

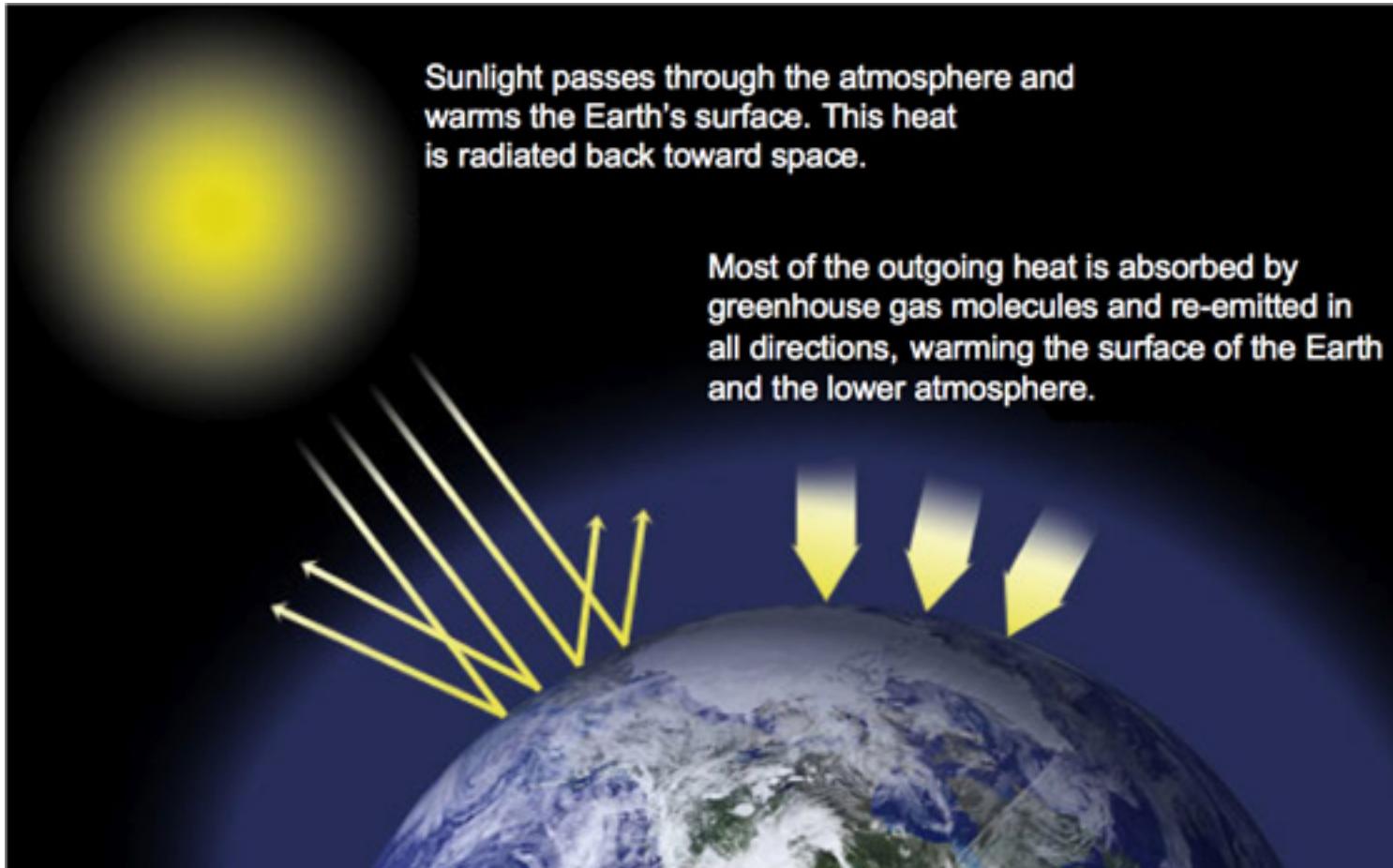
Sustainability Pioneers: Community Conversations

