Light Duty Vehicle Pathways

July 26, 2010

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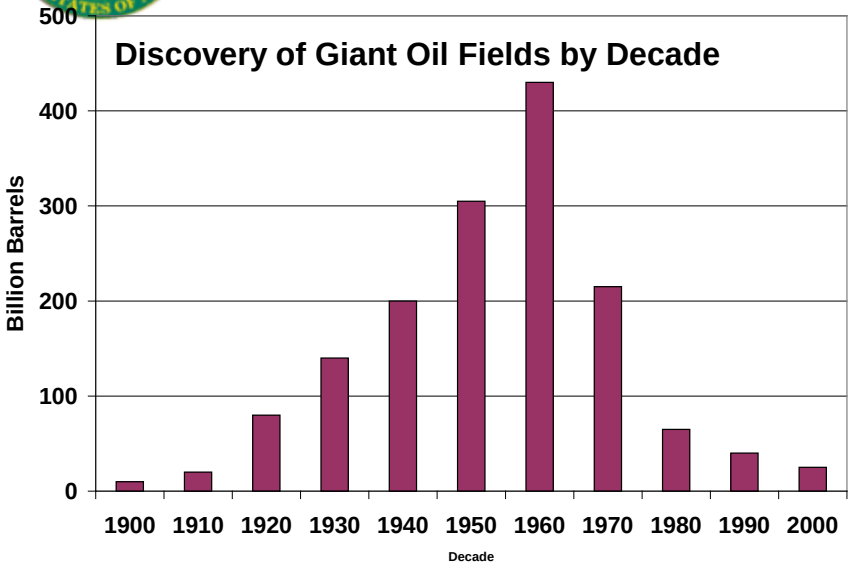
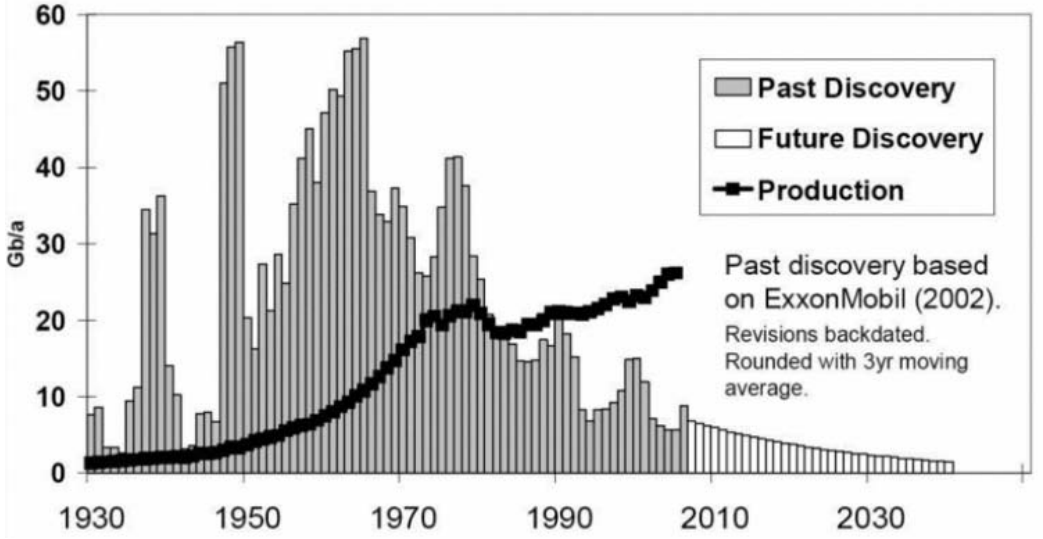
Conventional Oil



