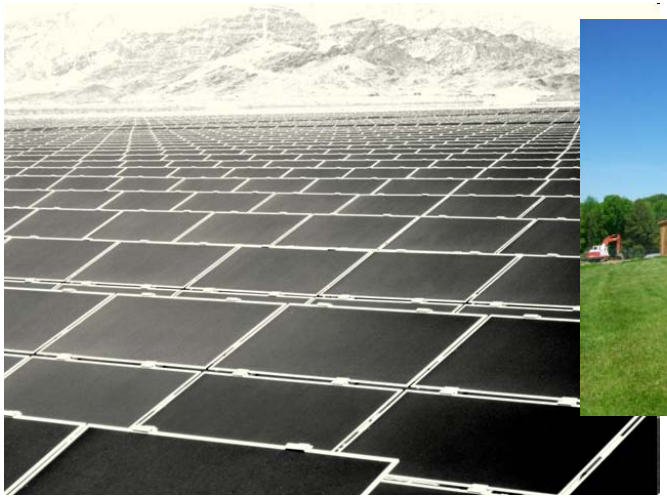

Photovoltaics and the Government

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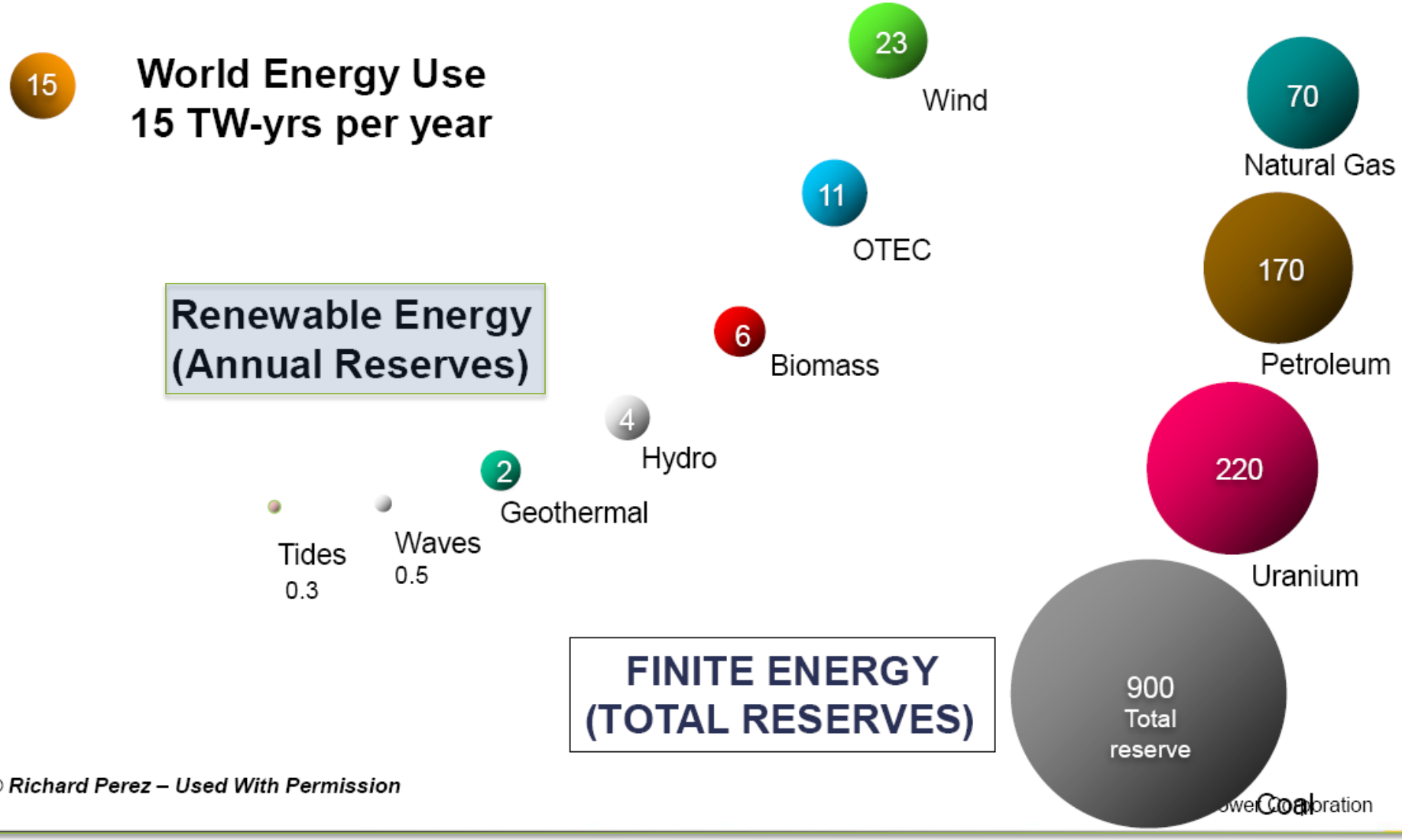
Solar Potential

