



Panel Discussion: GLOBAL EXPERIENCES IN CLEAN ENERGY DEVELOPMENT

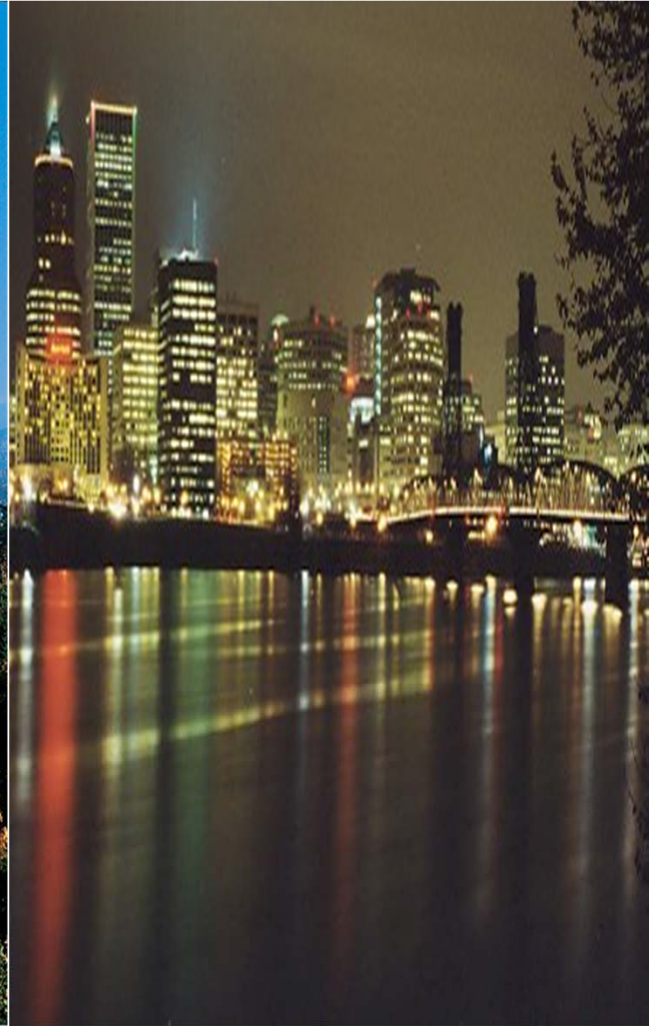
Workshop on Clean Energy Development
Strategies in East Africa

July 16-18, 2012, Arusha, Tanzania

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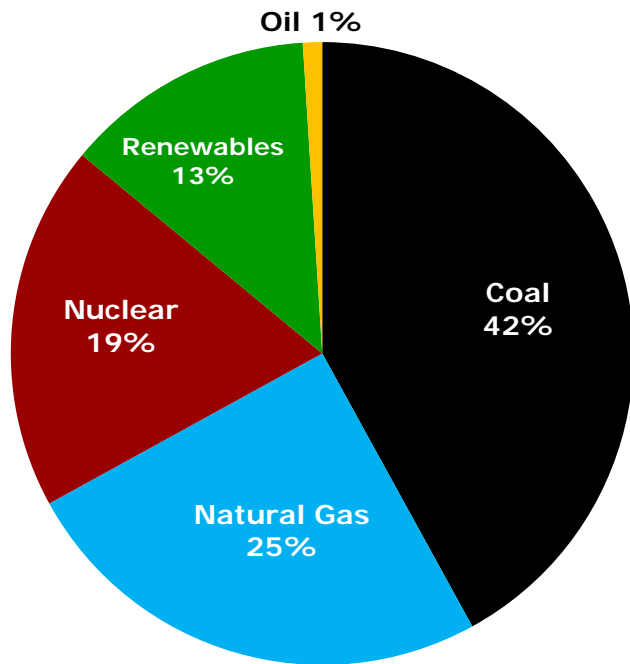
Schiff Residence – 4.32 KW PV system with PV Powered Inverter