#3 Renewable Energy Opportunities and Challenges

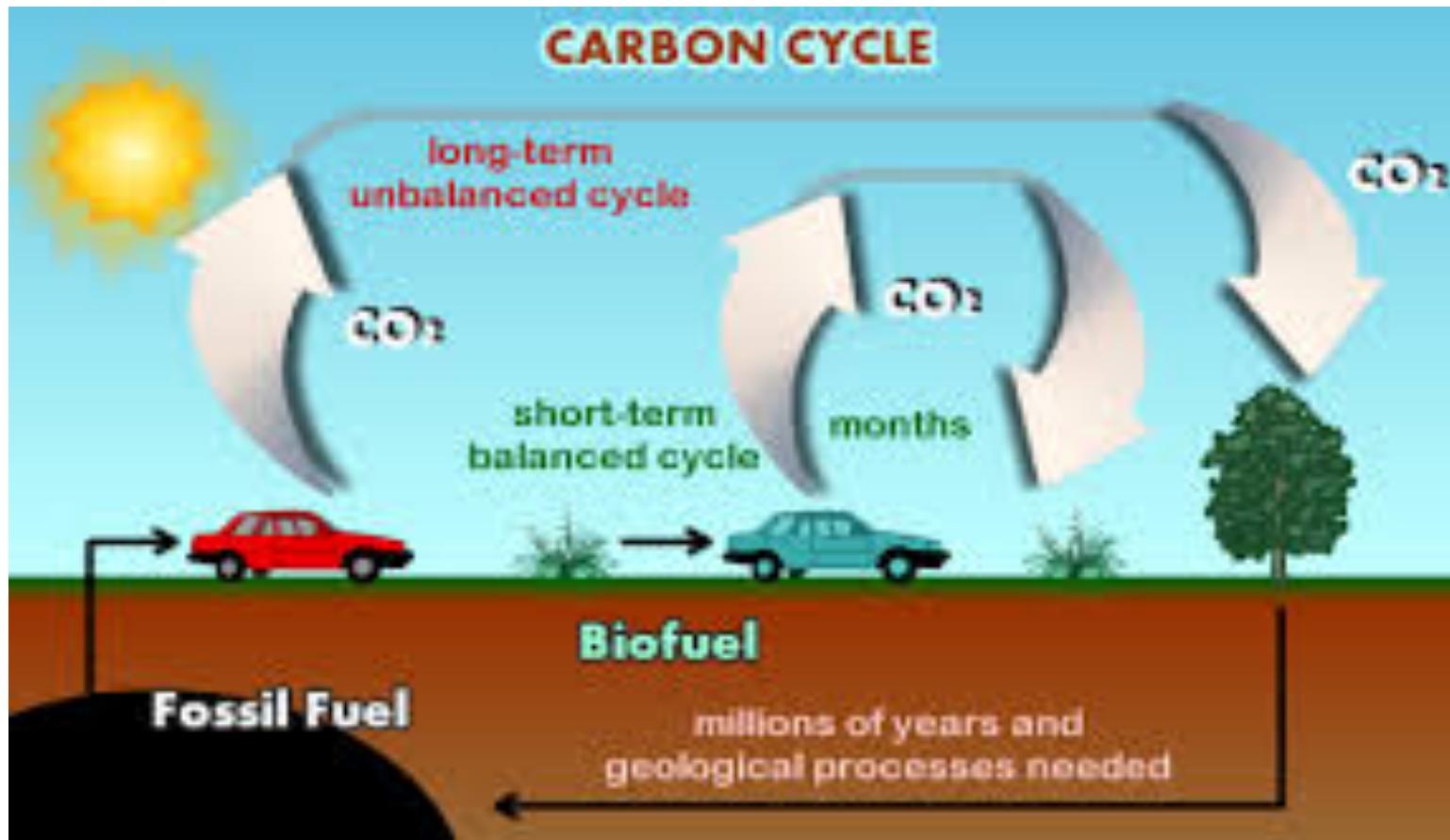
February 13, 2017



Why GHG Cause Warming



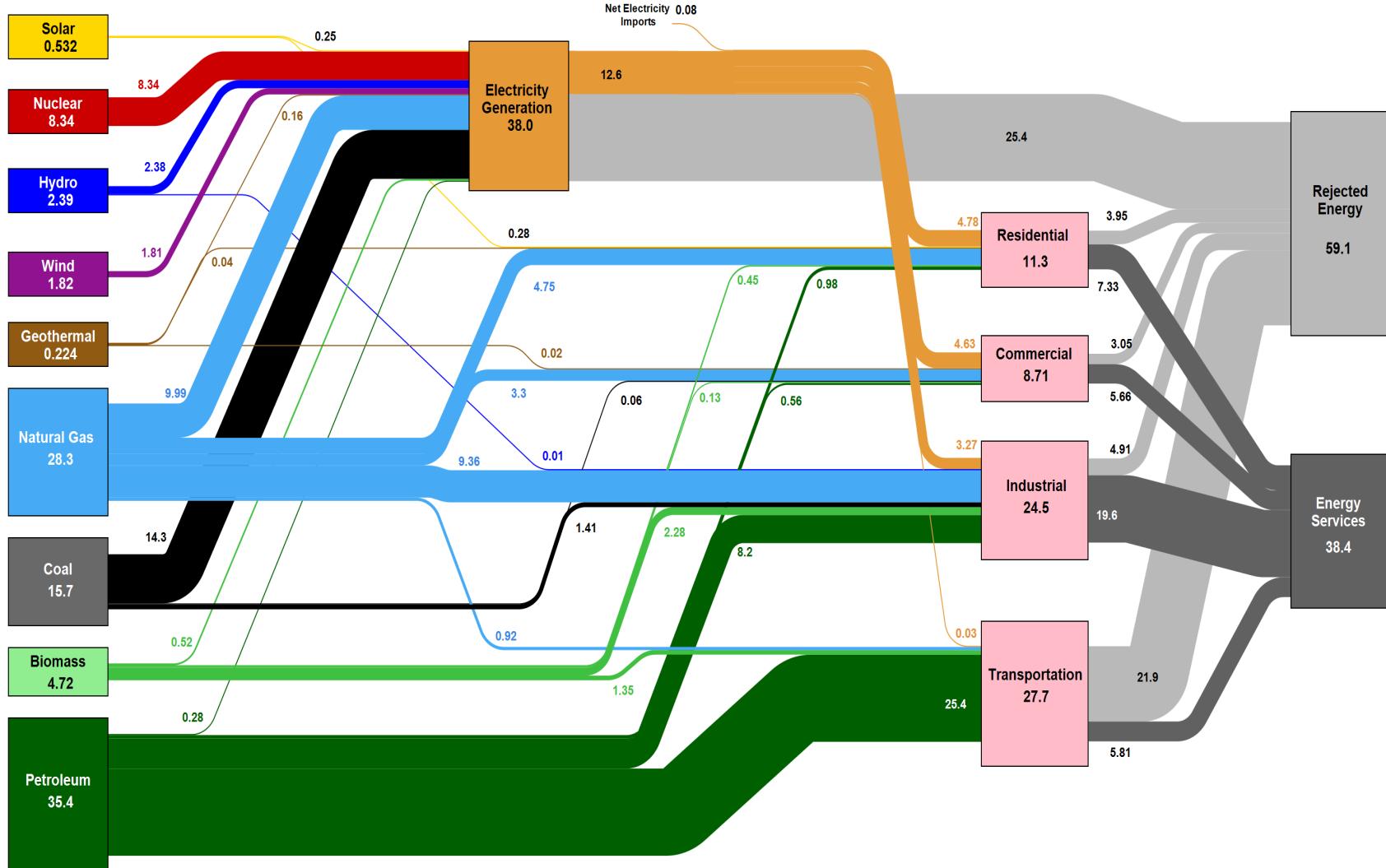
200 Year CO₂ Cycle



A Time to Choose...within our control – for another 10,000 years



Estimated U.S. Energy Consumption in 2015: 97.5 Quads



Source: LLNL March, 2016. Data is based on DOE/EIA MER (2015). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Re-define the Problem:

- We receive from the sun over 10,000 times more energy per year than we are projected to use worldwide
- Solar (renewable) energy sources are FLOWS
- Solar energy is already distributed
- Solar energy is reliable (the sun comes up every day...)
- We have the technology to use it NOW!
- Solar energy does not pollute and it is safe