- Largest practical source of renewable energy
- Available almost everywhere
- Has potential to be harnessed cost-effectively
- Variability? A “10%” issue until solar grows to a substantial portion of electricity
  - That gives time for other solutions

Among Global Energy Sources…



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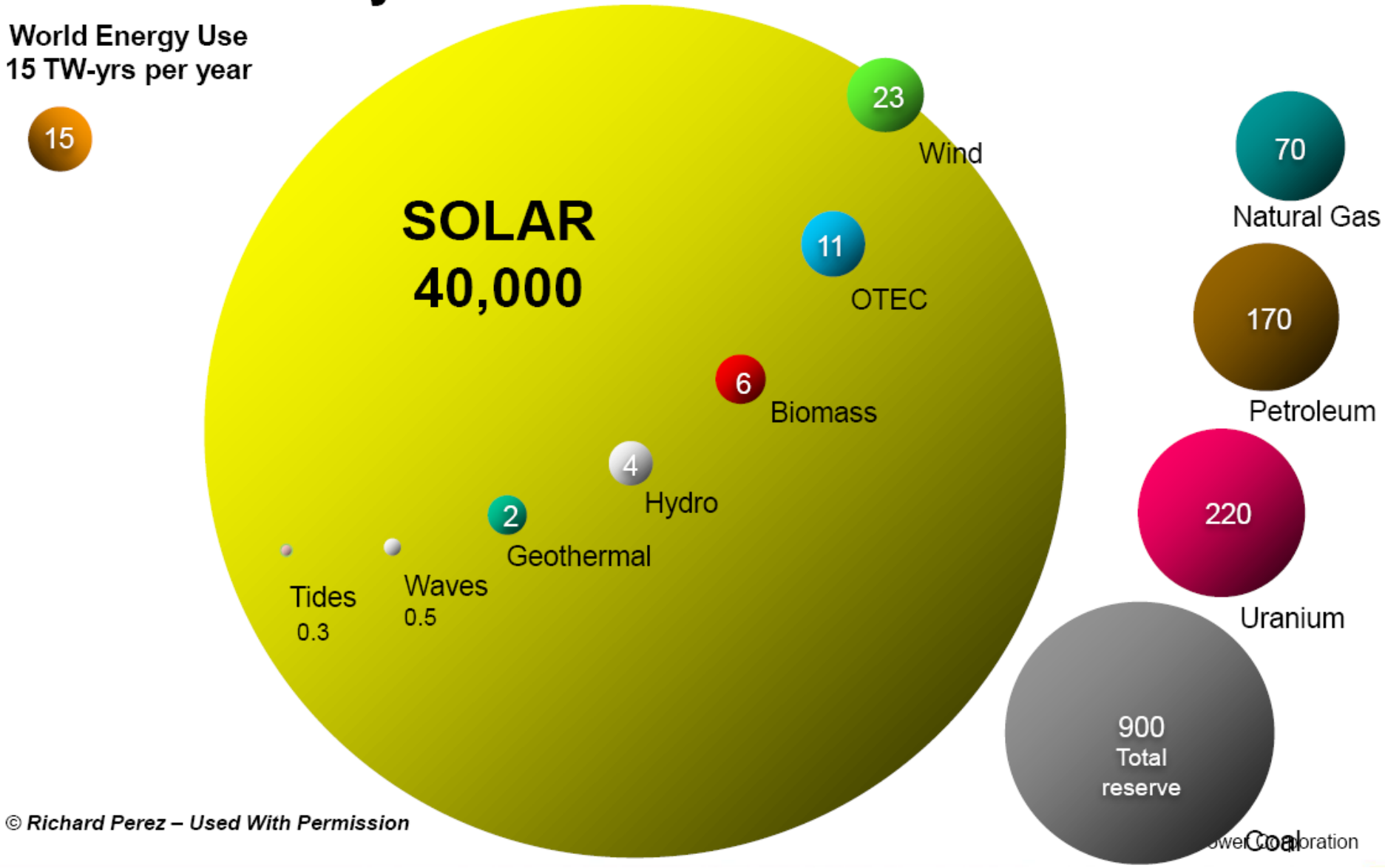
…Solar is by Far the Most Abundant