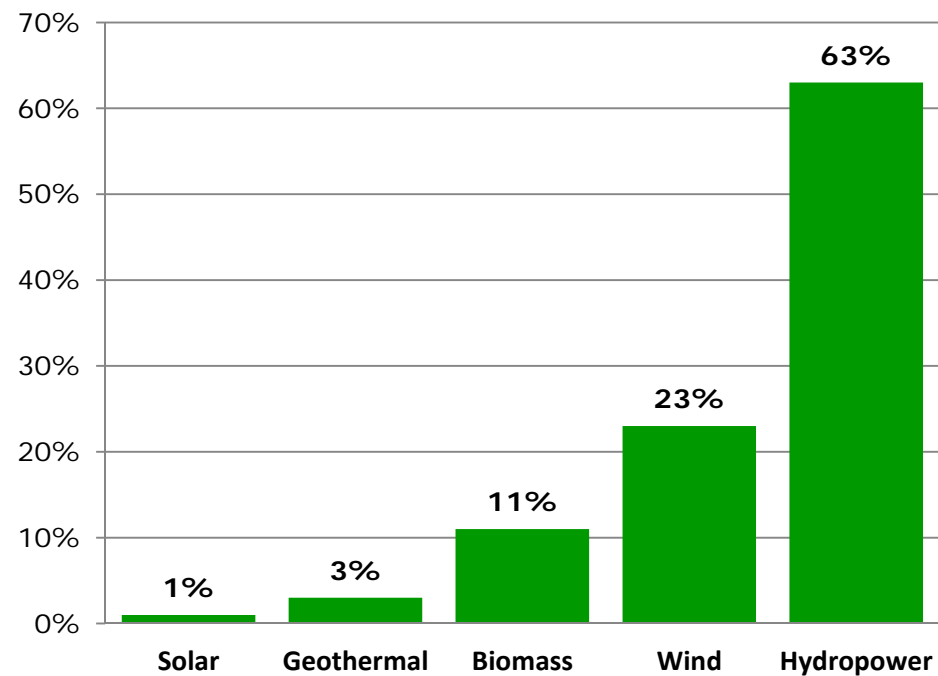
This type of installation is becoming more common; incentives in some states help homes and institutions like schools install grid-connected PV that can feed back into the grid during peak periods