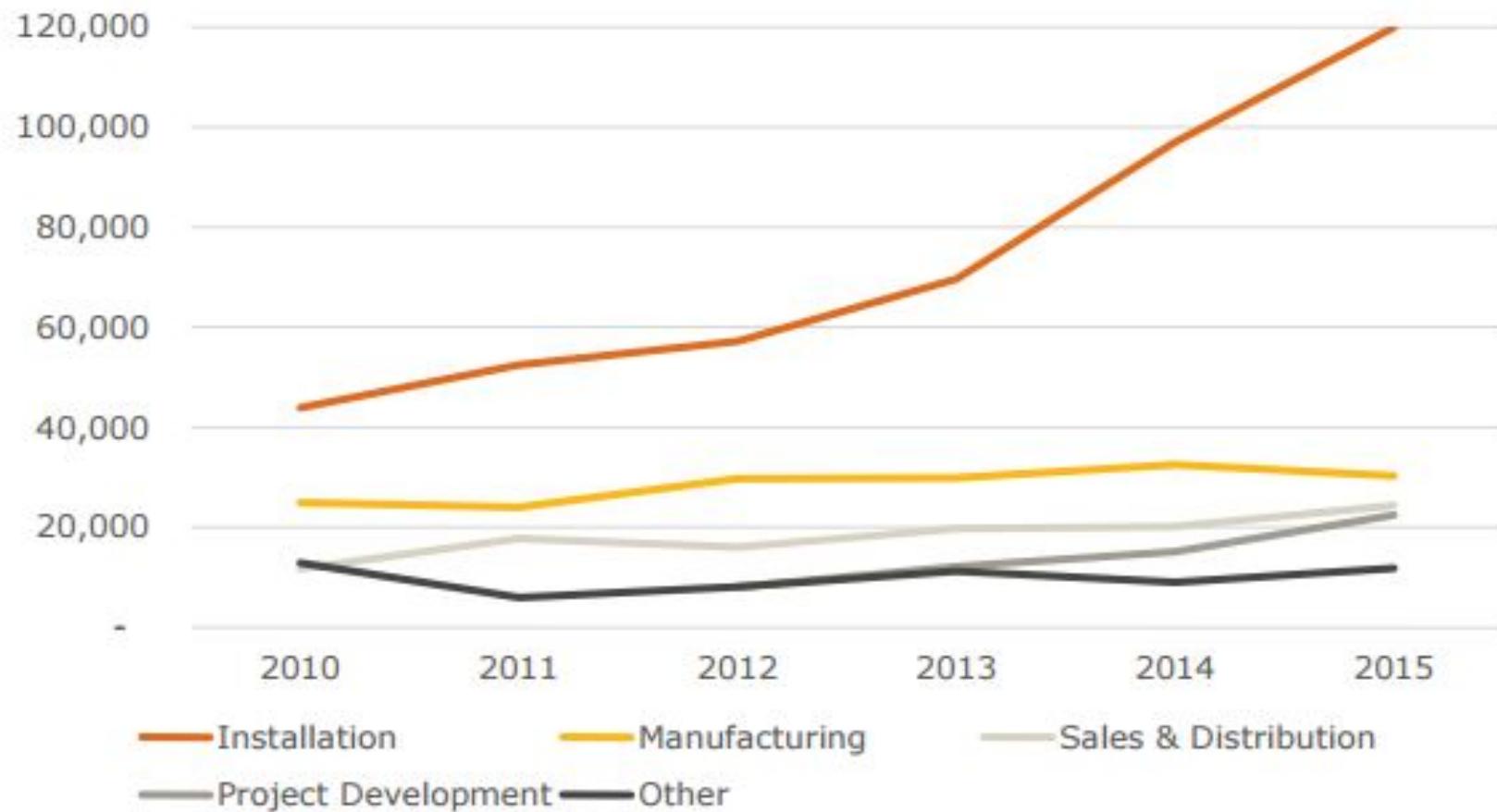
Jobs/Environment

- **“We reject the notion that we have to choose between good jobs and a clean environment. We need to have both or we will have neither!”**

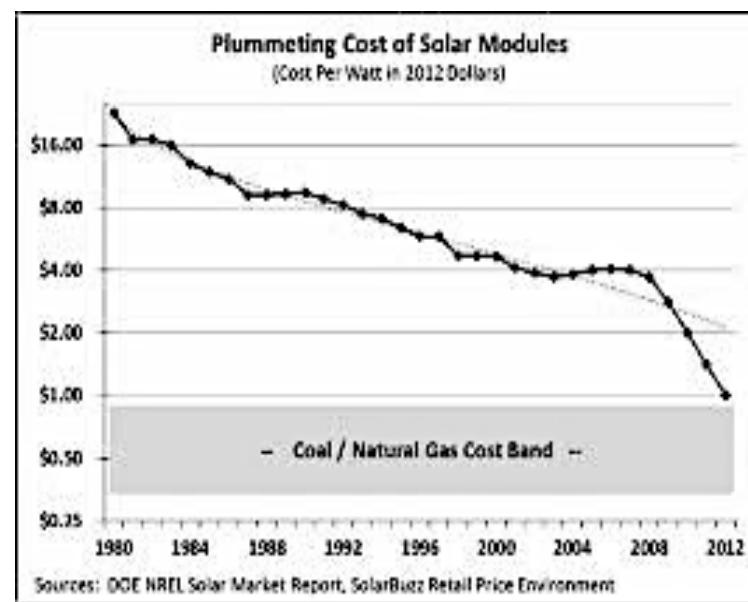
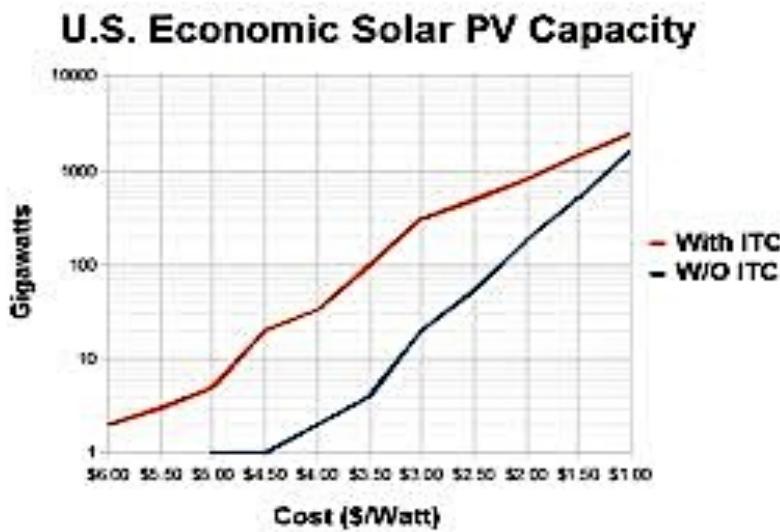


Leo Gerard, United Steel Workers Union
Good Jobs, Green Jobs Conference March 2009

Solar Industry Job Growth -US

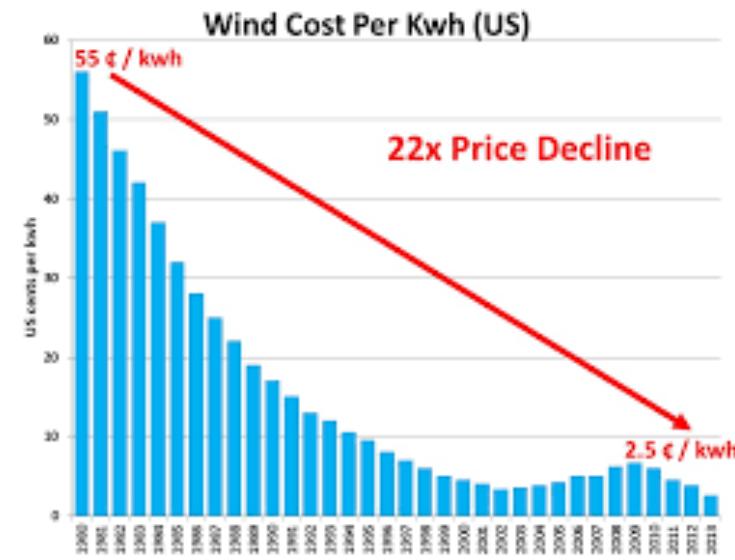
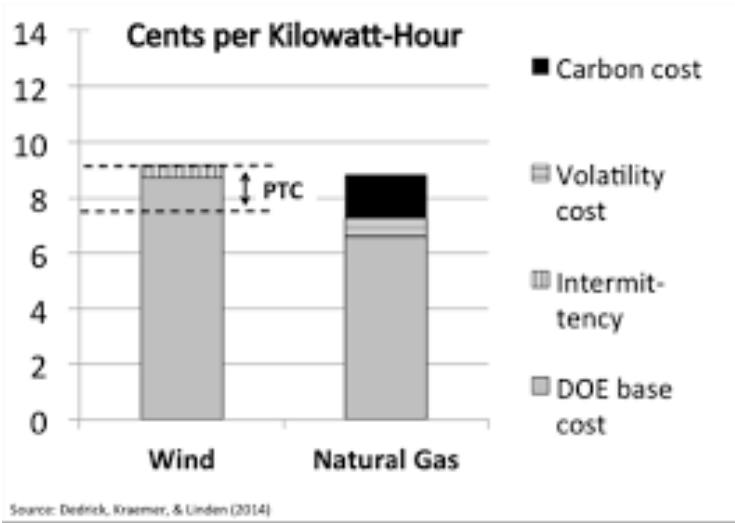


Cost Competitive and Better!



