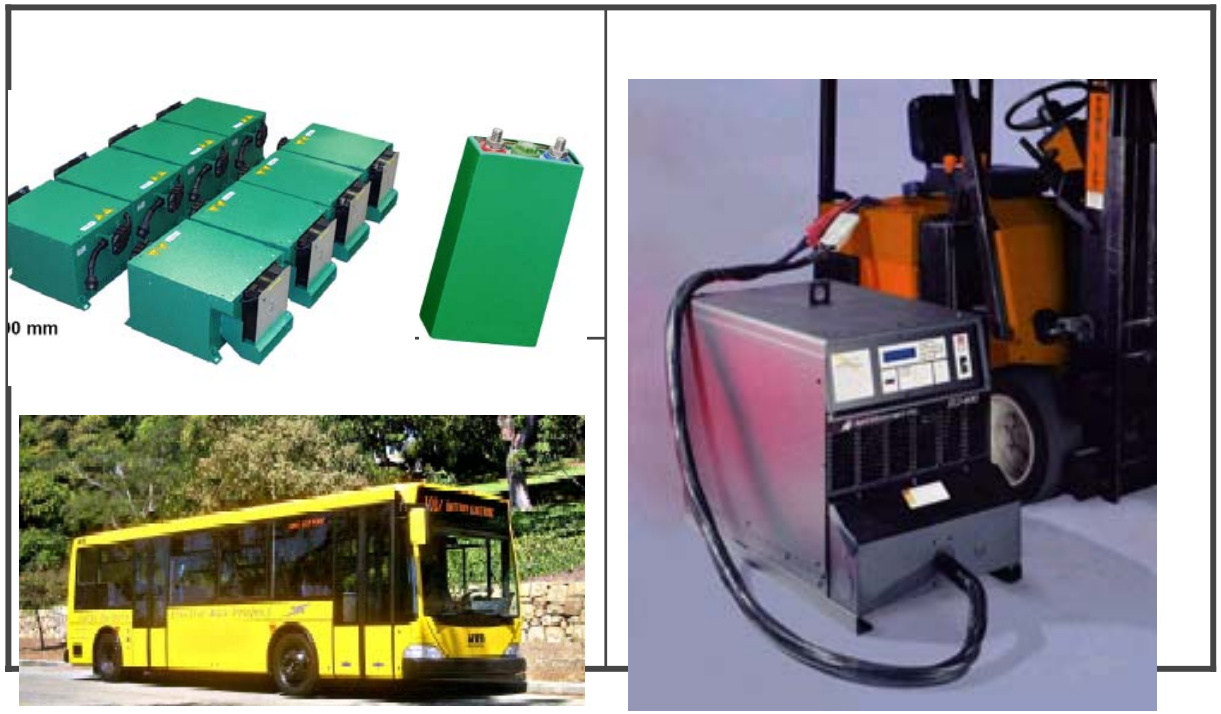
DOE Workshop on Systems Driven Approach for Solar Applications of Energy Storage

Electric Transportation Research at EPRI

25 Years of Electric Transportation Research



- Current Activities
  - Non-road ET: fast charging, electric material handling, airport GSE, truckstop electrification, and emissions analyses.
  - Plug in HEVs: transit buses and heavy duty vehicles, Para transit, delivery vans, and passenger vehicles

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Avenues to U.S. Energy Independence Presentation Outline

- **Background**
  - Where we have been
  - Where we are
- **Technology Opportunities**
  - Electric Transportation
  - Electric-Drive Vehicle Technologies
  - EPRI Research Programs
- **Barriers to Getting There**
- **Policy Options and Recommendations**
- **Summary**

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Background

- Oil dependence is among Nation's most critical energy challenges
- U.S. imported 35% of it total consumption in 1973 and projected to reach 60% by 2010
- Transportation sector accounts for 2/3 of U.S. oil consumption, and 33% of CO_2 emissions and expected to climb over the next two decades surpassing all other sectors including electricity
- Achieving oil independence requires demand reduction, diversified supply and increased efficiency