U.S. Electricity Sector: 2011

Electricity Generation by Fuel Type in the United States, 2011



Renewable Electricity by Source, 2011

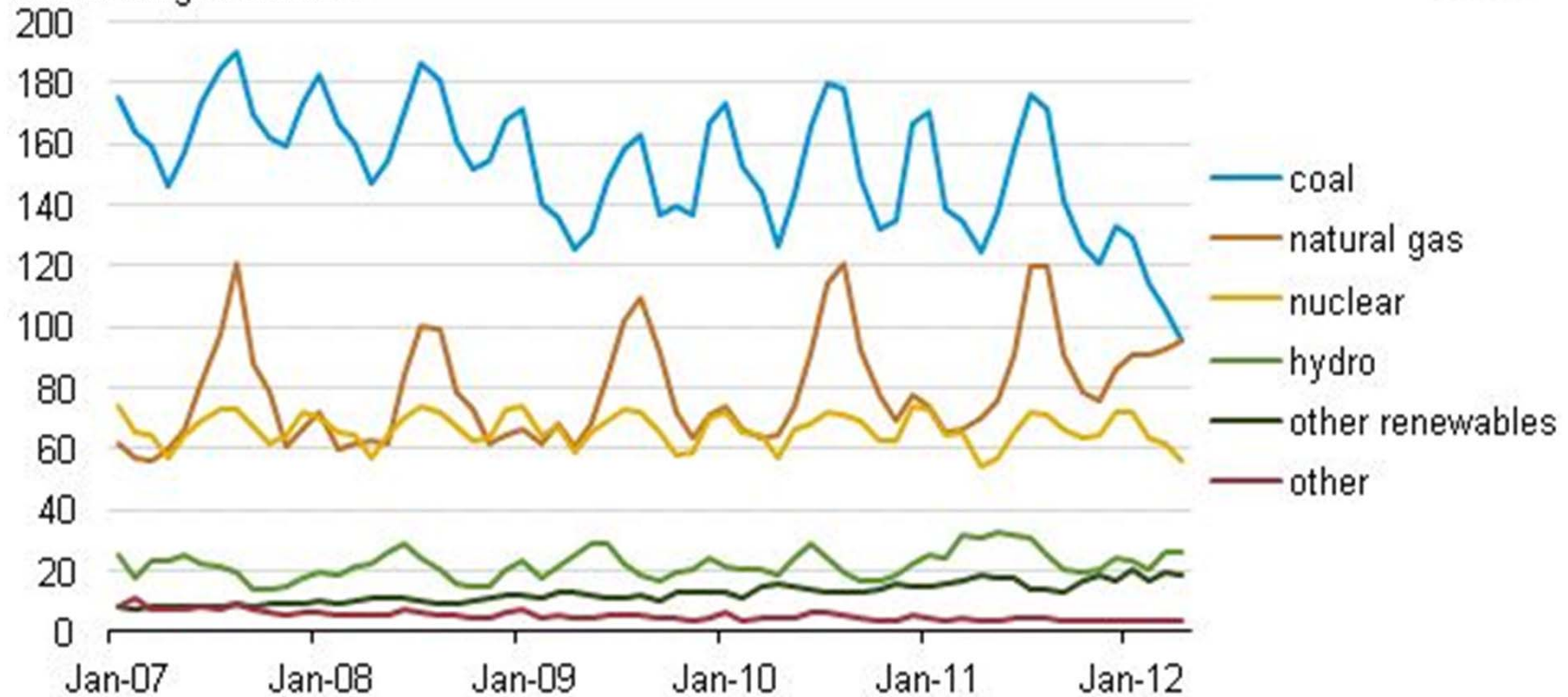


Source: US Energy Information Administration (EIA), Energy in Brief, Renewable Electricity, June 2012

In one year. . .

