

The Obama Administration's ST&I Policies As They Relate To The Intersection Of Energy, Economy, Climate Change, & Security

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Coverage of these remarks

- The Obama Administration's view of the challenges and opportunities in science, technology, & innovation
- What the President has done to enhance ST&I for national needs
- Challenges at the intersection of energy, economy, environment, & security and the role of the defense sector in addressing them
- How the defense sector is positioned to lead
- The challenges ahead



“Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been before.” - President Barack Obama, April 27, 2009

Challenges linked to ST&I: Domestic

- economic recovery & growth: S&T as drivers (infotech, biotech, nanotech, greentech...?)
- health care: better outcomes for all at lower cost
- energy & climate: cleaner, safer energy supply (incl reduced oil imports & GHG emissions)
- other resources & environment: water, land use, coastal zones, toxics, biodiversity, sustainability
- national & homeland security: IED detection & disarming, cyber- & power-grid security, bio-defense, ensuring safety/reliability of shrinking US nuclear stockpile without nuclear testing

Challenges linked to ST&I: Global

- Health: Defeating preventable and pandemic disease
- Development: Eradicating poverty and providing the possibility of sustainable prosperity for all
- Energy-Climate: Providing for societies everywhere the energy their economies need without wrecking the climate their environments need
- Land-Water: Managing the intensifying competition for the world's land & fresh water among food, fiber, fuel, infrastructure/industry, and ecosystem function
- Oceans: Maintaining their ecological integrity & productivity
- WMD: Avoiding use of nuclear and biological weapons

President Obama's views on the challenges

- They're interdisciplinary and interconnected (I&I)
 The energy/economy/climate-change/national-security nexus is a prime example.
- S&T are not just germane to success but central.
 Centrality means putting S&T in the center of what the federal government thinks, says, and does about these challenges.
- Success requires focusing not only on specific challenges but also on the foundations of strength in S&T.
 basic research, scientific infrastructure, STEM education, an innovation-friendly economic & political culture
- I&I mean solutions require partnerships
 among federal agencies; branches & levels of government; public, private, & philanthropic sectors

**What has President Obama
done to enhance
science, technology, & innovation
for national needs?**

What he's done: Presidential appointments

- Five Nobel Laureates in science
 - Energy Secretary Chu, OSTP Associate Director for Science Wieman, NCI Director Varmus, PCAST Members Molina and Zewail
- Another 25+ members of the NAS, NAE, IOM, and American Academy of Arts & Sciences
 - Including heads of NIH, NOAA, USGS, FDA, NIFA
- A CTO (Chopra) and a CIO (Kundra) in the White House for the first time
- An engineer running EPA (Lisa Jackson)

ST&I have never been so prominent in leadership positions.

The President & his PCAST (with 3 Nobel Laureates)



Pres Obama meeting with his Council of Advisors on Science & Technology 3-12-10

What he's done: speeches & events

Highlighting ST&I in...

- Speeches throughout the campaign, then Inaugural Address and speeches at: 2009 annual meeting of the NAS, Cairo Egypt, Albany NY, MIT, State of the Union (2010, 2011), Kennedy Space Center, Marquette MI, Portland OR (today!)
- White House events with nat'l middle-school and high-school science & math winners, National Medal of Science and National Medals of Technology & Innovation winners, groups of US astronauts (on 9 occasions), US Nobel Prize winners, STEM teaching & mentoring award winners, early-career S&E award winners.

No president has ever talked as much about ST&I.

With middle-school “Mathletes” in the Oval Office



What he's done: ST&I initiatives

- ST&I in the Recovery Act (1-09)
 - >\$100B for research, energy, space, S&T infrastructure
- The American Innovation Strategy (9-09, 10-10)
 - investing in the foundations, reforming tax & other policies, catalyzing breakthroughs for national needs
- Educate to Innovate (11-09, 10-10)
 - >\$700M in private & philanthropic support for partnerships to improve STEM education
- Startup America (3-11)
 - more partnerships & policies to support entrepreneurs
- plus health IT, data.gov, Wireless Initiative (WI³)...

No president has invested so much political capital in ST&I.

What he's done: Federal S&T budgets

- Huge boost for ST&I in the stimulus/recovery package.
- New goals for investments in ST&I (4-09) : double budgets of basic science agencies in 10 yr; make Research & Experimentation Tax Credit permanent: lift public + private investment in R&D to $\geq 3\%$ of GDP.
- FY2010 budget (~\$150B for Federal R&D) + Recovery Act put us on track to meet the goals.
- President's FY2011 budget would have continued on track if the Congress had passed it.
- Despite setbacks, S&T fared better in the FY2011 Continuing Appropriations Act than most other sectors.