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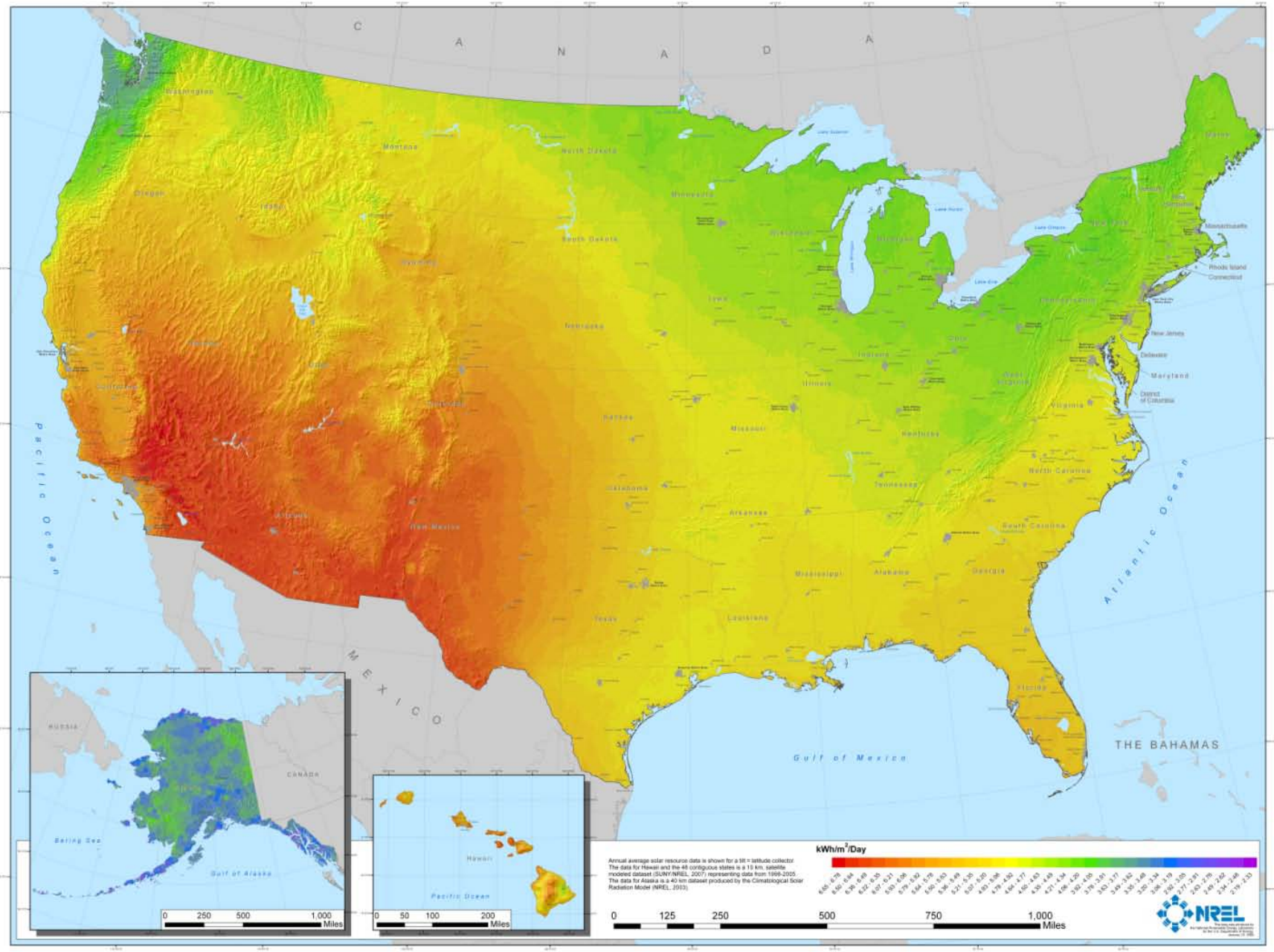
United States Photovoltaic Solar Resource : Flat Plate Tilted at Latitude