U.S. monthly net electric power generation, January 2007 – April 2012

million megawatthours

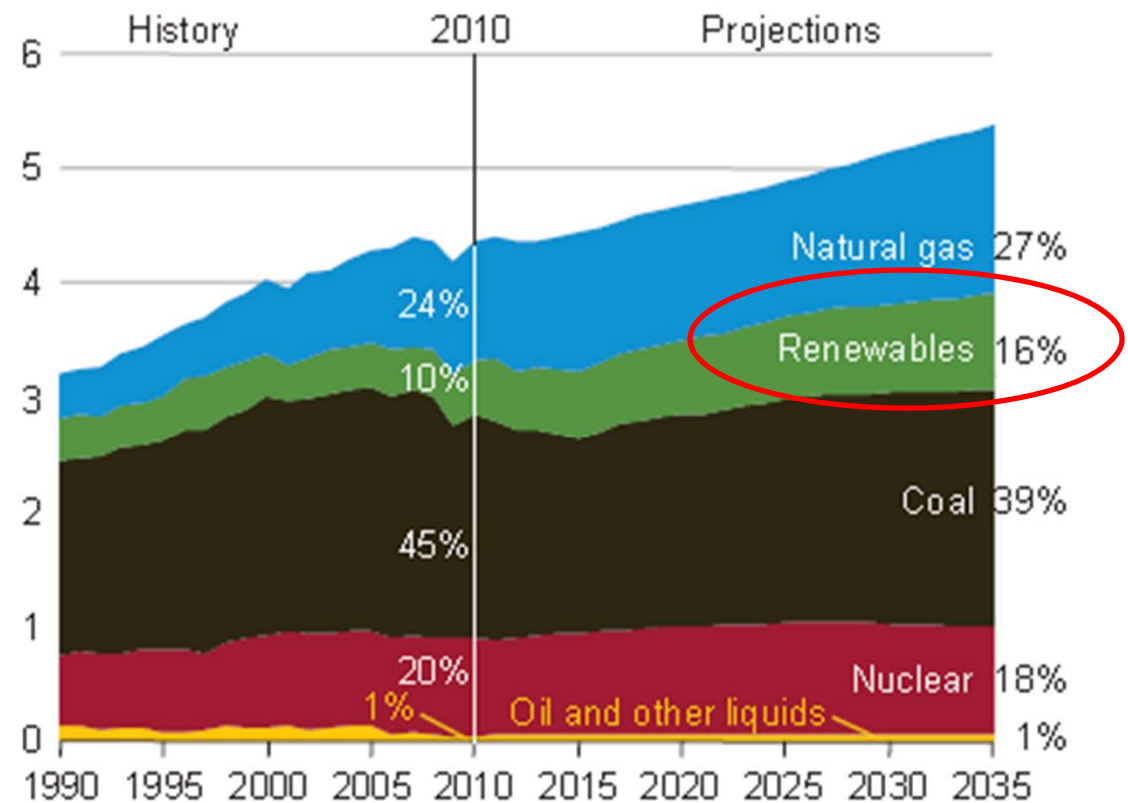


U.S. Electricity Sector: 2035

- Electricity generation from renewable sources is projected to grow to **16% in 2035**
- Even with high growth, renewables still projected to lag behind natural gas, coal, and nuclear power

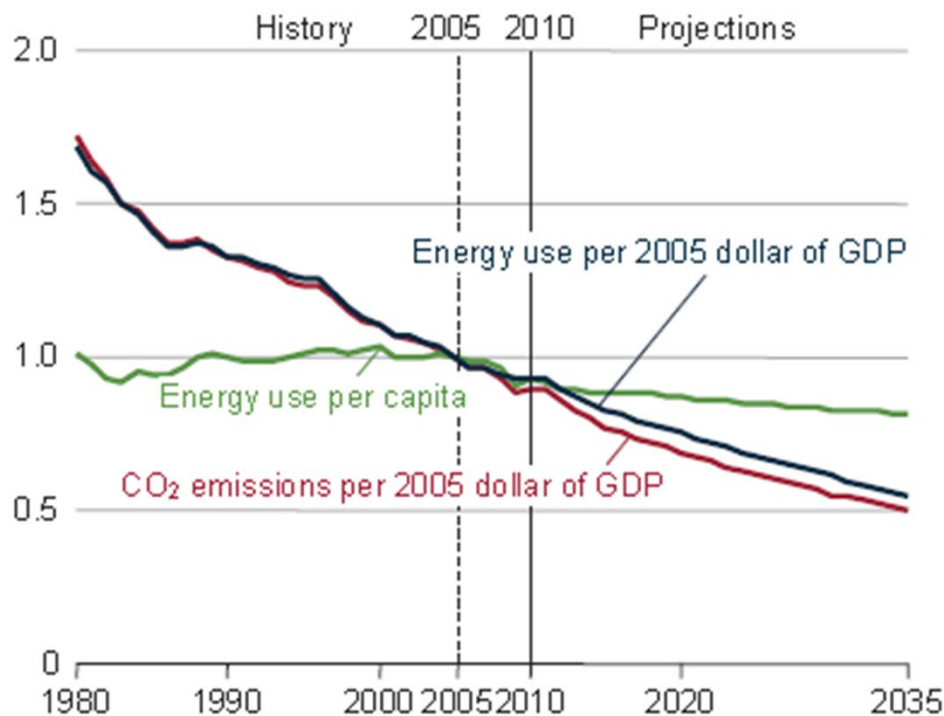
Source: US Energy Information Administration (EIA),
Annual Energy Outlook 2012 Early Release

**Electricity Generation by Fuel Type in the U.S.,
1990-2035 (in trillion kWh/year)**



The U.S. is Becoming More Energy-Efficient

U.S. Energy Use per Capita, Energy Intensity, and CO₂ Emissions Intensity, 1980-2035



- Energy use per capita is projected to decline by 0.5% per year from 2010-2035
- Higher efficiency due to economic recession; improved vehicle efficiency standards; more energy-efficient buildings and appliances

Source: US Energy Information Administration (EIA), Annual Energy Outlook 2012 Early Release

What affects clean energy development in the U.S.?