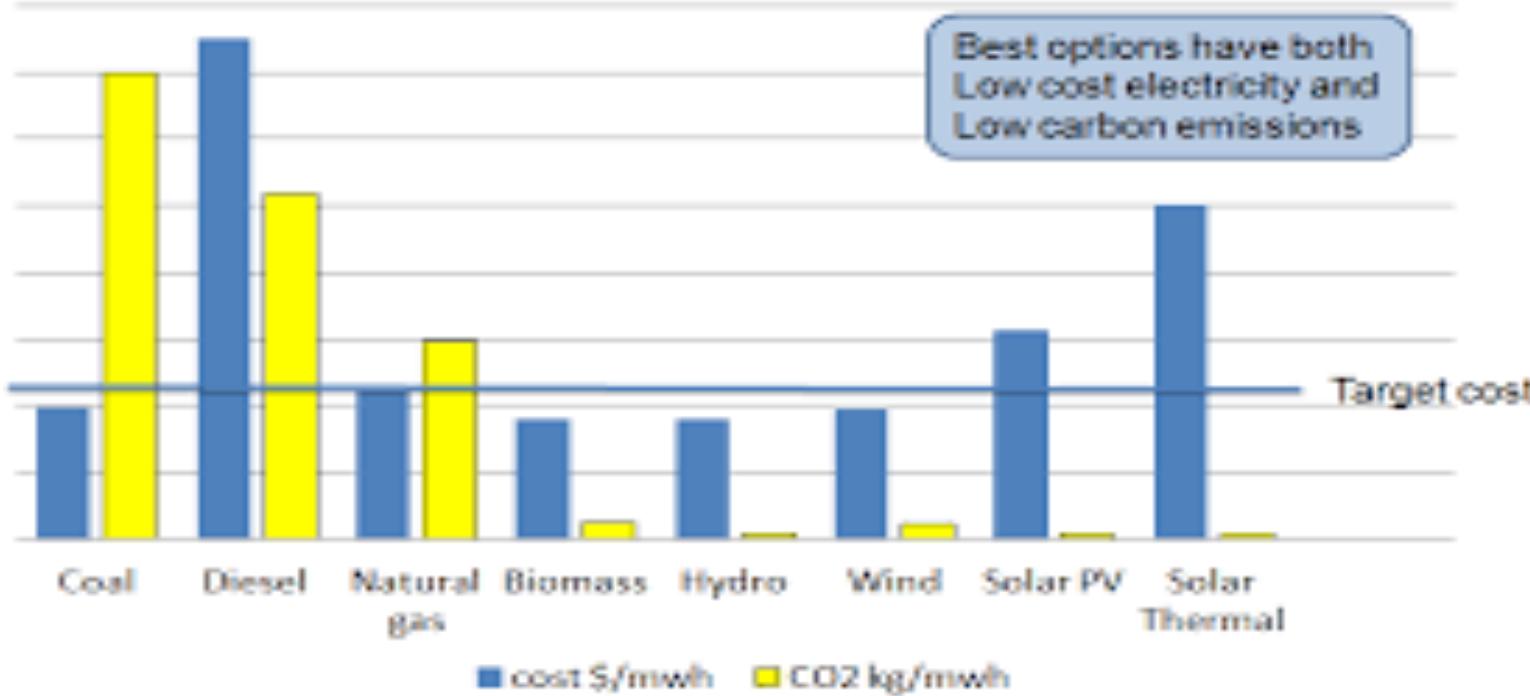
Tracking the Sun IV: The Installed Cost of Photovoltaics in the U.S. from 1998 – 2010, Lawrence Berkeley National Laboratory, Jan. 2011, p. 1.
<http://eetd.lbl.gov/ea/ems/reports/lbnl-5047e.pdf>.

Wind Efficiency and Cost



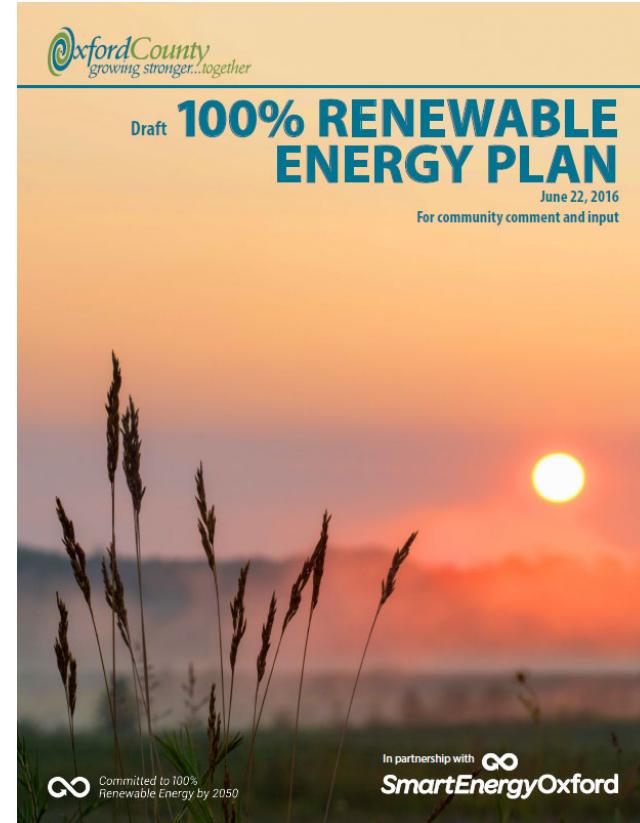
Balancing Cost and CO₂

Electricity Cost & Carbon Dioxide Emissions
per kilowatt hour



US 100% Renewable by 2050 ?

- Need a PLAN
- Need Commitment
- Need PUBLIC SUPPORT!



Stable Incentives for renewable development



- **Investment tax credits**
- **Guaranteed purchase price for renewable-generated electricity**
- **Government loans and grants for renewable energy development**
- **Tax deductions for renewable & conservation at all levels**

Federal Energy Policy

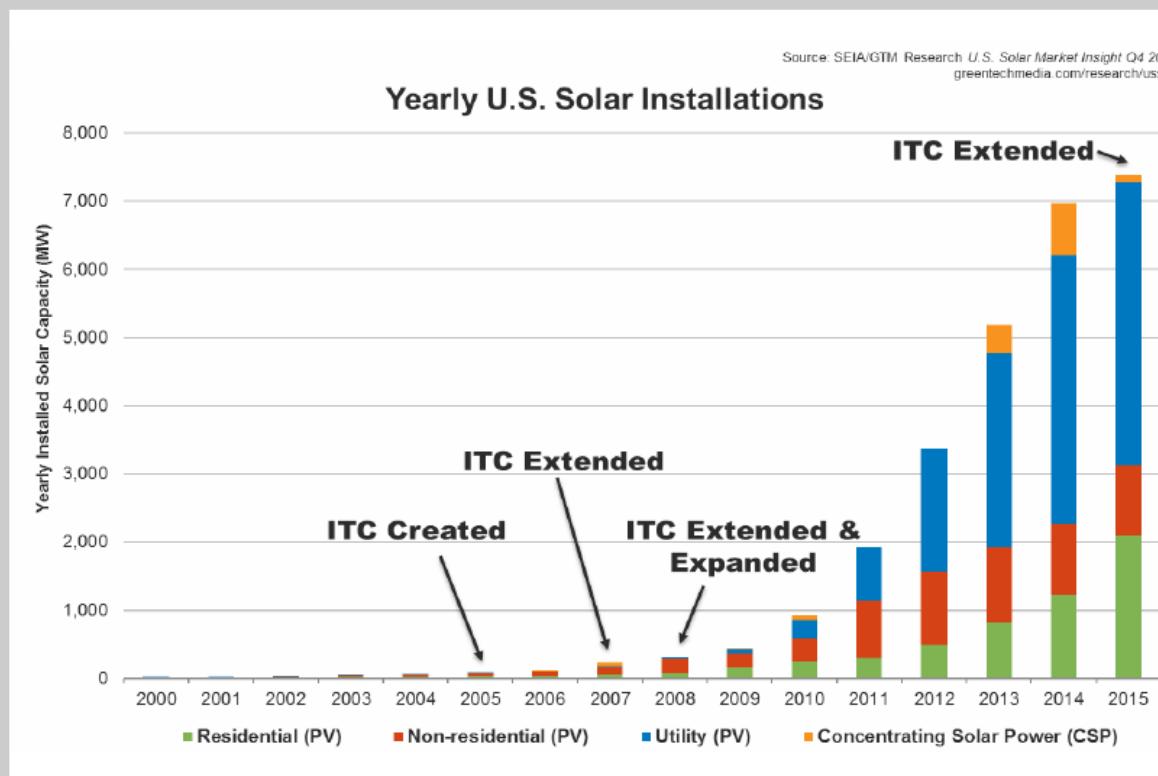
- 30% ITC for residential & Commercial Solar (PV, Heating & cooling, Concentrating Solar) extended until 2021
- Renewable Electricity Production Tax Credit

\$0.0184/kWh for 10 years

Enacted in 2005, expired in 2016.