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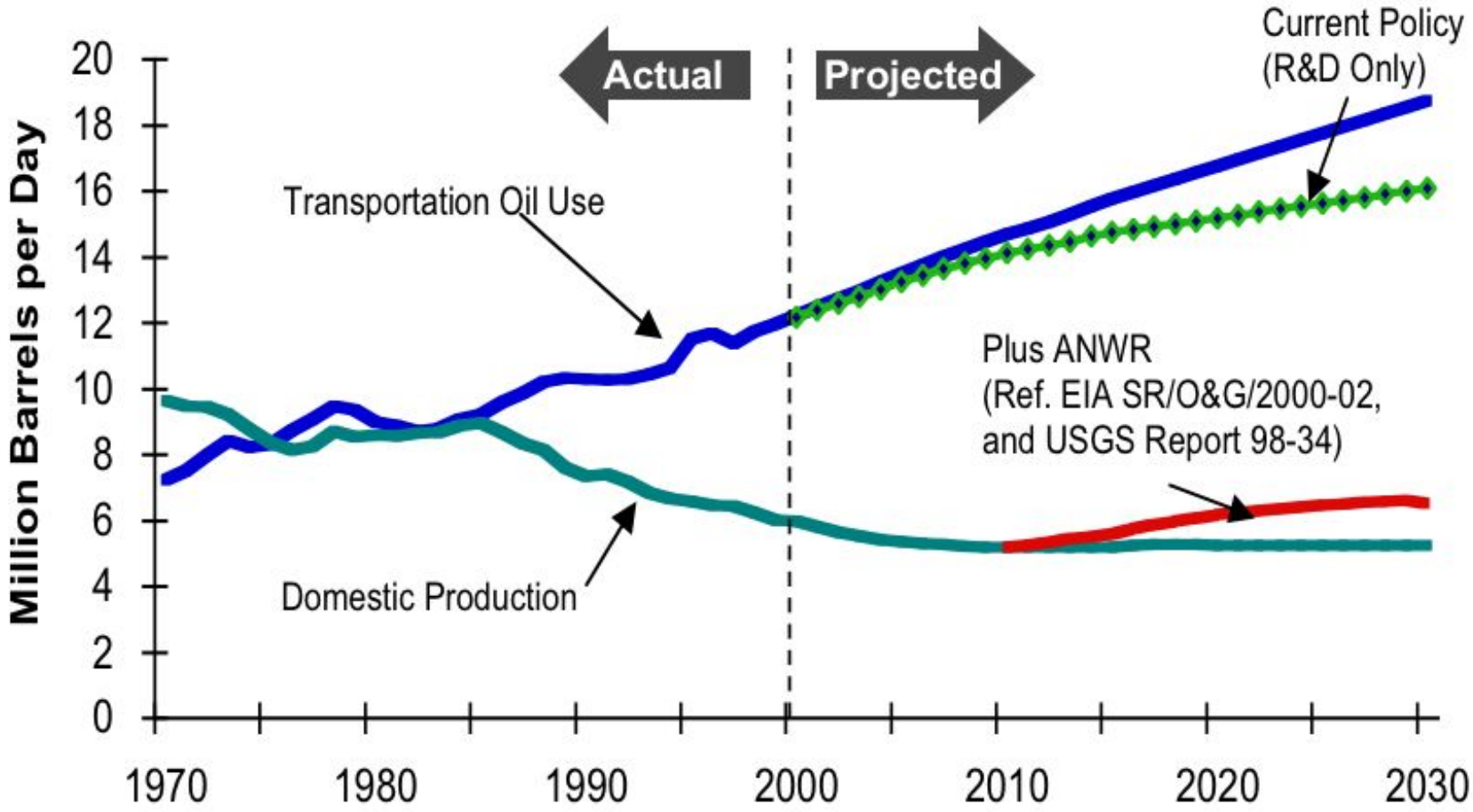
Projected Transportation Oil Use