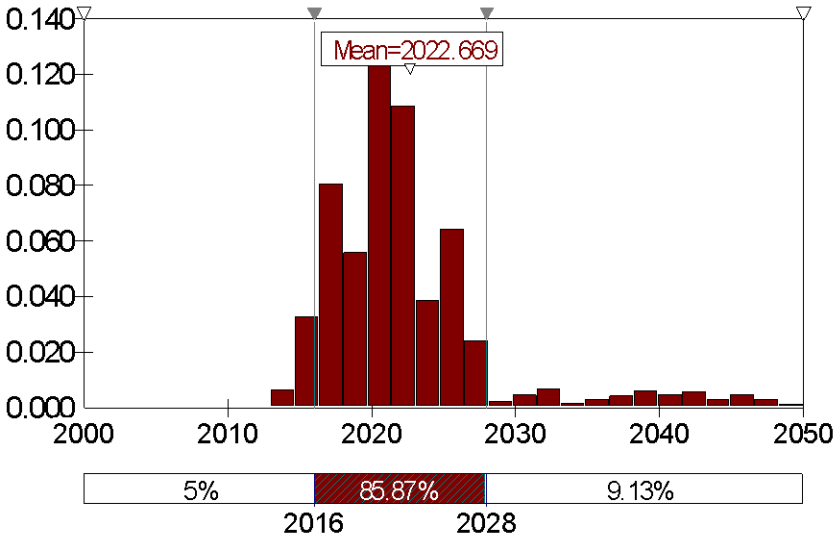


International Energy Agency, 2008

- Across 798 of world's largest oil fields, average production decline of 6.7%/year.
- Of 798 fields, 580 had passed peak.
- To meet growth & replace exhausted resources, will have to add 64 MB/d by 2030, or 6X Saudi Arabia.

- Sources: (Figure 1) Fredrik Robelius, Uppsala Universitet; (Figure 2) Association for the Study of Peak Oil; (Figure 3) David Greene, ORNL.

Peak Year of ROW Conventional Oil Production: Reference/USGS



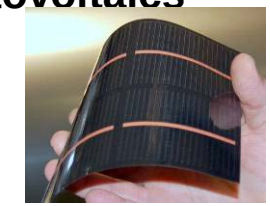
InterAcademy Panel Statement On Ocean Acidification, 1 June 2009

- **Signed by the National Academies of Science of 70 nations:**
  - Argentina, Australia, Bangladesh, Brazil, Canada, China, France, Denmark, Greece, India, Japan, Germany, Mexico, Pakistan, Spain, Taiwan, U.K., U.S…..
- **"The rapid increase in CO2 emissions since the industrial revolution has increased the acidity of the world's oceans with potentially profound consequences for marine plants and animals, especially those that require calcium carbonate to grow and survive, and other species that rely on these for food."**
  - Change to date of pH decreasing by 0.1, a 30% increase in hydrogen ion activity.
- **"At current emission rates, models suggest that all coral reefs and polar ecosystems will be severely affected by 2050 or potentially even earlier."**
  - At 450 ppm, only 8% of existing tropical and subtropical coral reefs in water favorable to growth; at 550 ppm, coral reefs may be dissolving globally.
- **"Marine food supplies are likely to be reduced with significant implications for food production and security in regions dependent on fish protein, and human health and well-being."**
  - Many coral, shellfish, phytoplankton, zooplankton, & the food webs they support
- **Ocean acidification is irreversible on timescales of at least tens of thousands of years.**