Federal Investment Tax Credit

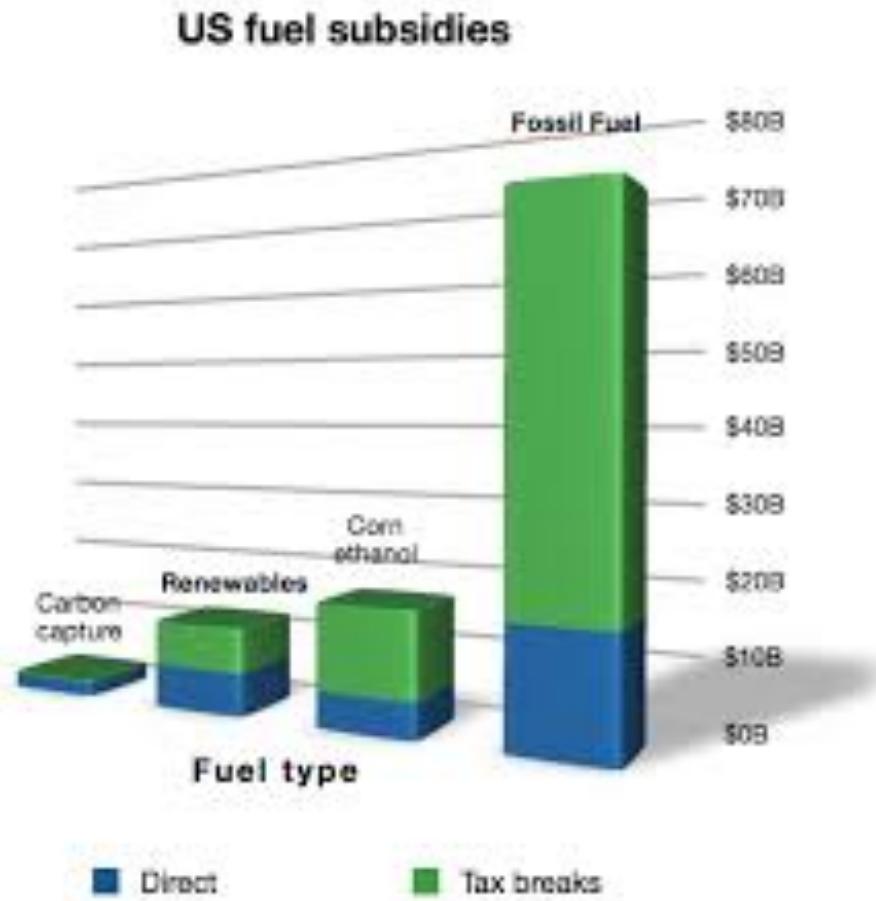


© 2017

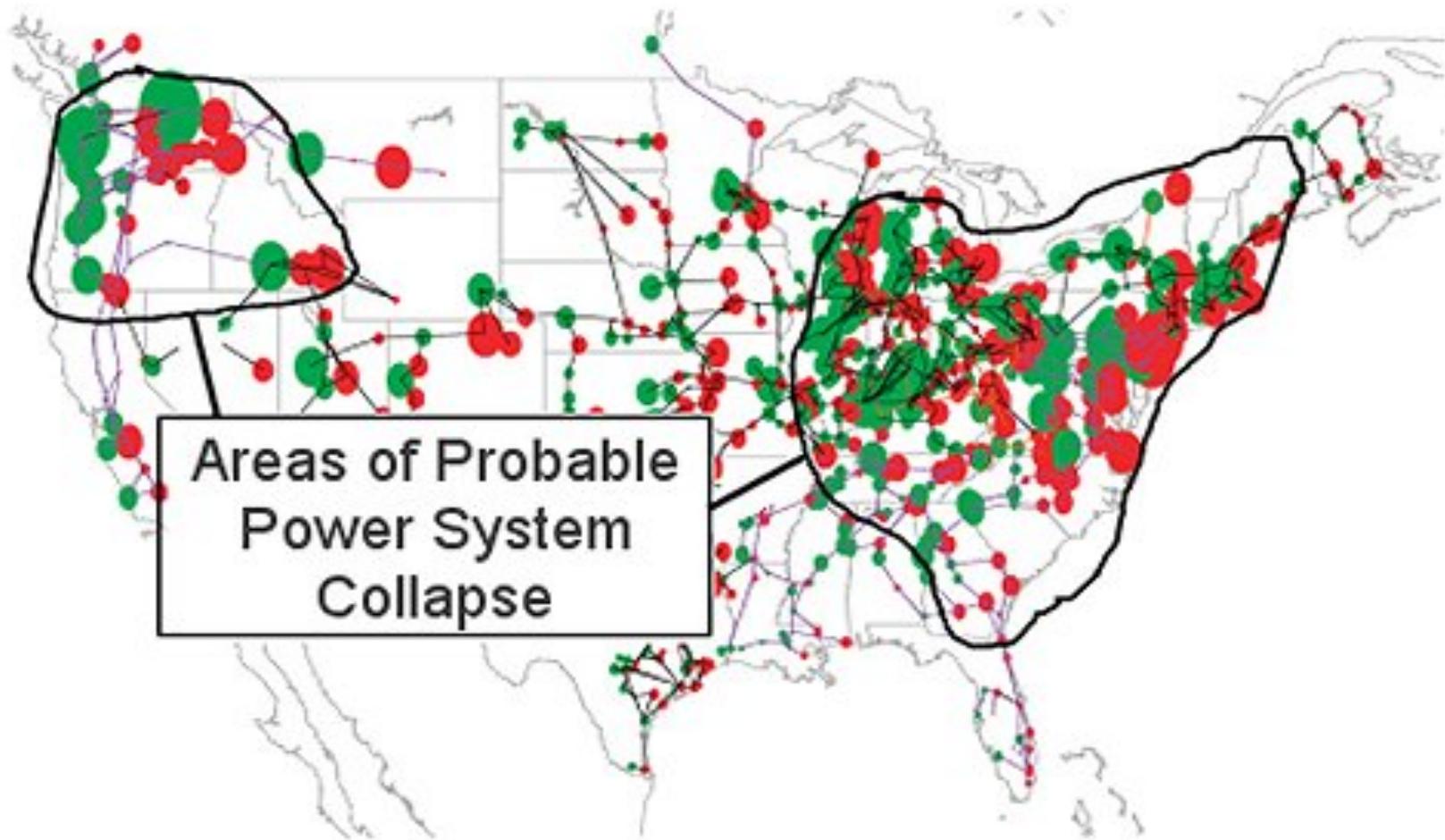
gtmresearch



Fossil vs Renewable Subsidies



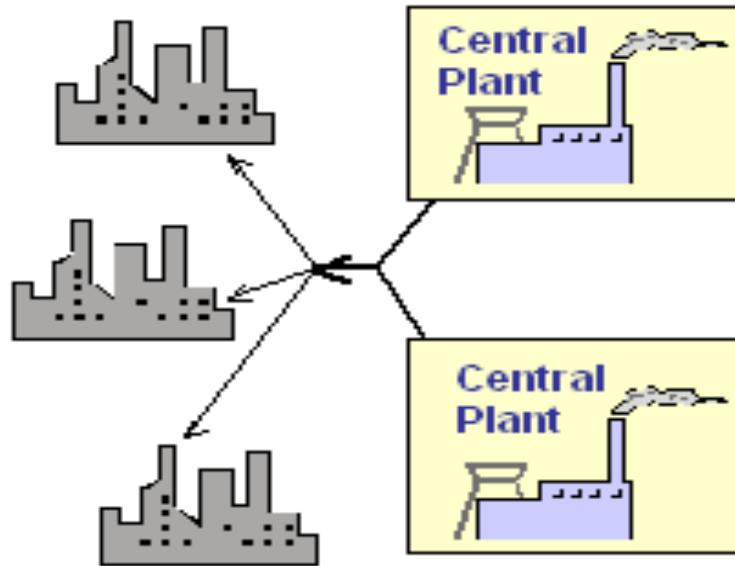
Vulnerability from Interconnected Grids



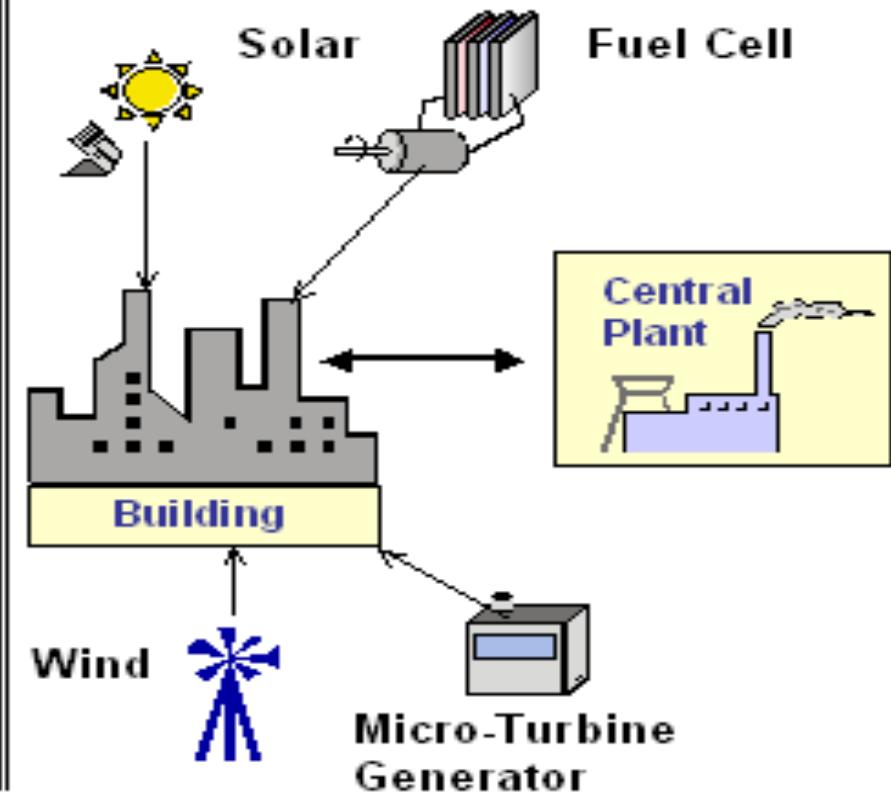
http://science1.nasa.gov/science-news/science-at-nasa/2009/21jan_severespaceweather/

CENTRAL vs. DISTRIBUTED GENERATION