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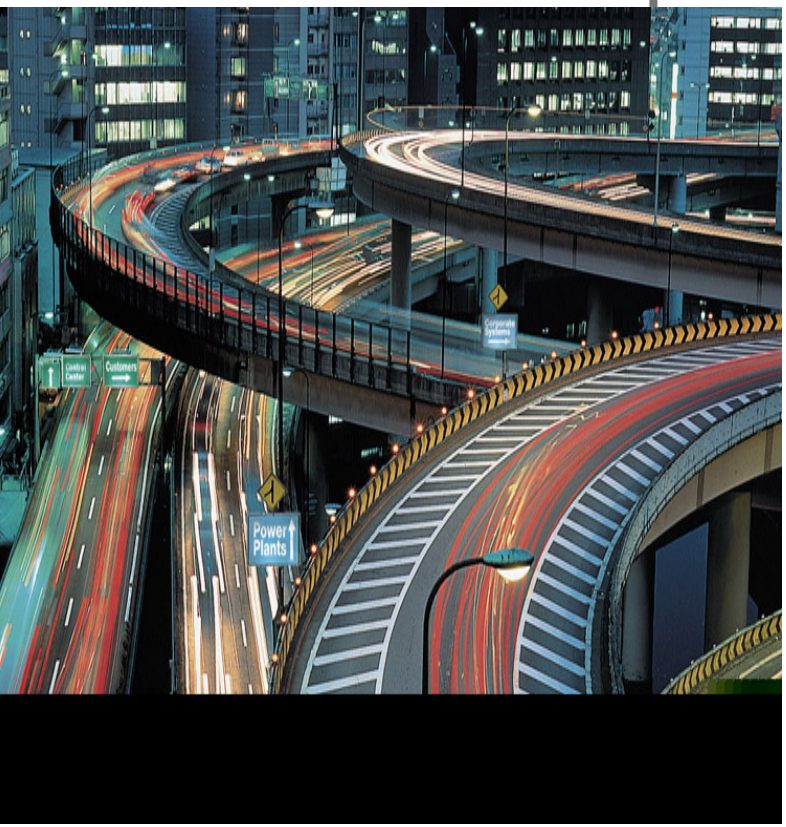

Drivers for Electrification of Transportation

Electric-Drive Vehicles (EDVs)

Battery Electric Vehicle (BEV)

Use on on-board electricity
Recharged from electrical grid

Hybrid Electric Vehicle (HEV)

Electric drive system complement combustion engine
Parallel or series drivetrain
Conventional or plug-in

Fuel Cell Electric Vehicle (FCEV)

Fuel cell generates electricity from hydrogen to power and electric motor drive system
Hydrogen generated off-board or on-board (via hydrocarbon reformation)

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Hybrid Electric Vehicles

Efficiency Factors for Hybrid Vehicles

- Efficient electric drive system contributes to performance and efficiency
- Smaller internal combustion engine operates at higher efficiency
- Engine idle can be reduced or eliminated
- Regenerative braking can conserve energy
- Relatively small battery is high-power and recharged by the engine
- Fuel economy is up to 80% greater than a conventional vehicle.

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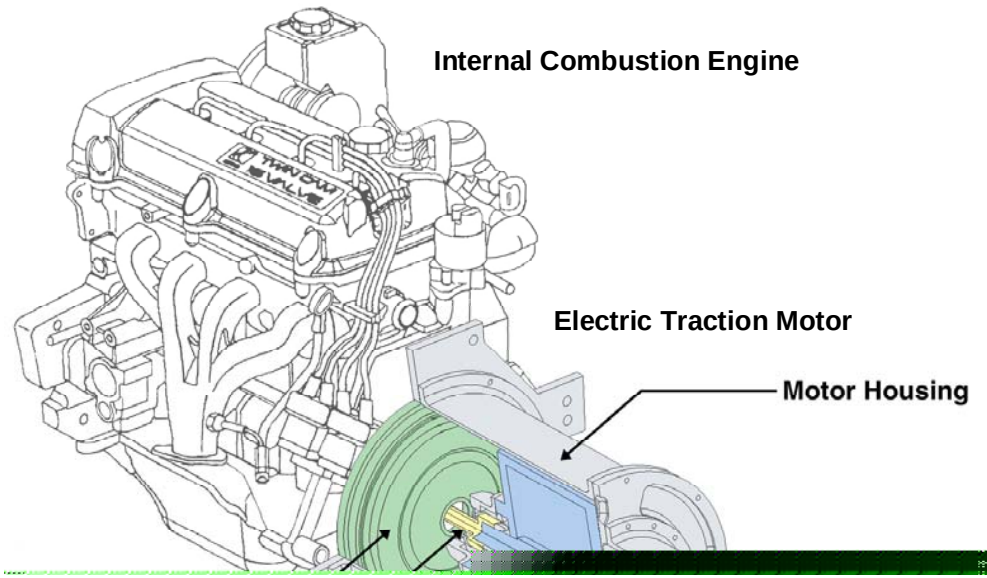
Plug-in Hybrid Electric Vehicles

Plug-in HEV Attributes

- Combine function of EVs and HEVs
  - Electric range of 10-60 miles
  - Home recharging at night
  - Continuous driving possible without recharge
- Plug-in HEVs use electricity while battery charge is high
  - Switches to hybrid mode when:
    - Battery charge is low
    - Higher vehicles speeds
    - Driver requires full power
- Plug-in HEVs have the potential for further petroleum reduction by substitution of grid electricity
  - Disadvantage of higher upfront cost and slightly increased mass



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