Partnership

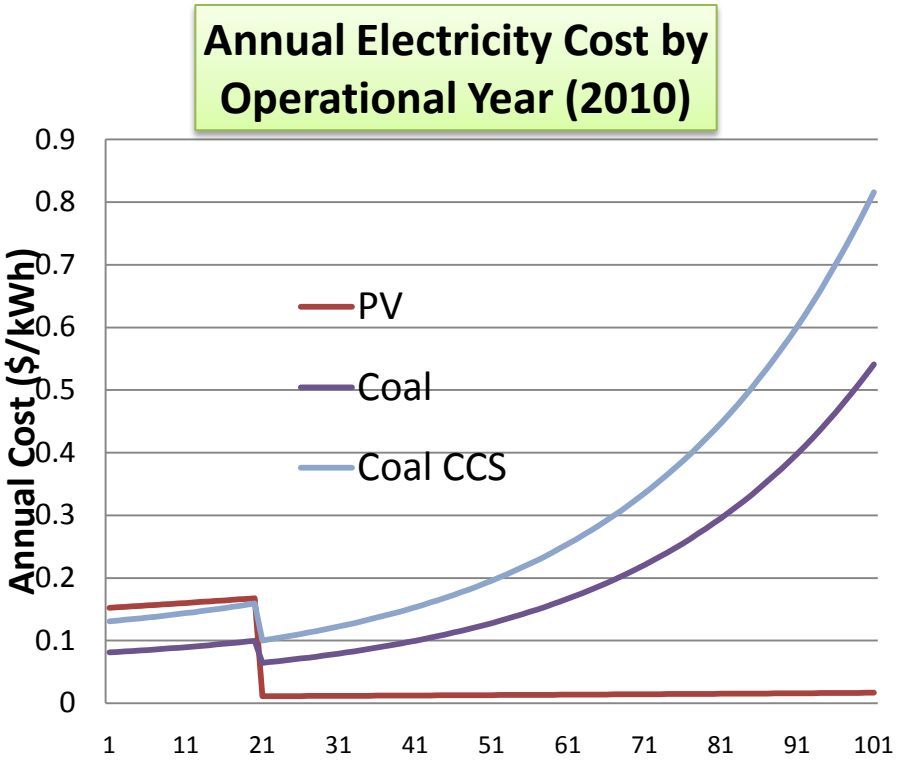
- Solar was developed as a Gov’t/industry (academic) partnership
- Solar subsidies continue that partnership
  - States
  - Feds
- Government choices about tax and other policy define the future of energy, including solar (energy is a highly gov’t-influenced industry)
- Solar is good for Gov’t purposes