The 2011 Continuing Appropriations Act

Billions of current dollars

	2010	2011
NIH	31.0	30.7
NASA	18.7	18.5
DOD S&T (6.1-6.3)	13.5	12.1
NSF	7.0	6.9
DOE Office of Science	4.9	4.9
NOAA	4.7	4.3
USGS	1.1	1.1

The President's FY2012 R&D Budget

- \$147.9B for Federal R&D—up \$08B from FY2010 enacted
- Nondefense R&D = \$66B—up \$4.1B (6.5 percent)
- Basic & applied research = \$66.1B—up \$6.9 billion (11 percent)
- NIH—\$31B (up 2.4 percent)
- DOE total—\$13.0B (up 20 percent)
 - DOE's Office of Science—\$5.4B (up 10.7 percent)
- NASA—\$9B (up 6 percent)
- NOAA—\$5.5B (up 158percent)
- DHS—\$1.05B (up 19 percent)
- National Science Foundation—\$7B (up 13 percent)
- NIST—\$764M (up 15.1 percent)
- Defense Department's R&D portfolio—\$76.6B (-4.9 percent)

Challenges at the Intersection of Energy, Economy, Environment, & Security and the Role of the Defense Sector in Addressing Them

The energy/economy/environment/security challenge in a nutshell

- Without energy there is no economy.
- Without climate there is no environment.
- Without economy and environment there is no material well-being, no civil society, no personal or national security.

The problem is that the world is getting most of the energy its economies need in ways that are imperiling the climate its environment needs.

Obama's energy & environment initiatives

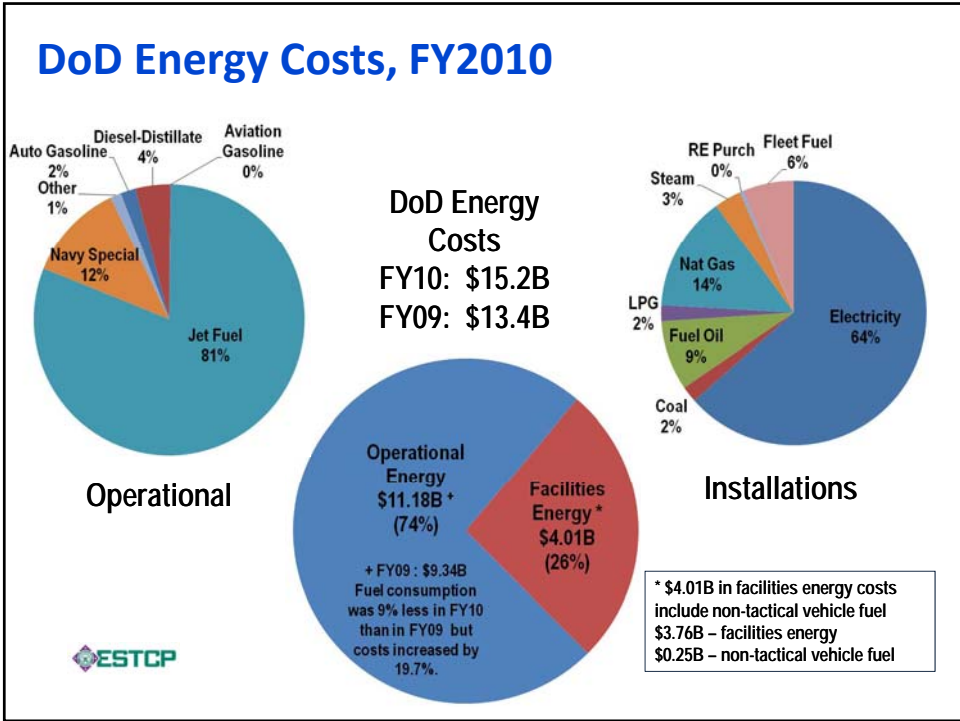
- \$80 billion for clean & efficient energy in ARRA
- creation of ARPA-E (\$400M in 2009-10, \$300M proposed for FY2011), 3 energy-innovation hubs
- first-ever fuel-economy/CO₂ tailpipe standards
- Interagency task force led by OSTP, CEQ, NOAA to coordinate of govt's climate-adaptation activities
- Expanded responsibilities for the renamed NSTC Committee on Environment, Natural Resources, and Sustainability
- Revival of US Global Change Research Program
- New National Oceans Policy & National Oceans Council

Energy & environment initiatives (continued)

- FY2012 Budget has \$550M for ARPA-E; EERE up 43%; energy hubs doubled 3→6
- Making climate change mitigation & adaptation a priority for initiatives in departments & agencies, employing existing authorities.
- Working with the new Congress on initiatives for accelerating the transition to cleaner & more efficient energy options that bring multiple economic, environmental, & security benefits.
- Working with other major emitting countries to build technology cooperation + individual & joint climate policies for mitigation and adaptation.