DRIVERS

State-level mandates and goals

Federal tax policy/subsidies

Federal Research and Development (R&D)

Loan Guarantees for Commercialization

CHALLENGES

Cost-competitiveness

Federal tax policy/subsidies

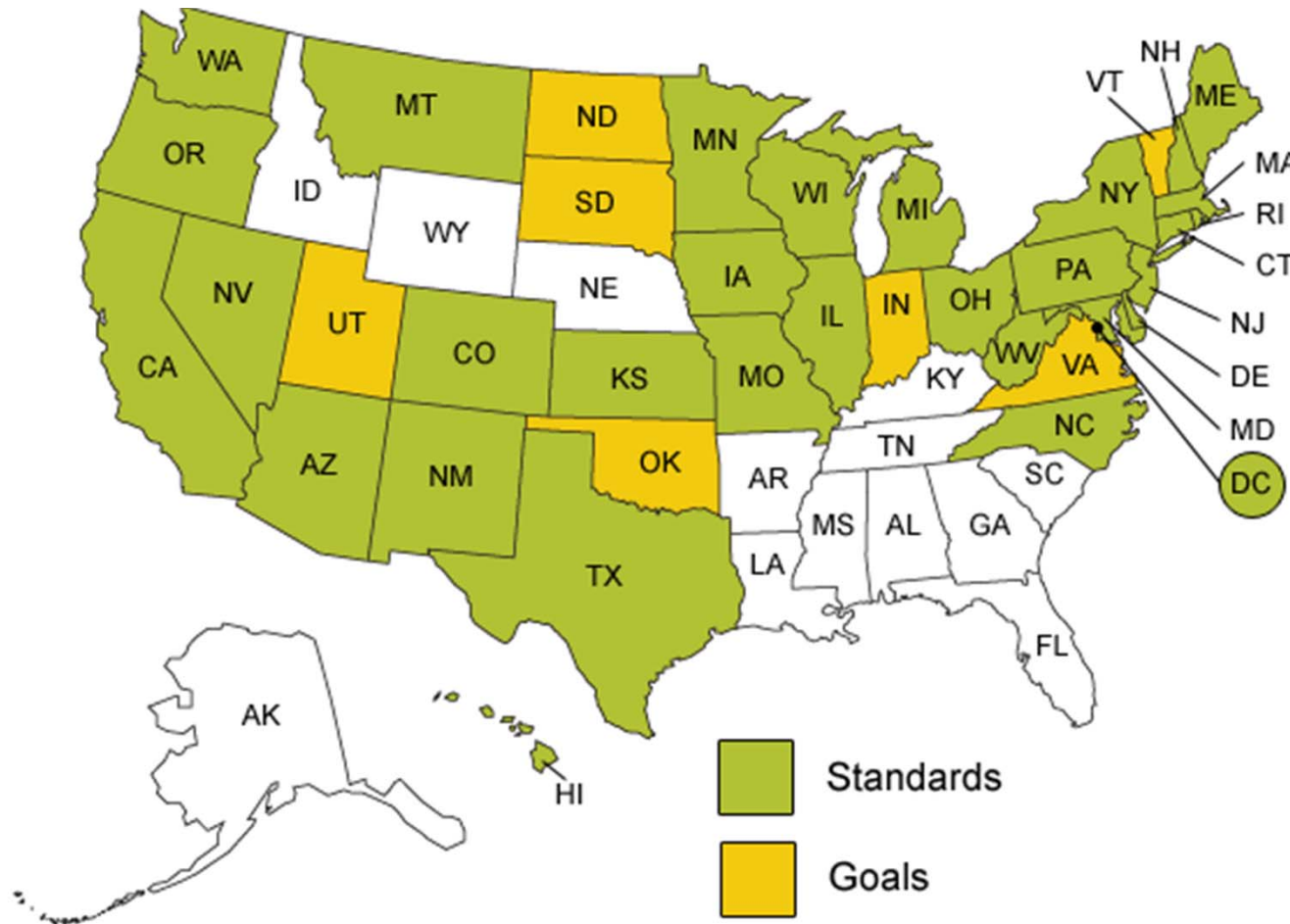
Land-use and siting issues

