DOE Quadrennial Technology Review

Grid Modernization Workshop

Scottsdale, AZ

23 May 2011

www.energy.gov/QTR

Welcome

FACA Guidelines

- Participants attending this Workshop are not members of a Federal Advisory Committee, nor do we intend to use this group as a Federal Advisory Committee.
- We are not seeking a group decision or consensus view with respect to the issues before you, or as to any action the Federal government should take.
- We welcome your individual recommendations and advice, and are looking forward to a productive workshop.

Transparency and Outreach

PCAST Recommendation: *"The [process] needs strong external input from many sources, including other levels of government, large and small businesses, academia, national laboratories, Congress, nongovernmental organizations, consumers, and other Federal agencies. …"*

We are committed to engaging our stakeholders consistent with the President's commitment to transparency, public participation, and collaboration. To meet these goals, the DOE will pursue a variety of mechanisms, including:

- A publicly accessible web site
- Release of ex parte communications
- Request For Information (RFI) and Framing Document (published mid-March)
- Public comment
- Focus groups & workshops through mid June

Notes and attendee list from this workshop will be published on the project webpage. Individuals' names will be redacted from comments.

Outreach: Workshops

TRANSPORT

- Alternative Fuels
  - April 26
  - Chicago, IL
- Vehicles Efficiency and Electrification
  - May 4
  - Knoxville, TN

STATIONARY

- Stationary Efficiency
  - May 17
  - Pittsburgh, PA
- Grid
  - May 23
  - Scottsdale, AZ
- Clean Electricity
  - June 7
  - Denver, CO

Capstone
July 13 in Washington, DC

Agenda and Logistics

8:30-9:00 AM	**Welcome and framing remarks**
	Dr. Steven E. Koonin, Under Secretary for Science
9:00-9:30 AM	**Panel discussion of cross-cutting questions**
	George Arnold, NIST
	Mark McGranaghan, EPRI
	Kris Mayes, Arizona State University
9:30-10:00 AM	**Full-workshop open discussion with the panel on cross-cutting questions**
10:00-10:15 AM	**Break**
10:15-11:30 AM	**Breakout sessions on the cross-cutting questions**
11:30-1:00 PM	**Lunch (non-working)**
1:00-2:00 PM	**Technology roadmaps presentations from QTR Technology Team**
	Gil Bindewald, William Parks, & Imre Gyuk
2:00-3:00 PM	**Technology-specific breakout sessions**
3:00-3:15 PM	**Break**
3:15-3:45 PM	**Report-back session I from technology breakout followed by brief discussion**
3:45- 4:00 PM	**Report-back session II from the morning's cross-cutting breakout sessions**
4:00-4:45 PM	**Full group discussion on cross-cutting questions**
4:45-5:00 PM	**Closing Remarks**
	Dr. Steven E. Koonin, Under Secretary for Science

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DOE Quadrennial Technology Review

Steven E. Koonin

Under Secretary for Science

U.S. Department of Energy

23 May 2011

Scope

- The DOE-QTR will provide a context and robust framework for the Department's energy programs, as well as principles by which to establish multiyear programs plans and budgets. It will also offer high-level views of the technical status and potential of various energy technologies.

- The primary focus of the DOE-QTR process and document will be on the following:
  - Framing the energy challenges
  - A discussion of the roles of government, industry, national laboratories, and universities in energy system transformation
  - Summary roadmaps for advancing key energy technologies, systems, and sectors
  - Principles by which the Department can judge the priority of various technology efforts
  - A discussion of support for demonstration projects
  - The connections of energy technology innovation to energy policy

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Timeline

Nov 2010

PCAST made recommendations for DOE to do QER

3/14 – 4/15

Public comment period for DOE-QTR Framing Document

4/20

First batch of public comments released on project website

Through mid-June

Hold workshops and discussions of each of the Six Strategies

End July/Aug

Submit DOE-QTR to White House for approval

Before Dec 2011

Release DOE-QTR

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DOE-QTR Logic Flow

Energy context
- Supply/demand
- Energy essentials

Energy challenges
- Oil security
- US competitiveness
- Environmental Impact

Players and Roles
- Private/Gov't
- Within gov't
- Econ/Policy/Tech
- Acad/Lab/Private

