DOE’s Energy Technology Strategy

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U.S. Energy Challenges

Oil

- Daily Spot Price OK WTI

Environment

- Atmospheric CO₂ at Mauna Loa Observatory

Competitiveness

- Global Lithium-ion Battery Manufacturing (2009)
  - Other 2%
  - U.S. 1%

Share of Reserves Held by NOC/IOC

- Reserves to which International Oil Companies have Full Access: 6%
- Reserves Held by New Russian Companies: 6%
- Reserves Held by National Oil Companies (equity access): 10%
- Reserves Held by National Oil Companies (limited equity access): 78%

January Global Surface Mean Temp Anomalies

- Land and Ocean
- Ocean
- Land

Federal Deficit

- Actuals
- CBO Projected
Administration Goals

- From a 2005 baseline, reduce energy-related greenhouse gas emissions by
  - 17% by 2020
  - 83% by 2050

- Reduce our daily petroleum consumption in 2020 by 3.5 million barrels, from a 19-million barrel baseline.
Barriers to Supply-Side Transformation

**Ubiquity**
Consider economic, political, and social dimensions

**Longevity**
Stock of existing assets

**Incumbency**

**Scale**
Large capital and access to existing infrastructure are required

**New technologies compete on cost**
Energy Essentials

As a whole, energy is:

- A big and expensive system
- In private hands
- Governed by economics, modulated by government policies

Supply:

- Fewer, long-lived centralized facilities with distribution networks
- Change has required decades
- Power and fuels are commodities with thin margins
- Markets with government regulation and distortion
- Transport and Stationary are disjoint
- Transport is powered by oil
- Power
  - Requires boiling large amounts of water
  - Sized for extremes (storage is difficult)
  - Numerous sources with differing...
    - Capex and Opex
    - Emissions
    - Base/Peak/Intermittency

Demand:

- Many distributed players, shorter-lived assets
- User benefit (economics, convenience, personal preference)
- Determined by price, standards, behavior
- Little attention to system optimization for stationary use
Estimated U.S. Energy Use in 2009: ~94.6 Quads

Source: LLNL 2010. Data is based on DOE/EIA-0384(2009), August 2010. 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 flows for non-thermal resources (i.e., hydro, wind and solar) 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 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

U.S. DEPARTMENT OF ENERGY
Six Strategies

**Stationary**

**Supply**
- **Clean Electricity**
  - Solar, Wind, CCS, Nuclear, …

**Mobile**

**Supply**
- **Alternative Fuels**
  - Biofuels, …

**Demand**

**Modernize the Grid**
- Power electronics, Model the grid, …

**Progressive Electrification**
- Batteries, …

**Building and Industrial Efficiency**
- Appliances, CHP, HVAC, …

**Vehicle Efficiency**
- Light-weighting, ICE efficiency, …
Goal: Catalyze timely, material, and efficient transformation of nation’s energy system and secure U.S. leadership in clean energy technologies

**Deploy the Technologies We Have**

- **Drive energy efficiency** to reduce demand growth
- Demonstrate and deploy clean energy technologies
- Modernize the electric grid

**Discover the New Solutions We Need**

- Accelerate energy innovation through precompetitive R&D
- Facilitate tech transfer to industry and leverage partnerships to expand impact
- Establish technology test beds and demonstrations

**Lead National Conversation on Energy**

- Provide sound information on energy systems and their evolution
- Promote energy literacy
- Make federal government a leader in sustainability

**Selected Targeted Outcomes**

- Establish > 6 appliance standards/year
- 2010: make loan commitments for 2 nuclear reactors
- 2012: support 2x renewable energy generation
- 2012: assess materials degradation issues for light water reactor plants operating beyond 60 yrs
- 2013: retrofit 1 million homes
- 2015: support battery manufacturing capacity for 500,000 PHEVs
- 2011: establish Phase III SBIR Commercialization Program
- 2012: establish new contracts to lower commercialization barriers
- 2012: demo advanced irradiated fuel inspection techniques
- 2014: validate >2 new CCS geologic reservoirs and exploration techniques
- 2015: enable energy-related simulations
- 2015: complete > 2 new national tech user facilities
- **Small modular reactor**: 2016 (design cert), 2019 (demo)
- 2016: facilitate >5 commercial-scale CCS demos
- 2020: reduce DOE emissions by 28%
DOE Quadrennial Technology Review

- **Scope**
  - Reflect many items PCAST suggested
  - Provide context and robust framework for Department’s energy programs
  - Outline principles for establishing program plans with five-year horizons
  - Offer high-level views of technical status and potential of various energy technologies

- **Process**

- **Outreach and Transparency**
  - DOE is committed to engaging stakeholders – consistent with the President’s commitment to transparency, public participation, and collaboration
  - A publicly accessible website
  - Release of ex parte communications
  - Request For Information (RFI) and framing document
  - Public comment
  - Focus groups
  - Workshops
A Technology Discussion Includes….

Why this technology is included

Headroom Resource

Current industry Actors and their roles

Roadmap

DOE history and accomplishments

Policy context Barriers

Tech-specific items needed for prioritization

More?
Questions or Comments?

DOE Strategic Plan for Fiscal Years 2011-2016

- http://www.energy.gov/about/budget.htm

DOE-QTR

- http://www.federalregister.gov/