Transmission and grid infrastructure

Investment capital

State Policy is Driving Force for Renewable Energy & Energy Efficiency

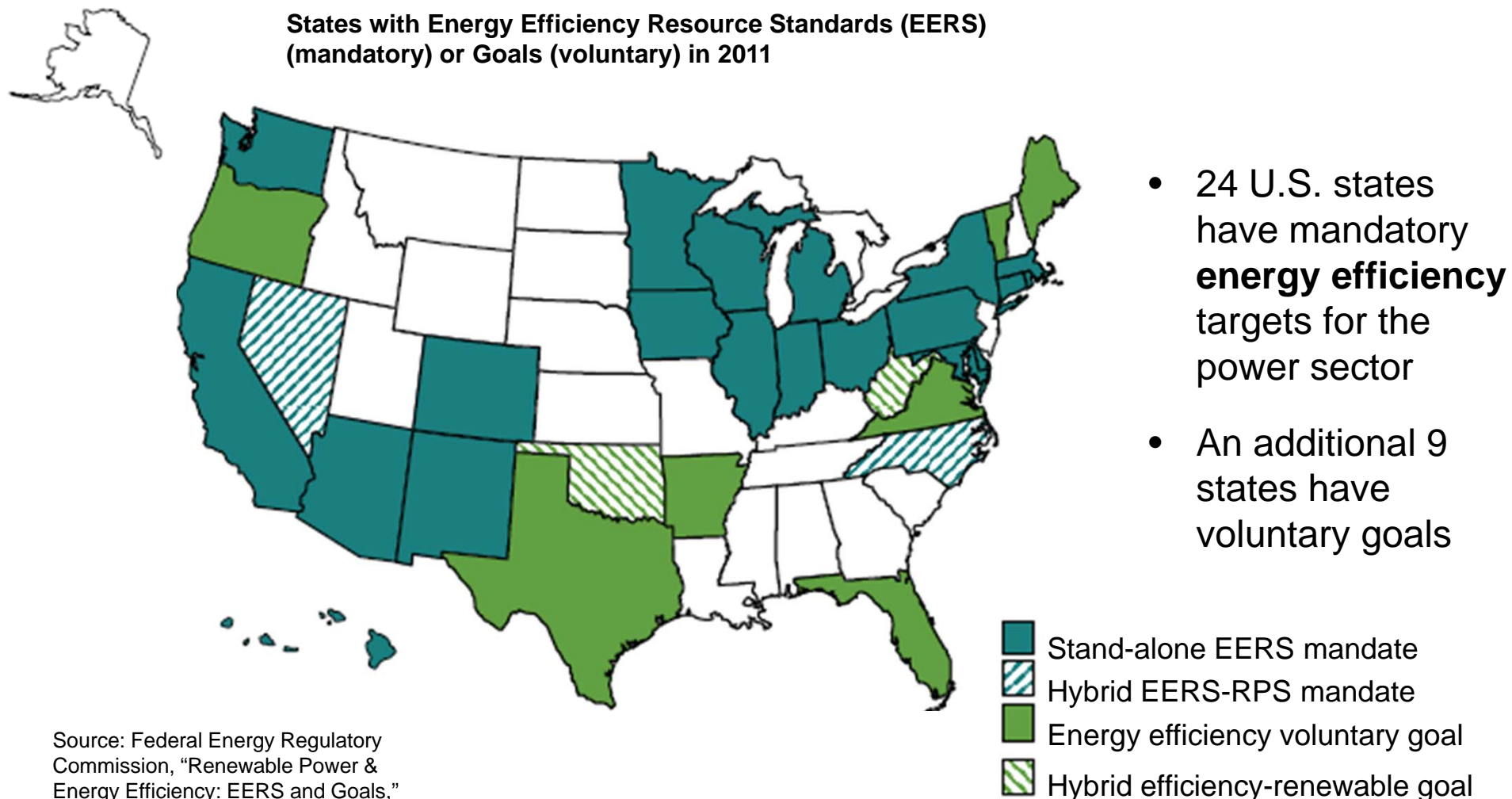
States with Renewable Portfolio Standards (mandatory) or Goals (voluntary) in 2012