Central Generation

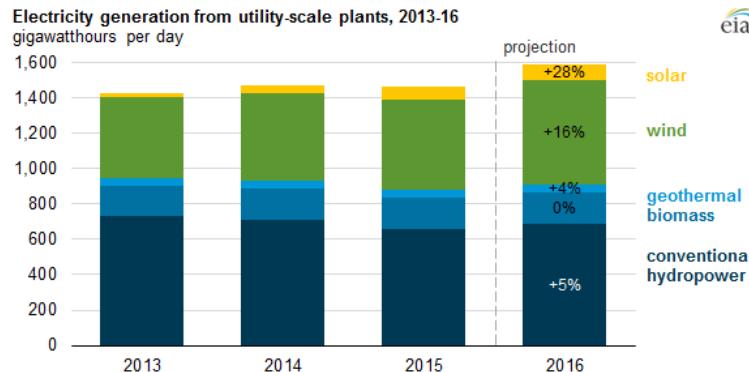


Distributed Generation



Utility Scale Renewables

EIA expects 14% utility scale Renewables in 2016



Innovative Solar Systems Project in NC

Renewable Energy Job Profile

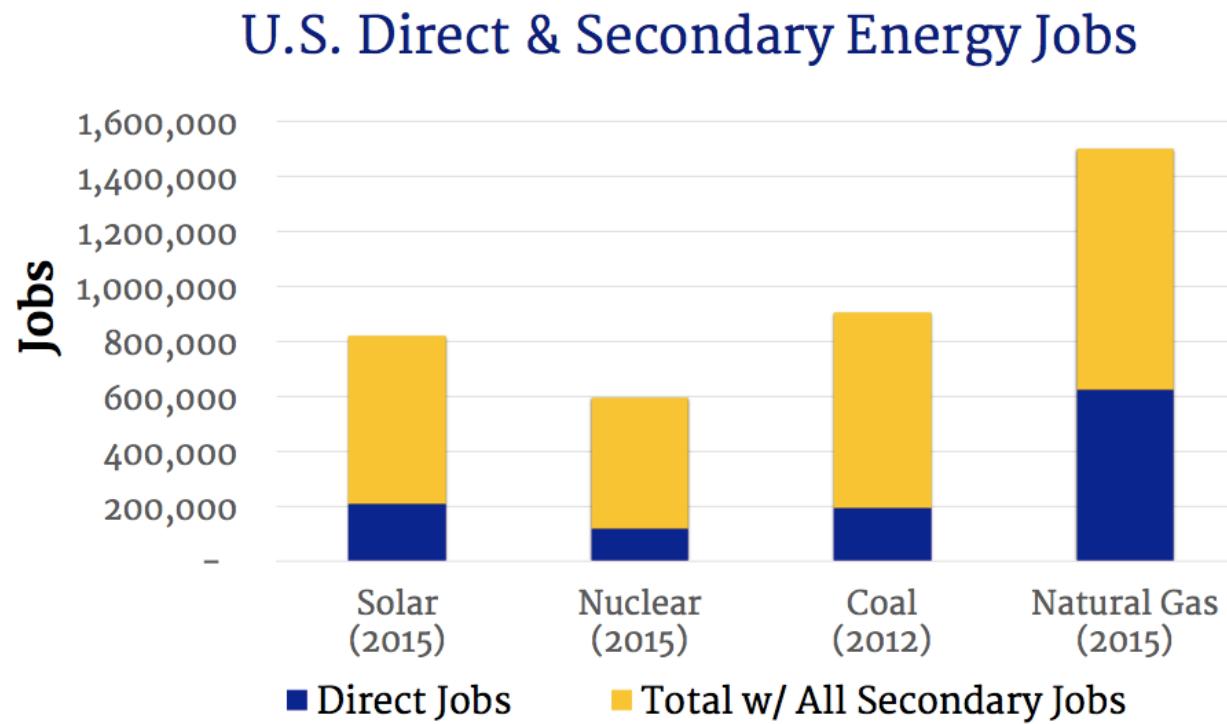
Labor

- Local to communities
- Manufacturing
- Design/engineering/architecture
- Installation
- Operation