Renewable Electricity Systems

Photovoltaics

c-Si

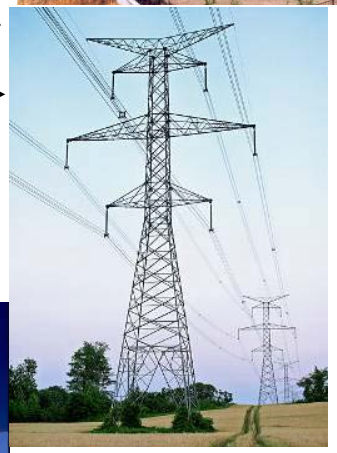


Cu(In,Ga)Se_2

500x

Distributed Generation

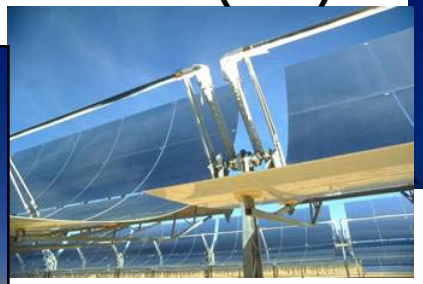
Wind



Smart Grid

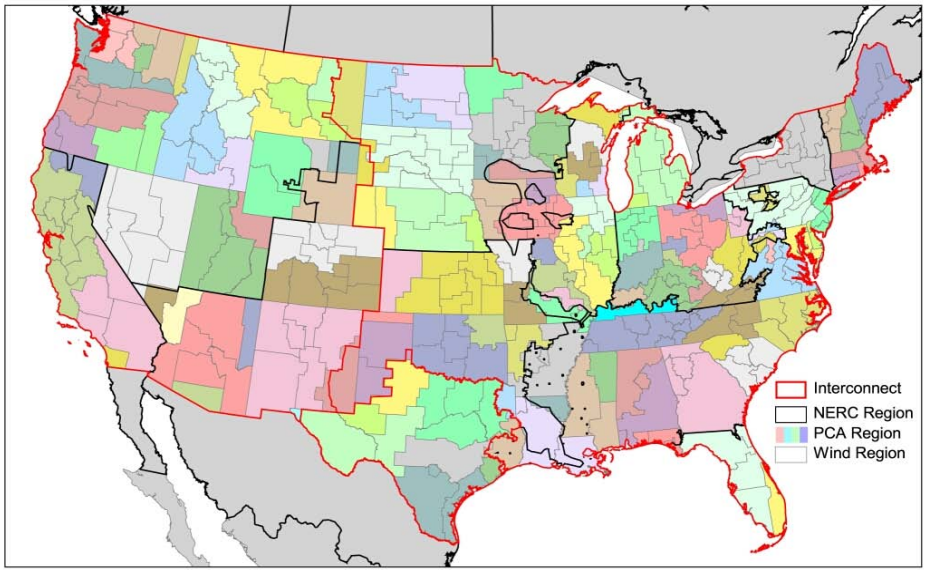
Plug-in Hybrids

Concentrating Solar Power (CSP)