Confluence of Gov't Purposes

- Climate change reduction
- Energy self-sufficiency
  - Economic well-being
  - Energy security
  - Minimize international conflict over energy supply
- Secondary environmental issues
  - Clean air
  - Environmental degradation
  - Clean water and water use
  - Safety

Unique Relationship

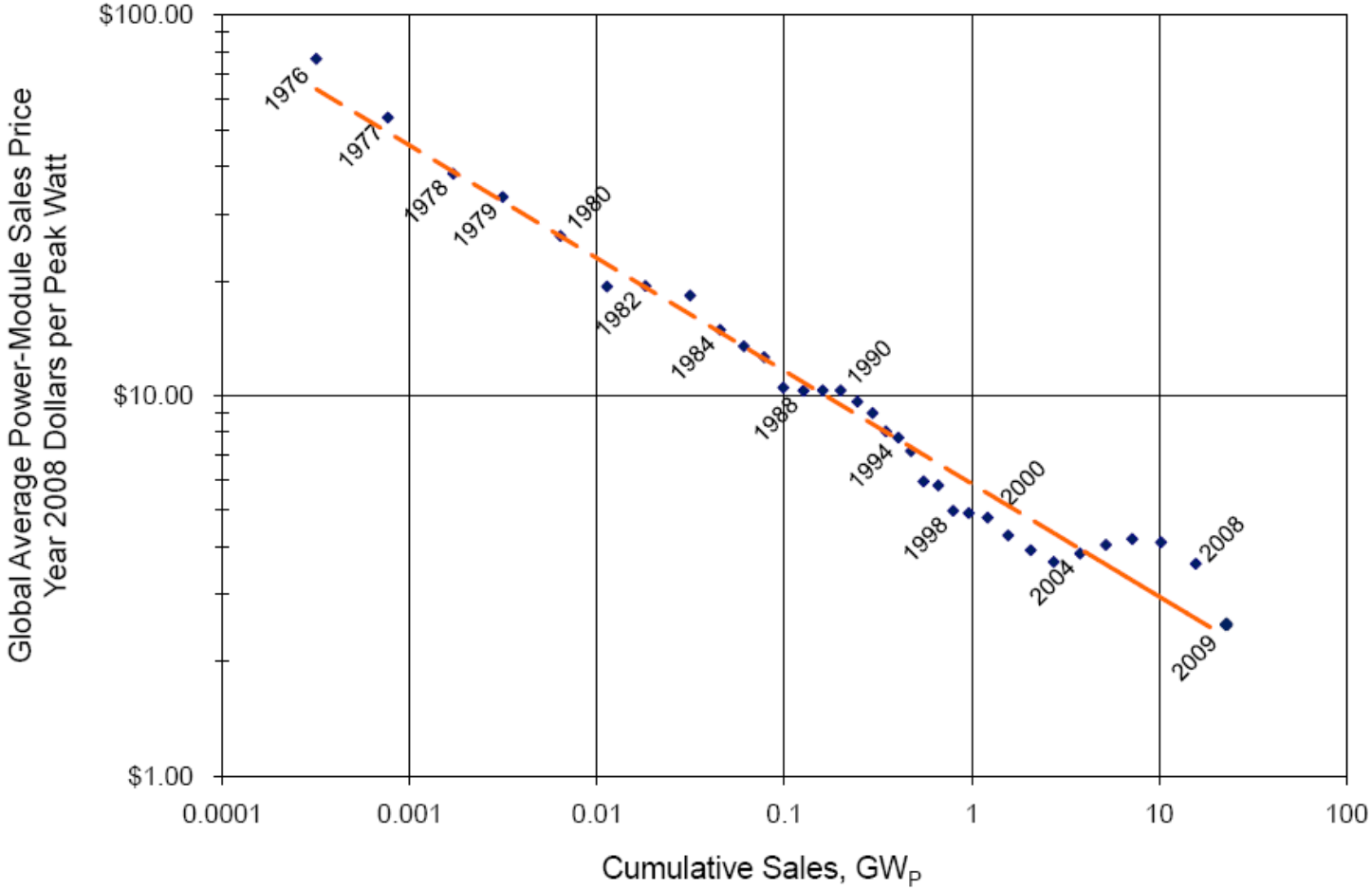
- Long-term planning of government choices
- Long life of gov't installations (military bases) and buildings
  - High coincidence of gov't electricity demand and daylight
- Low interest rates for gov't projects