Defense-sector issues around energy and climate change

- The defense sector is a major user of energy and a correspondingly major emitter of greenhouse gases.
- The defense sector's energy use is a significant cost issue and an even bigger logistics & vulnerability issue.
- US oil dependence and greenhouse-gas-driven global climate change both pose significant national- and international-security challenges.
- The defense sector is positioned to lead in developing & deploying clean-energy & energy-efficiency solutions.



Cost & vulnerability in the logistics of energy

“Unleash us from the tether of fuel.”

Lt. Gen. James Mattis, USMC

Estimates of fully burdened cost of delivering fuel to theater have ranged from \$12 - \$500 per gallon

According to Army Energy Security Office, a 1% fuel savings will result in 6,444 fewer soldier-trips

US supply convoys in Afghanistan have suffered the loss of more than 3000 troops or contractors

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Climate connections to national security

Climate change itself can have impacts on...

- international tensions, increasing chance of conflict
- types of missions security forces must perform
- effectiveness of troops & equipment in combat

Remedies for climate change may affect...

- tensions/vulnerabilities from energy dependencies
- access of states & terrorists to nuclear weapons
- international cooperation (*reducing* tensions)

Both impacts *and* remedies could reduce...

- funding for forces and readiness

Climate-security connections (continued)

Impacts of climate change on tensions

- water shortages in international river basins → increased disputes
- ice-free Arctic → disputes over ownership of and access to undersea resources there
- suffering → civil disorder, government instability → oppression, external conflict as a distraction
- suffering → large flows of environmental refugees → civil disorder, reaction-intervention
- disputes & tensions over responsibility and compensation for climate-change damages

Climate-security connections (continued)

Impacts of climate change on types of missions

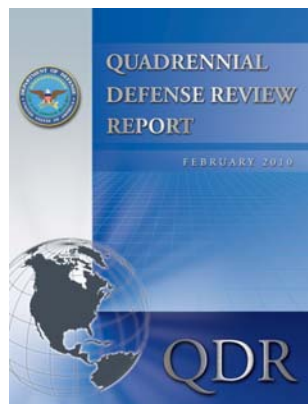
- floods, droughts, wildfires, powerful storms, pest outbreaks → increased “civil defense” demands
- ice-free Arctic → ship traffic, resource-harvesting operations → increased patrol requirements

Impacts of climate change on effectiveness

- complication of combat operations by increased heat, dust, mud, storms, flooding...
- impacts on troop health by worsened disease environment (malaria, dengue...)
- impacts on viability, effectiveness of bases

Climate Change in the Quadrennial Defense Review

“DoD will need to adjust to the impacts of climate change on our facilities...”