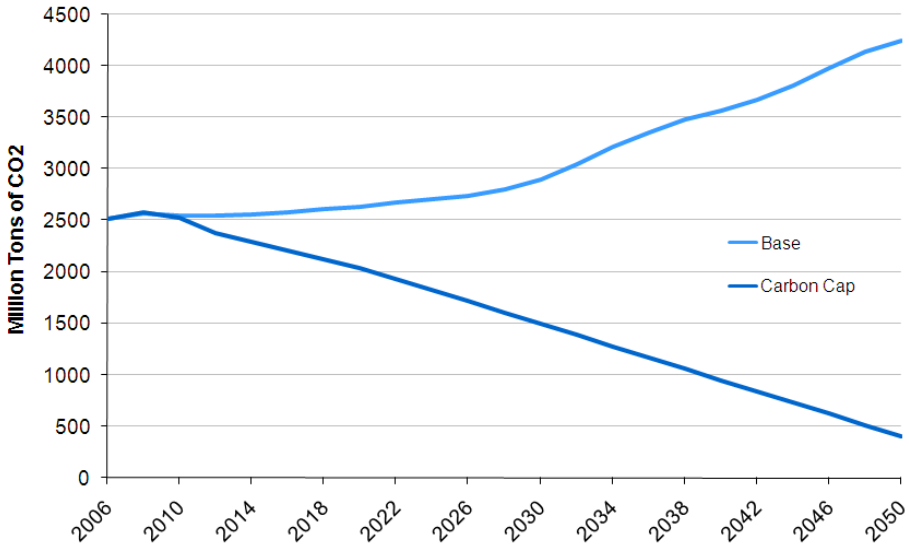


ReEDS Model

- **356 regions in Continental U.S.**
- **Linear program cost minimization**: 23 two-year periods from 2006-2050.
- **All major power technologies**–hydro, gas CT, gas CC, 4 coal (w/wo CCS), gas/oil steam, nuclear, wind, CSP, biopower (wo *CCS*), geothermal, 3 storage technologies.
- **17 time slices in each year**: 4 daily x 4 seasons (+one super-peak).
- **Input future electric demands and fuel prices by region.**
- Simple elasticities provide *demand* and fossil fuel price response.
- **6 levels of regions** – RE supply, power control areas, RTOs, states, NERC areas, Interconnection areas.
- **Existing/new transmission lines.**
- **State-level incentives.**
- **Stochastic treatment of resources.**
- **Does not yet directly include PV or distributed benefits;** PV a placeholder
- **Policy: 80% emissions reduction from 2005 by 2050.**