Partnership Thrusts

- Continued partnership
  - Incentivizing markets and manufacturing
  - Federal R&D
- Government deployment
  - Solar on gov’t buildings
  - Solar on military bases
  - Solar as a national electricity backbone
    - Distributed
    - Southwest

Social Contract



ASP data source: P. Mints, Navigant Consulting PV Service Practice

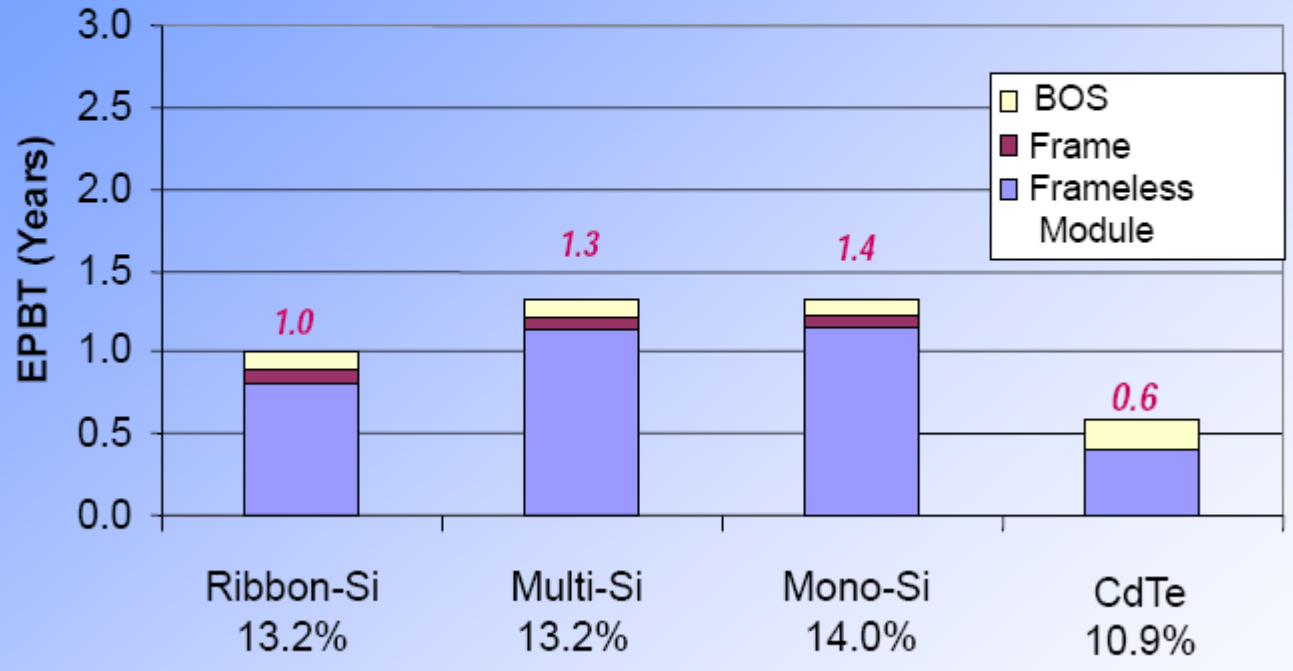
3/08/10

Land Use is a *Strength* for Solar

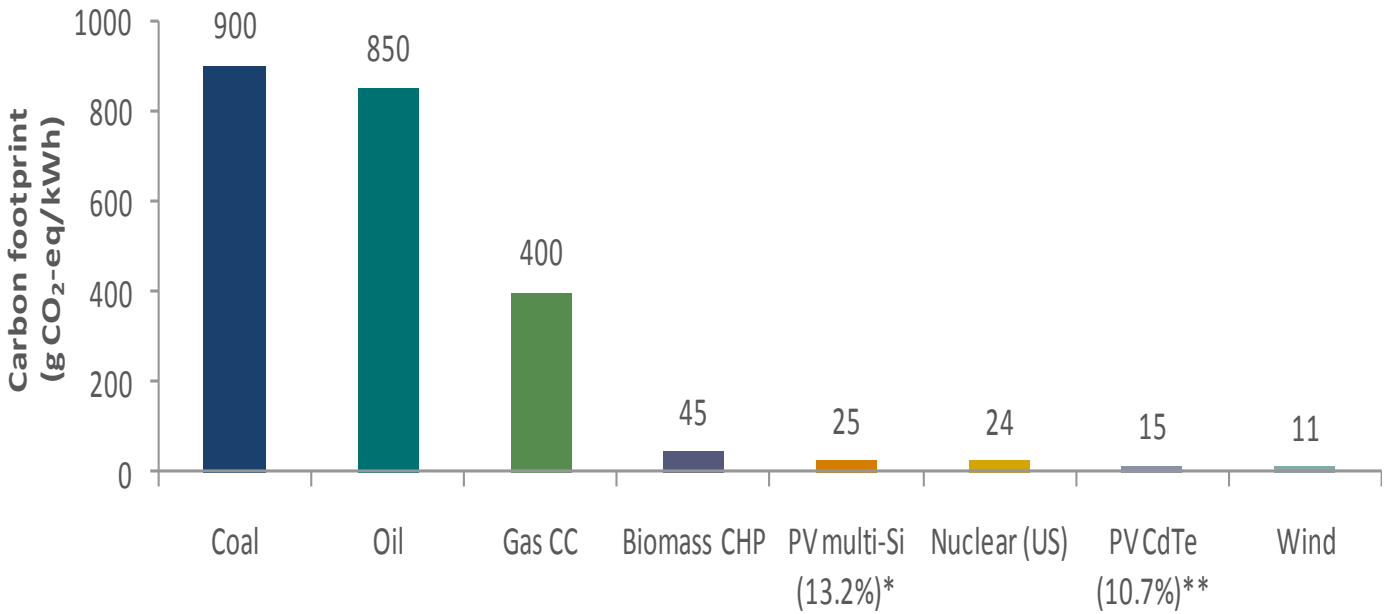
	Conventional	**Solar (and roofs!)**
Hydro	Hydro lakes over 1% US land 7% electricity 300 TWh/yr	0.7% US land could make 4000 TWh/yr (100% US electricity) **20 times less land than hydro per kWh**
Coal	About the same as solar when strip mining is not "stripped away"*	With solar, the land is not destroyed
Biomass	Plant efficiency less than 0.1% after conversion to useful work	**Efficiency and land use about 40-100 times better than biomass (and no water or food issues)**
Farm set-aside program	34 million acres in US	**Solar for all electricity – 20 million acres**

Energy Payback Times in the US-SW

Insolation: 2300 kWh/m2-yr



Carbon Footprint - Comparison across Technologies



Sources: *de Wild-Scholten, M., presented at CrystalClear Final Event in Munich on May 26, 2009. **de Wild-Scholten, M., 'Solar as an environmental product: Thin-film modules – production processes and their environmental assessment,' presented at the Thin Film Industry Forum, Berlin, April, 2009. Both PV technologies use insolation of 1700 kWh/m^2. All other data from ExternE project, 2003; Kim and Dale, 2005; Fthenakis and Kim, 2006: Fthenakis and Alsema, 2006; Fthenakis and Kim, in press.