Technology Assessments
- History
- Status
- Potential

Technology Roadmaps
- Milestones
- Cost
- Schedule
- Performers

Six strategies

DOE portfolio principles

DOE priorities and portfolio
Balanced within and across strategies

Program plans and budgets

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Six Strategies

	Supply		Demand
Stationary	Deploy Clean Electricity	Modernize the Grid	Increase Building and Industrial Efficiency
Transport	Deploy Alternative Fuels	Progressively Electrify the Fleet	Increase Vehicle Efficiency

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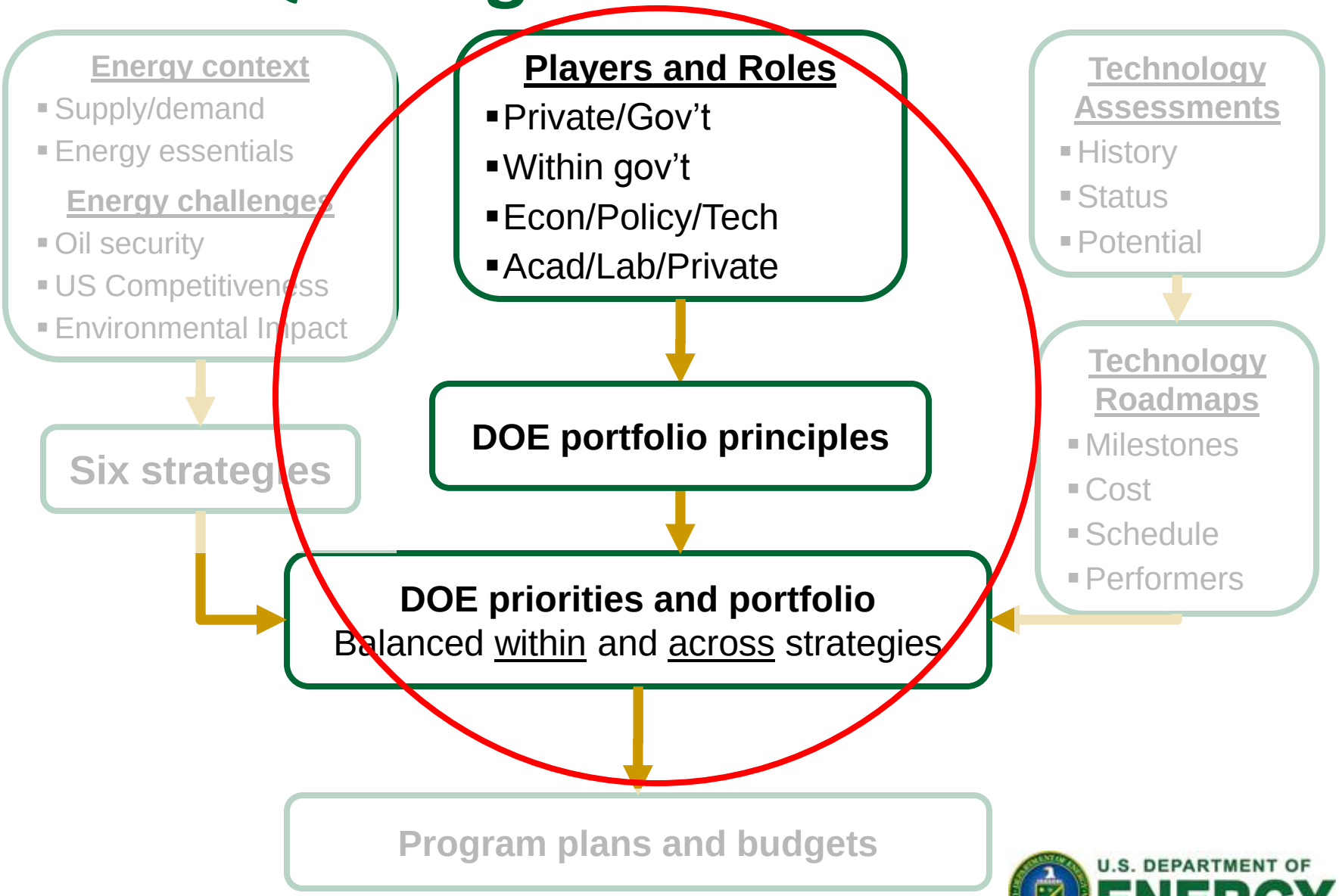
A QTR Technology Discussion Includes

- 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

DOE-QTR Logic Flow



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We will require input on:

- Roles of government, industry, national laboratories, and universities in energy system transformation
- Principles by which the Department can evaluate and prioritize various technology efforts
- Connections of energy technology innovation to energy policy