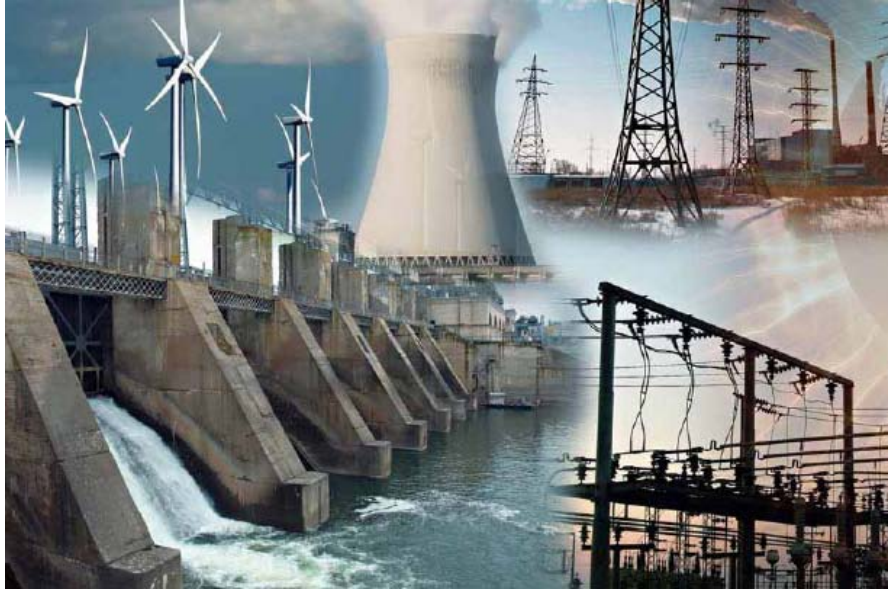
Annual Carbon Emissions



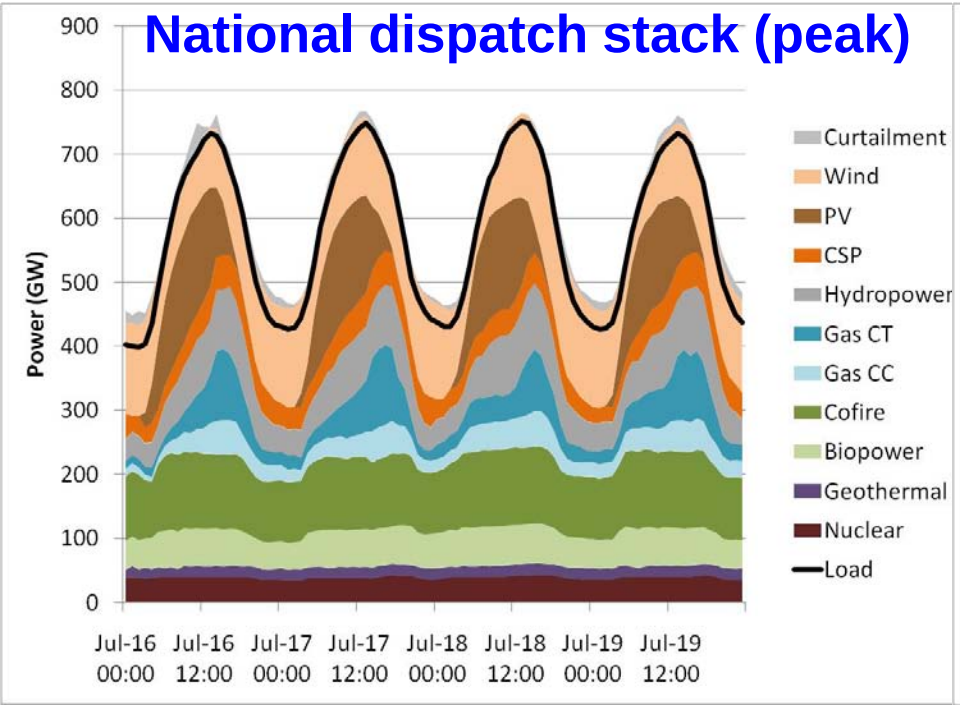
Source: Walter Short, NREL

GridView

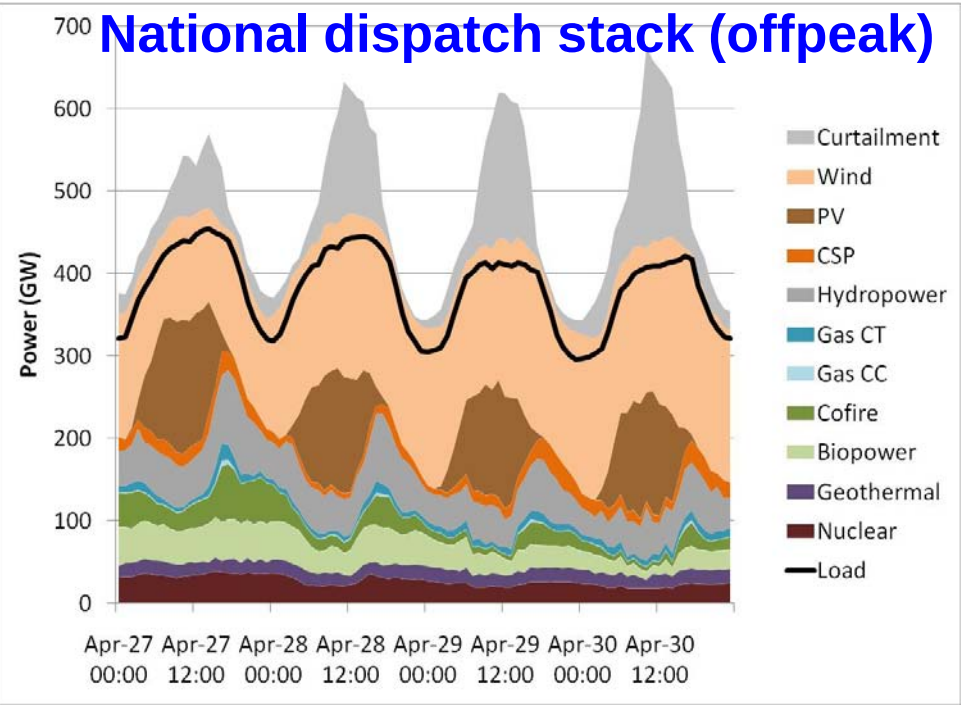
- Commercial Production cost model by ABB
- Used by ISOs, utilities, others for planning…
- 11,000 Generators; 85,000 Transmission lines; 34,000 Buses w load; 65,000 nodes; 136 transmission zones
- Simulates 8760 hours/year: power flow, dispatch, transmission congestion, unserved load; etc.