Water

- PV and wind use essentially zero water during operation and a small amount over their life cycle
- Most thermal plants use huge amounts of cooling water "once through" or can be adapted to recirculating water at about 1 gal/kWh (est.)
  - "Once through" cooling trails irrigation (40%) as the second largest use of water in the US (39%)
  - But actual consumption from water system is much smaller (but will rise as "once through" is phased out)
- CSP uses a lot but can be made "dry cooling" at a cost

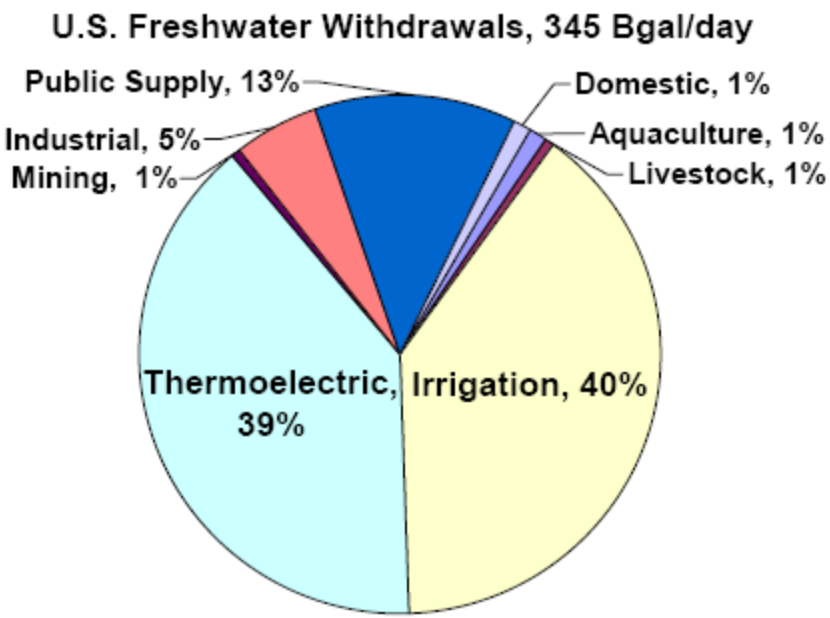
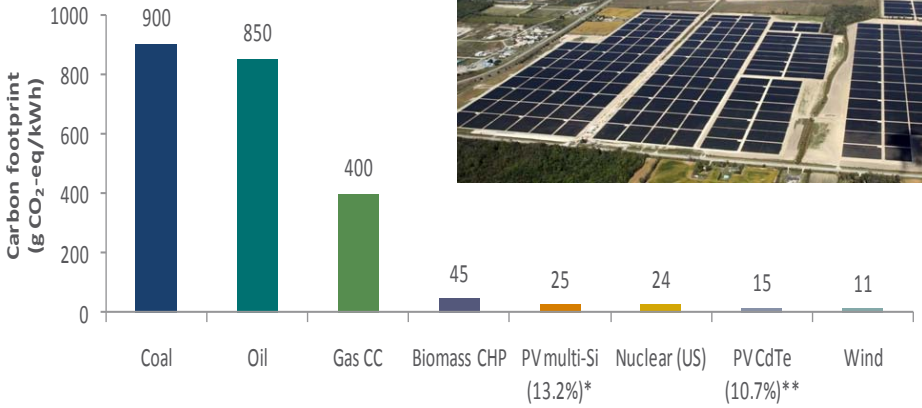


Figure II-1. Estimated Freshwater Withdrawals by Sector, 2000 (Hutson et al., 2004)

US Plan for Dialing Down CO2 and Oil

- Domestic non-CO2 electricity from wind and solar (no need for storage until ~2030)
- Back-up from natural gas
- Smart grid and transmission to balance with demand
- Electric cars to reduce oil



Thanks

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http://thesolarreview.org/

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Alhama de Granada, Spain (1.88MW); Phoenix Solar AG