- 31 U.S. states have mandatory **renewable energy** targets for the power sector
- An additional 7 states have voluntary goals

Source: Renewable Energy Council, Database of State Incentives for Renewables & Efficiency, January 2012

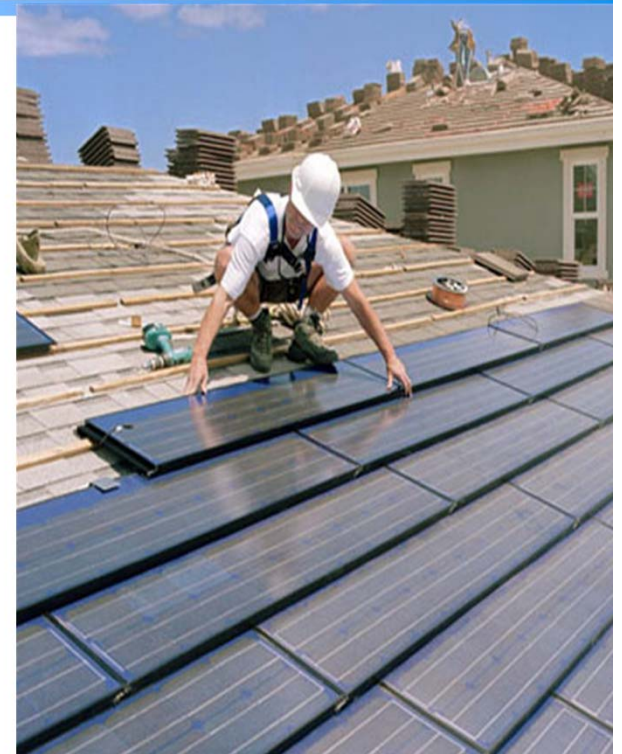
State Policy is Driving Force for Renewable Energy & Energy Efficiency



Source: Federal Energy Regulatory Commission, "Renewable Power & Energy Efficiency: EERS and Goals," Sept. 2011

Federal Tax Incentives Encourage Renewable Energy

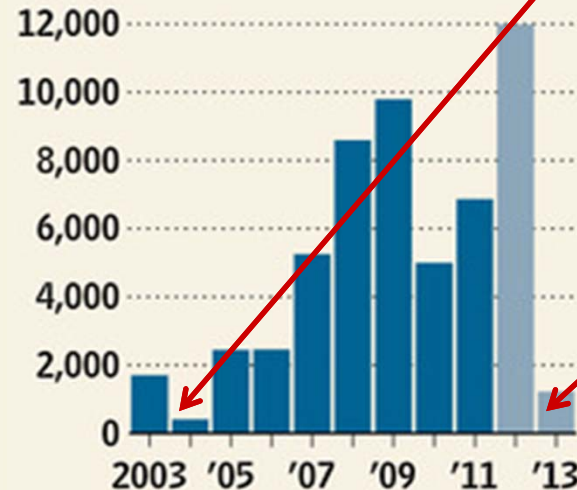
- U.S. Government subsidizes renewable energy use through **tax credits** for homes and businesses that install qualified technologies
- Incentives expire in 2016 if not renewed
- Qualified technologies:
 - Solar Hot Water Heaters
 - Solar Photovoltaics
 - Wind turbines
 - Fuel Cells
 - Geothermal Heat Pumps
 - Biomass
 - Combined Heat and Power/Co-generation