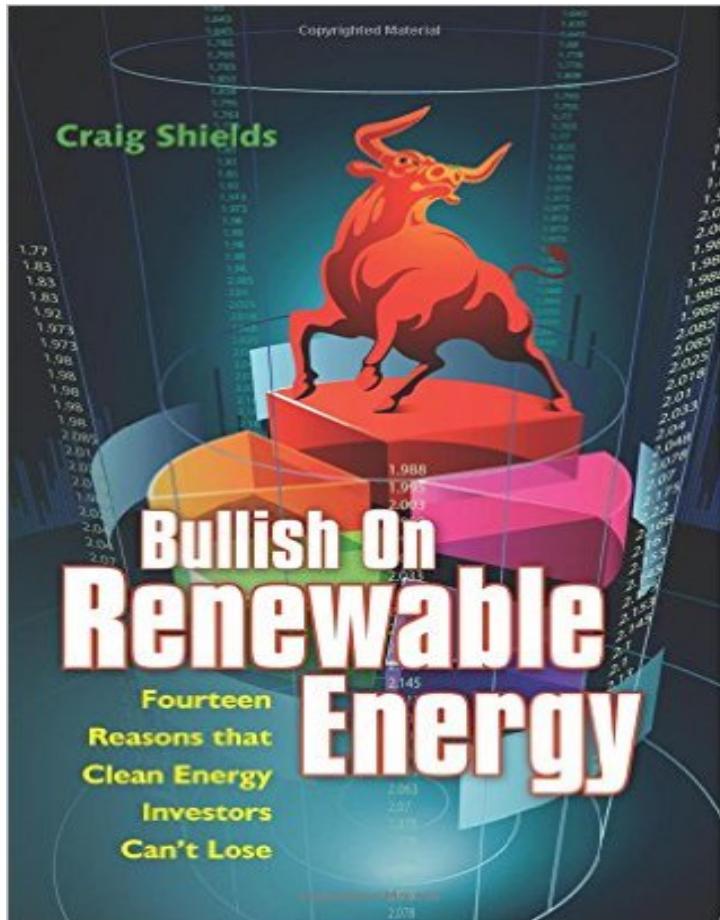
Wind energy engineer



Solar jobs growing



Renewable Energy Investment Profile

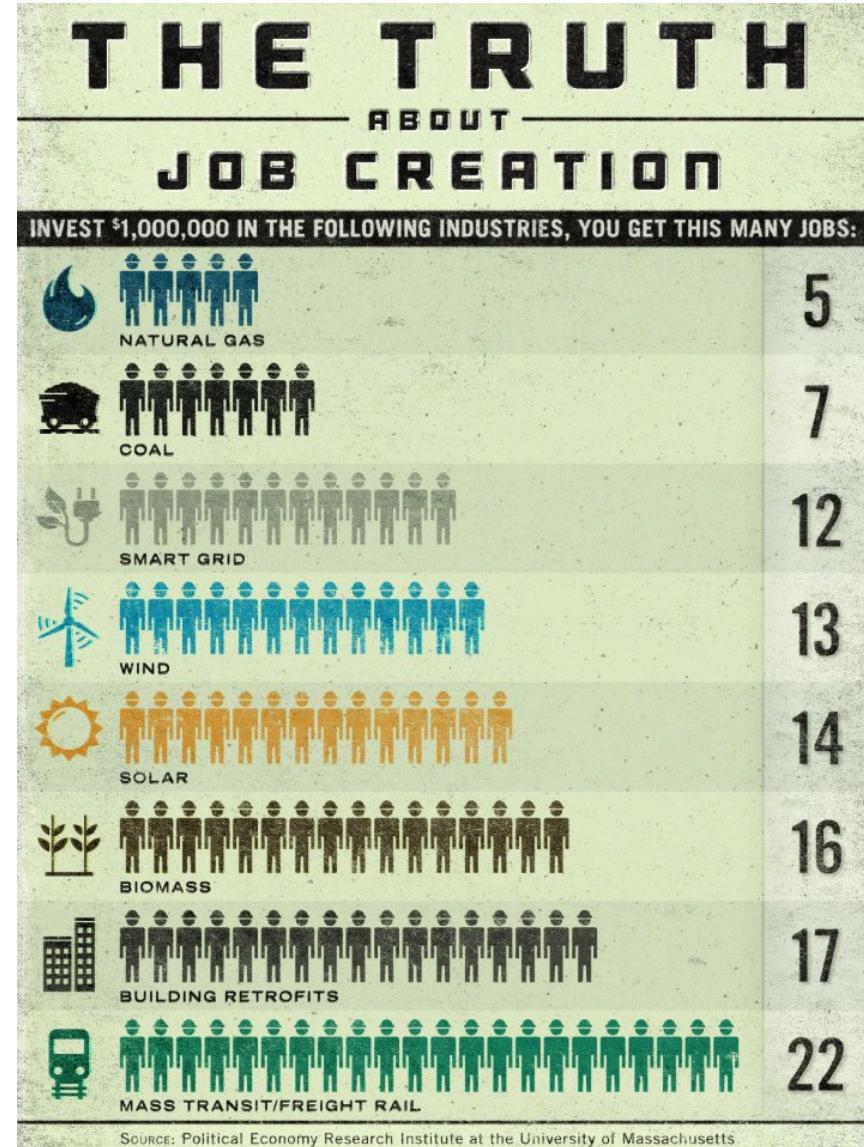


- Capital
- Distributed
- Multiple sectors
- Scaled to use
- Decentralized – multiple corporations