A Few Comment Excerpts Specific to the Grid

William F. Pickard, Washington University	"In this present world, energy is the commodity of commodities; and Congress should do whatever is constitutionally permissible to facilitate its flow throughout our nation. The log jam on energy transmission must be removed. Assuring the safety of that transmission is a realistic goal..."
UTC Power Corporation	"Policies that encourage utilities to deploy distributed generation technology to support and supplement the central grid would provide significant stimulus to the market development."
Near Zero	"Vaclav Smil was blunt: 'compared to Europe the country has no inter-regional interconnections and the grid looks quasi-medieval.'" "Other experts saw the task of modernizing the grid as one of deployment not development, and thus questioned the need for much DOE investment."
The Babcock & Wilcox Company	"We believe DOE should… develop roadmaps and set guidance on combining intermittent renewable supply with back-up power or storage to address grid impact issues. Wind and solar PV technology providers continue to improve reliability and lower costs, but currently have no incentive to develop solutions to the intermittency problem."

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Comments can be found at: http://energy.gov/qtr/10091.htm

A Few Things We've Heard at Previous Workshops

Alternative Fuels	• The value proposition of the Department is predominantly in technology assessment, not technology invention. • Inexpensive energy drives US competitiveness.
Vehicle Efficiency and Electrification	• Uncertainty around consumer acceptance of new technologies. We're entering a decade of experimentation. • Infrastructure is an issue; DOE's role here is uncertain. • Public-private partnerships are valuable. • EVs: Disagreement on the need for fast charging, and the ability of the grid to handle growing electrification.
Building and Stationary Efficiency	• We need better data on how energy is actually used in buildings and industrial processes, and better models informed by this data; DOE is well positioned to contribute here. • Skilled workforce matters, but DOE's role is uncertain.

Cross Cutting Questions

- The grid encompasses many technologies and applications, both transferring electricity and connecting key generators, end-users and eventually transportation. How should DOE balance:
  - Depth vs. breadth of investment?
  - Technological R&D vs. addressing non-technical barriers?
  - Different timescales of impact?
  - Widgets vs. systems?
- Are infrastructure investments keeping pace with new generation investments and end-user investments? What role should DOE play in shaping future infrastructure investments?
- At the applied technology level, is there a sequence that would be more effective than others regarding the large-scale deployment of clean electricity, smart-grid, energy storage? Should DOE time their efforts in a different way?
- What do you think are the prospects of significant new transmission assets being deployed nationally? If yes, what type and where? What would have to happen to alter your opinion on this topic? How should DOE's portfolio differ in the absence of new transmission?
- What are the rules of entry, allocation and exit in the grid portfolio? As a technology matures, how should DOE's posture change? What metrics should DOE use to measure progress in grid technology?
- What specific value does DOE provide to you? Where have you seen the benefit of DOE's involvement in your work with the electric power system?

Panel Discussion

- George Arnold, NIST
- Mark McGranaghan, EPRI
- Kris Mayes, Arizona State University

Breakout: Cross-cutting questions

- Groups have been assigned

Technology Roadmaps Presentation

- Gil Bindewald
- William Parks
- Imre Gyuk

Breakout: Technology-specific

- Groups have not been assigned – you are free to choose

1) System Awareness and Control (sensors, routable power, control algorithms)
2) Modeling & System Dynamics (understanding grid science, model validation)
3) Storage & Ancillary Services (storage, impact to grid and operations)
4) End-Use Participation (AMI, cyber security, EV, DG)

Break Out: Cross-cutting Questions

DOE as convener & educator of stakeholdes	• DOE has the ability to bring groups together (regulators, utilities, vendors), set a vision, say what's worked in other settings and move the group forward. • Difficult to assess/measure convener role. •Regulators/Consumer Advocates need info on success and value of techniology to achieve confidence in the value of cost-recovery •Look to EPRI's process in 1960s and 1970s for good model of effective convener.
Goals	•Define its aggregator role to create targets for utilities companies and all stakeholders. •Metrics need to be based on future market not current: Transparency (of usage), robustness (national security/ natural disasters), undelivered energy (blade feathered) • Use specifics of state RPS as interim milestones for Federal goal of 80% clean electricity by 2035.
Portfolio	•Too widget oriented, significant role in fundamental engineering understanding of grid & its performance. •DOE should invest where industry will not -- not inventing widgets but pulling everything together for systems implementation.