Importance of Federal Tax Policy: the Production Tax Credit Rollercoaster

- Production tax credit -- a per-kilowatt-hour incentive for electricity generated by renewables
- Credits expire in 2013 for most technologies. For wind, 2012
- Without credits, renewable energy can't compete pricewise with coal and natural gas
- Uncertainty impacts demand and could mean loss of jobs at turbine plants
- The wind industry employs an estimated 75,000 people in the U.S.

A sharp drop in U.S. wind projects is forecast for 2013 as a key federal tax credit expires on Dec. 31. New wind-generation capacity added, in megawatts:



Dip in wind capacity when production credit left to expire in 2004

Similar impact expected for 2013

Notes: Federal tax credit previously expired in 2004; Data for 2012 and 2013 are forecasts

Source: IHS Emerging Energy Research
The Wall Street Journal

Source: Wall Street Journal, "Wind Power Faces Taxing Headwind," July 2012

Major Clean Energy Research and Development Programs

- **National Renewable Energy Laboratory (NREL)**

National laboratory dedicated to advancing renewable energy and energy efficiency

- **Advanced Research Projects Agency – Energy (ARPA-E)**

Mandate to support alternative, cutting edge energy R&D. Currently: smart grid, electric vehicle battery technology, renewable energy storage and transmission

- **Clean Energy Innovation Hubs**

Brings together teams of best researchers and engineers to solve energy challenges

ARPA-E Objective: “Focus on creative ‘out-of-the-box’ energy research that industry by itself cannot or will not support due to its high risk, but where success would provide dramatic benefits to the nation.”



Scaling Up Clean Energy Financing

- Financing large clean energy projects a challenge
- More private sector investment in clean energy is needed
- US Government passed PACE legislation; hasn't been implemented
- U.S. Dept. of Energy reduces investment risk by backing private lender loans for clean energy projects
 - Program successful overall, leveraging over \$40 billion private sector investment
 - Program controversy after 2011 solar company bankruptcy, leaving U.S. with \$527 million loan

Siting Challenges



Projects face major hurdles:

- Space for large scale projects
- Large scale projects must pass careful environmental review
 - Wildlife, endangered species habitat, bird migration routes
 - Aesthetics and noise concerns (NIMBY)
- National security concerns
- Transmission lines

Grid Challenges



Most of the U.S. electricity grid built before World War II

Power grid needs to improve

- Development of intelligent, two-way electric grids
- Large-scale and distributed electricity storage
- Enhanced long-distance transmission

Sources: National Research Council, "Electricity from Renewables: Status, Prospects, and Impediments," Press Release, 2009 and American Physical Society, "Integrating Renewable Electricity on the Grid," 2010.

Conclusions 1 – U.S. Renewable Future

- Clean energy projected to grow
- Policy uncertainty hampers growth
 - Federal government R&D, risk reduction, financial incentives are critical
 - States' renewable energy targets also are drivers

Conclusions 2

- Large-scale development
 - Need stakeholder buy-in and review
 - Need to update electrical grid
 - *If there's one thing the experts agree on: Since wind and solar energy are all about the weather, grid operators will need to hire a lot more weather forecasters. - NPR*
 - Energy efficiency can help reduce strain on grid and reduce demand for fossil-fuels
 - Need to ensure market infrastructure

And then there's sewer power!



Experts in renewable energy circles say they're impressed by the potential of this idea. John Lund, a professor of civil engineering at the Oregon Institute of Technology, says going to the sewer for energy could cut the cost of installing geothermal heating and cooling systems in half. You're just digging in and tapping into the sewer line, and just pulling the heat or rejecting it."



Thank You!

Questions?

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