Invest \$1 Million



Put more people to work

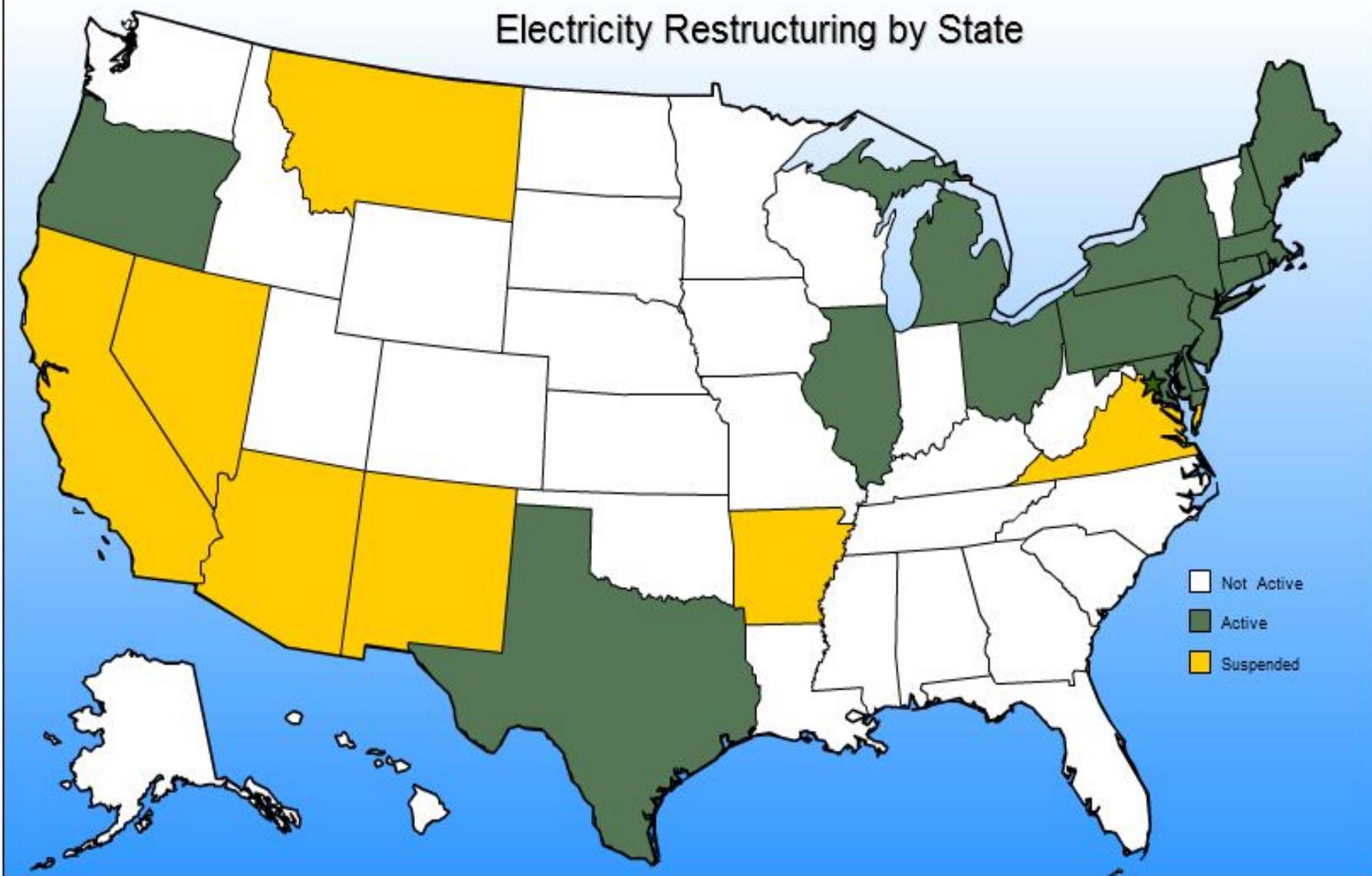


State Energy Policy

- Policies vary widely among states
- State grant programs
- Loan programs
- Renewable Energy Portfolio Standards
- Net Metering Tariffs



Electricity Restructuring by State



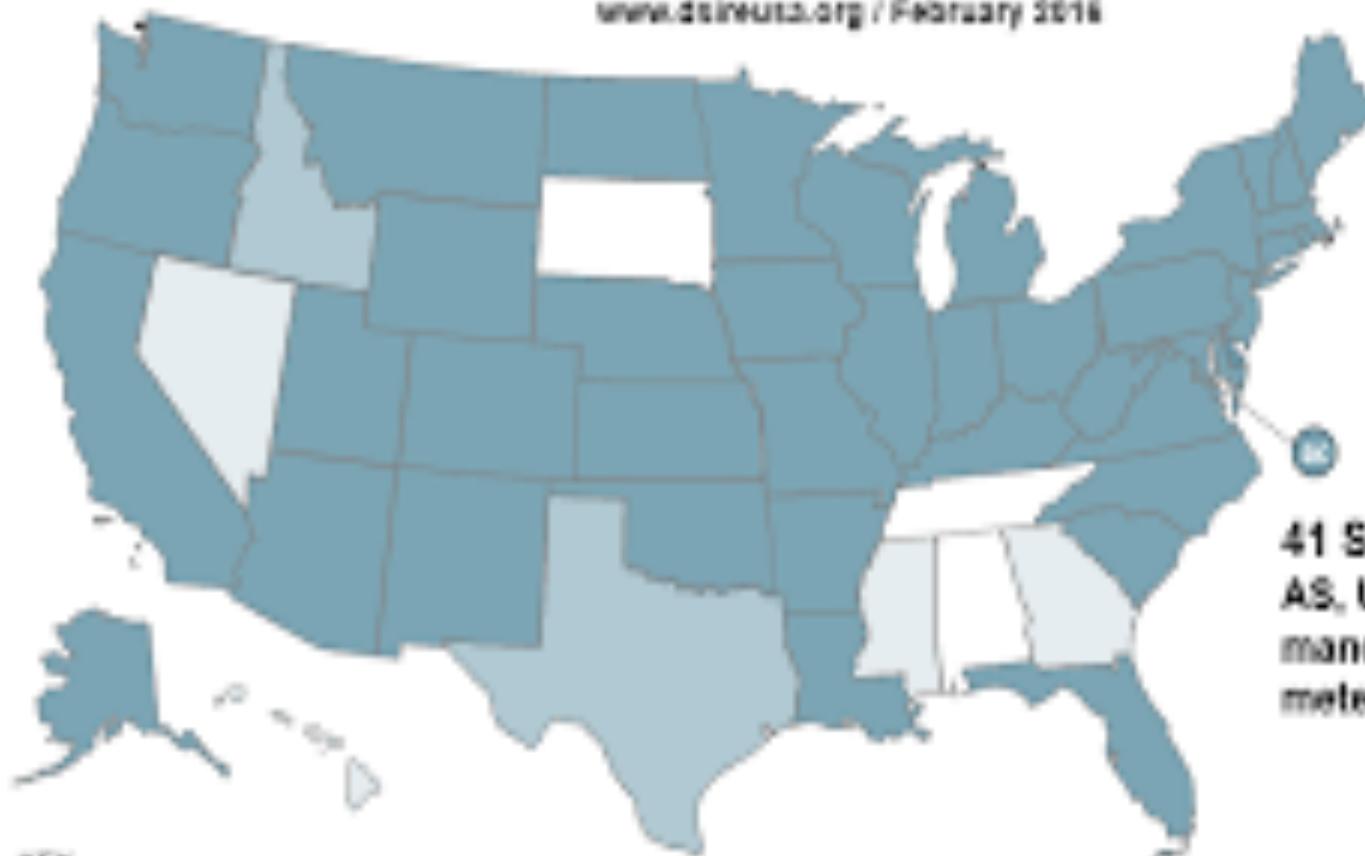
National Energy Act 1992- allowed states to de-regulate electricity

Renewable Portfolio Standards



Net Metering

www.dsireusa.org / February 2016



NET

State-developed mandatory rules for certain utilities (41 states + DC + 3 territories)

No statewide mandatory rules, but some utilities allow net metering (7 states)

Statewide distributed generation compensation rules other than net metering (1 states + 1 territory)

U.S. Territories:

AS	PR
VI	GU

Local Energy Policy

- Policies vary widely among local jurisdictions
- Zoning Ordinances for solar and wind installations
- Adopt renewable energy in municipal buildings
- Educate citizens



Zoning Ordinances

- May define land uses to promote renewable energy
- May grant variances in positioning buildings for optimum passive solar
- May define wind turbine height, placement and setbacks
- May establish safety and inspection requirements



Local Government



Zoning Allowances



Forest Hills Municipal Building

Final Schematic Design
PFAFFMANN + ASSOCIATES

Community Education





**Will we leave
our children
a living Earth?**

**Or will we be part
of the next
great extinction
of species?**