Break Out: Cross-cutting Questions

Allocation (short/med/long)	•50/30/20, 30/50/20, 40/30/30, 70/_
Time horizon	•The physical scale, capital exposure, and long-durability means that infrastructure deployment/replacement is planned on a 10-15 year timeframe (**incrementalism is important**).
Systems models	•We don't have the models we can give to utility commissions to show them how advanced systems would improve things. Utilities stick with proven tech
Chicken/egg problem for demos	•Need to have standards in place before running a demo to even get a utility to try. • Yet, standards can't take 5-10 years. Put together a team and set something in 90 days. Must close the time gap on standards

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Break Out: End-use Participation

Human / technology interface	•Too complex? Utilities tend to pull back, "we just provide infrastructure." •DOE: we're technology developers. Do we understand enough of customers?
EV	•Grid / system view different than that of consumer •Vendors nervous about mandates. Standards development moves more slowly than tech. innovation •Utilities not seen as having any deep understanding of consumers.
Security	•Need to build cybersecurity in to the technology, so DOE needs to engage on the issue. • Cybersecurity, Physical Security and Privacy all different issues, all require attention.

THANK YOU!

Project Website

http://www.energy.gov/qtr

Questions/Feedback

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Official (Public) Comments

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Proposed Mission Statement for DOE Energy Research

To facilitate the invention, refinement, and early deployment of meaningful technologies that enable options for scaling by the private sector toward national energy goals.

The words in this statement are carefully chosen:

- to facilitate – we convene and fund various entities – as well as support the basic research that underpins invention and refinement
- invention, refinement – we work on both revolutionary and evolutionary technologies
- early deployment – we support some activities beyond first commercial demonstration
- meaningful technologies – we pursue technologies that could have a material impact when deployed; accordingly, scale, economics, and timeliness are important criteria
- enable options – we do not pick commercial winners and losers; the markets make those choices
- scaling by the private sector – we support commercialization as an essential part of what we do
- toward national energy goals – we cannot and will not pursue all technologies; only those that enhance energy and national security, reduce environmental impacts, and increase U.S. competitiveness

Questions

- **Mission**: What do you think of the following mission statement for DOE energy research?
- **Clean Energy Leadership**: How can DOE activities best support U.S. leadership in clean energy innovation? In clean energy manufacturing? In clean energy deployment? How do we balance international competitiveness against international cooperation?
- **Program Definition and Management**: What principles should the Department follow for allocating resources among technologies of disparate maturity and potential time to impact?

  a) What should be the criteria for including a technology in the DOE portfolio? What should be the criteria for removing a technology from the DOE portfolio? How should programs be structured and managed to accommodate entry and exit of technologies within the DOE portfolio?

  b) How do we balance the diversity of technology options the Department could provide for the private sector against timeliness, scale, and cost-effectiveness?

  c) How can DOE be more effective at each stage of the innovation chain?

  d) What are useful metrics to guide DOE technology activities?

Questions

- **Private Sector Partnership**: What are the optimal roles for the private sector, government laboratories, citizens and academia in accelerating technology innovation?

  a) How can DOE best coordinate activities between and among these types of organizations (including the wide variety of institutions within each class)? How should we gauge the effectiveness of this coordination? How can the basic-applied coupling be optimized? Are there examples in other sectors or other countries that can serve as models?

  b) What are the design principles for an effective 'technology user facility'?

  c) How can the Department best gather technology market information? How can information on private sector innovation be captured without compromising competitive advantage?

Questions

- **Technology Demonstrations**: What are principles and best practices in performing large-scale demonstration projects?

  a) How close to commercial viability does a demonstration have to be? What are the optimal cost sharing arrangements? How might demonstrations be coordinated with DOE financing activities?

  b) How can demonstration projects better benefit all stakeholders beyond the immediate participants? How are lessons-learned best captured and promoted, and how is intellectual property best handled?

  c) How should DOE determine whether demonstrations adequately address technical and operation risks?

  d) What defines failure or success in the demonstration phase?

- **Non-technical Barriers**: A number of non-technical barriers—including federal, state, and local regulations, market failures, and non-technical risks—impact the rate of deployment of energy technologies. What, if any, role should the Department have in addressing these barriers?
- **Six Strategies**: Have we correctly identified and structured these six strategies?
- **Technology discussion**: Current selection of technologies and sources? Suggestions of alternate technologies and sources? Updated technology, cost, or forecast data, particularly in rapidly-moving fields?