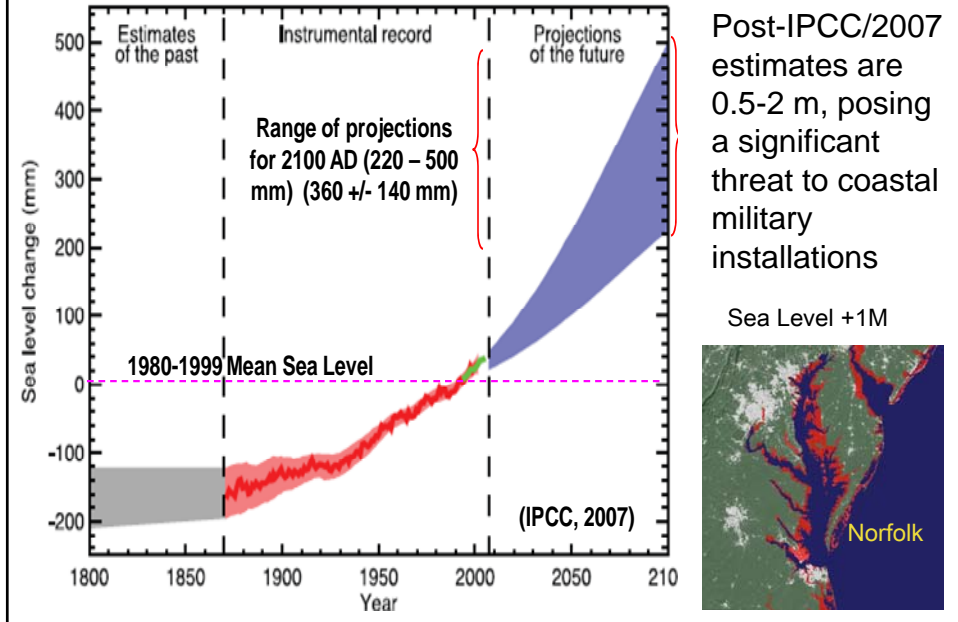
Climate Drivers at US installations

- Arid areas of the Southwest will become hotter and drier
- Increased temperatures and weather extremes in the Southeast
- Rising temperatures will impact cold-region installations
- Coastal areas will be impacted by sea level rise and storm surge

Installation Vulnerabilities

- Built infrastructure
- Training and testing lands
- Stressed ecosystems
- Military mission capability

Potential impacts of sea level rise



The defense sector is positioned to lead

- Responsible operation of facilities and ranges
 - Energy efficiency practices
 - Environmental stewardship
- Investments in science and technology
 - e.g. advanced fuels and propulsion systems, lightweight vehicles, batteries, enhanced Earth observations, ...
- Early procurement of energy efficient technologies



Facility Energy Test Beds

Emerging technologies hold the promise of dramatic improvements in building energy performance but face major impediments to commercialization and deployment

Test Bed Project Locations



- Use DoD Facilities As Test Bed For Innovative Energy Technologies
 - Validate performance, cost, and environmental impacts
 - Transfer lessons learned, design and procurement information across all Services and installations
 - Directly reach out to private sector for innovations
 - Leverage DOE investments
- Develop, Test, & Evaluate For All DoD Facilities
 - Energy Conservation & Efficiency
 - Renewable and Distributed Energy Generation
 - Control & Management of Energy Resources & Loads

F-22 Biofuel Flight Test



Successful flight test on March 18 2011 at supercruise speed (1.5 Mach) using a 50/50 blend of conventional JP8 petroleum and a biofuel derived from camelina

Capstone of tests conducted by the 411th Flight Test Squadron at Edwards Air Force Base

Studies have shown camelina-based jet fuel to reduce carbon emissions from jets by about 80%.

- In February Air Force officials certified the entire C-17 Globemaster III fleet for unrestricted flight operations using the HRJ biofuel blend
- Air Force considering implementation of bio-fuels in their fifth generation fighters.



Early Adoption Opportunities

Biofuels



Electric Vehicles



Solid State Lighting



White Roofs



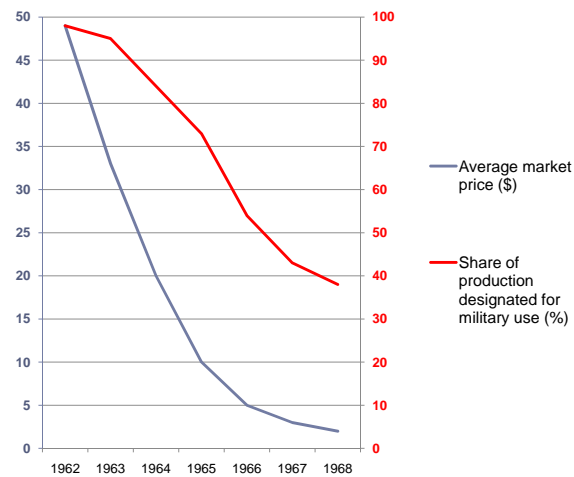
Photovoltaics



Government procurement as a catalyst: a historical example

- ▶ Early military use helped drive semiconductor market development
 - ▶ Helped to push prices lower
 - ▶ Lower prices spurred commercial applications
- ▶ Today's market is dominated by commercial applications
 - ▶ Global market over \$200 billion¹
 - ▶ DoD share only 1-2%¹

US Semiconductor Market Price and Military Use, 1962-1968²



Source: ¹Morris, Peter Robin. *A history of the world semiconductor industry*. 1990, pg 75; ²Defense Science Board, "High Performance Microchip Supply", 2005.

The challenges ahead

- Sustaining ST&I budgets in DoD, DOE, NSF, NIST...
In tight times, these budgets are often the first ones cut.
- Strengthening public-private partnerships
These are key to getting discoveries into the market-place.
- Getting key messages across
why science & engineering matter (to economy, environment, security), how ST&I works
- Advancing a coherent energy-climate policy
with large public investments in both mitigation and adaptation

The linchpin of progress in ST&I policy: a knowledgeable & committed President