National dispatch stack (peak)

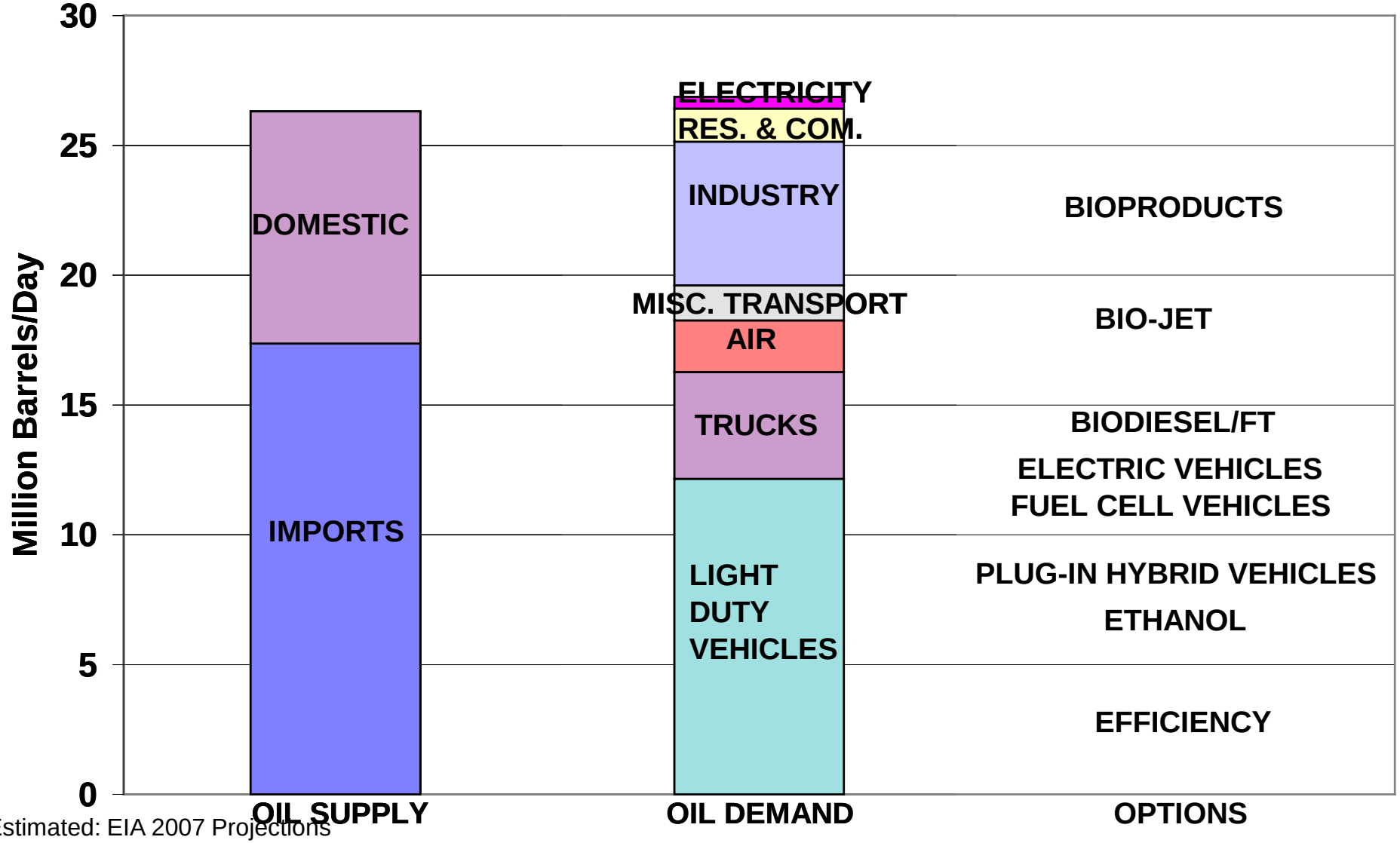


National dispatch stack (offpeak)



Can We Meet the Oil Challenge?

Oil Supply, Demand, Options in 2030



Estimated: EIA 2007 Projections

For more information

http://www.eere.energy.gov

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