

# Trends in stationary energy

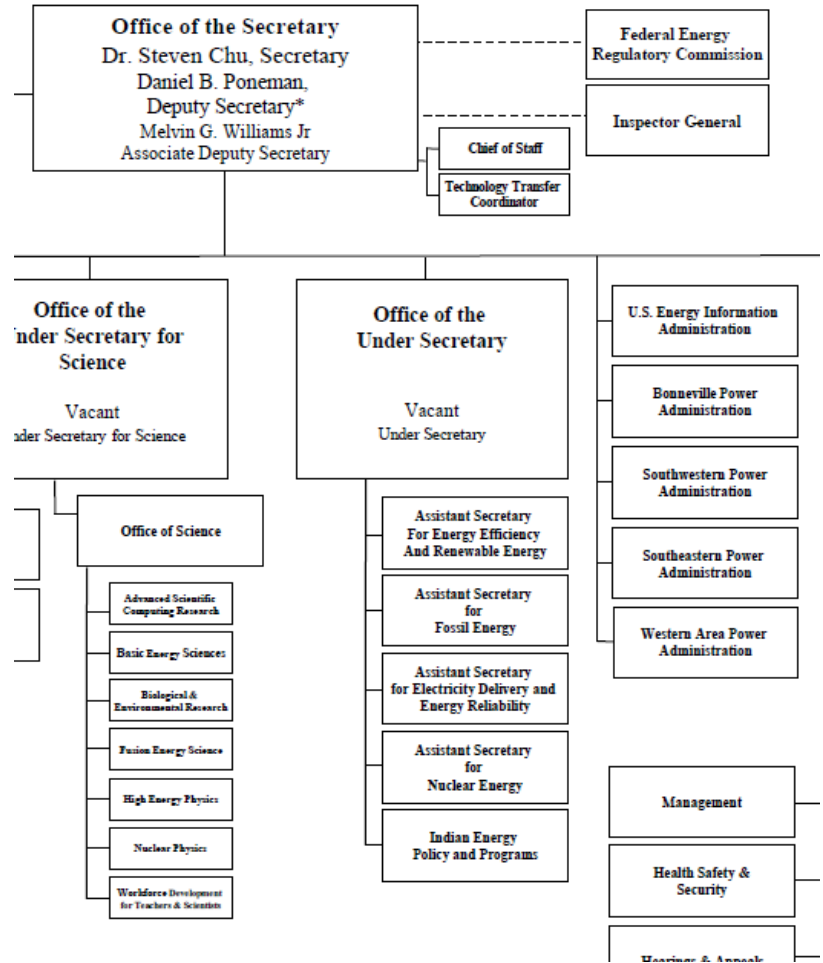
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US Department of Energy

Building Technologies Office Peer Review 2013

April 2013

# Under Secretary of Energy

- Oversee the applied energy programs
  - Efficiency & Renewables
  - Electric grid
  - Fossil energy
  - Nuclear energy
  - Indian energy
- Support interactions with Office of Science, ARPA-E
- Support cross-cutting topics in energy systems
  - Energy systems interaction
  - Water-energy nexus
  - Bulk energy storage
  - Energy finance
  - International Lab engagement
  - Quadrennial Technology Review (QTR)



# 2013: Already a busy year for energy

## 'Abnormality' caused power outage

By [Pat Yasinskas](#) | ESPN.com

Updated: February 4, 2013, 8:01 AM ET

NEW ORLEANS -- As he ran 108 yards for the longest kickoff return in Super Bowl history, [Jacoby Jones](#) saw only one thing.

"Daylight," Jones said after helping the [Baltimore Ravens](#) to a 34-31 victory over the [San Francisco 49ers](#). "Follow any avenue and it was daylight."

The irony was that Super Bowl XLVII forever will be remembered for a period of darkness.



## An Energy Coup for Japan: 'Flammable Ice'

By [HIROKO TABUCHI](#)

Published: March 12, 2013

TOKYO — Japan said Tuesday that it had extracted gas from offshore deposits of methane hydrate — sometimes called “flammable ice” — a breakthrough that officials and experts said could be a step toward tapping a promising but still little-understood energy source.

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## Saudi Arabia invites companies to bid for colossal renewables contracts

Government publishes white paper detailing plans to install 54GW of clean energy capacity by 2032

By [Jessica Shankleman](#)

22 Feb 2013

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## Suntech Unit Declares Bankruptcy

By [KEITH BRADSHER](#)

Published: March 20, 2013

HONG KONG — Suntech Power, a Chinese manufacturer that became the world's largest producer of solar panels by 2011 only to be battered by plummeting prices, announced on Wednesday evening that its main operating subsidiary had been pushed into bankruptcy by eight Chinese banks.

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## Hurricane Sandy Alters Utilities' Calculus on Upgrades

By [DIANE CARDWELL](#), [MATTHEW L. WALD](#) and [CHRISTOPHER DREW](#)

Published: December 28, 2012

After [Hurricane Sandy](#) wreaked havoc with power systems in the Northeast, many consumers and public officials complained that the electric utilities had done far too little to protect their equipment from violent storms, which forecasters have warned could strike with increasing frequency.

## China Surpasses US as World's Largest Oil Importer



By [Jared Anderson](#)

Published: March 11, 2013

Text Size

China recently surpassed the US as the world's largest net oil importer, as the US produces more and consumes less while Chinese demand steadily increases. US net oil imports have fallen from a peak of 13 million barrels per day in October 2006 to under 6 mmb/d in December 2012, according to a [Citi](#) research note issued February 28, titled "Milestones Toward US Energy Independence - Alert: US net Oil Imports Plummet to Second Place Behind China."

# Some notable trends in stationary energy



The rise of natural gas



New models for the grid



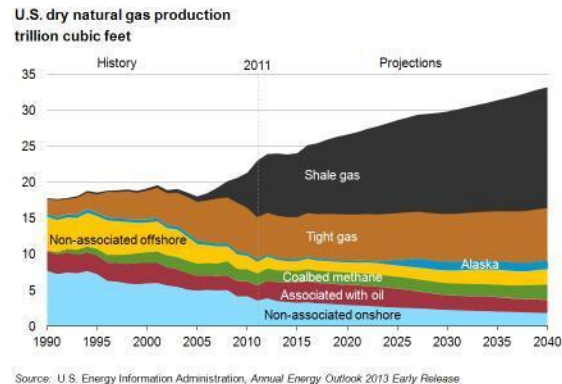
Global trends



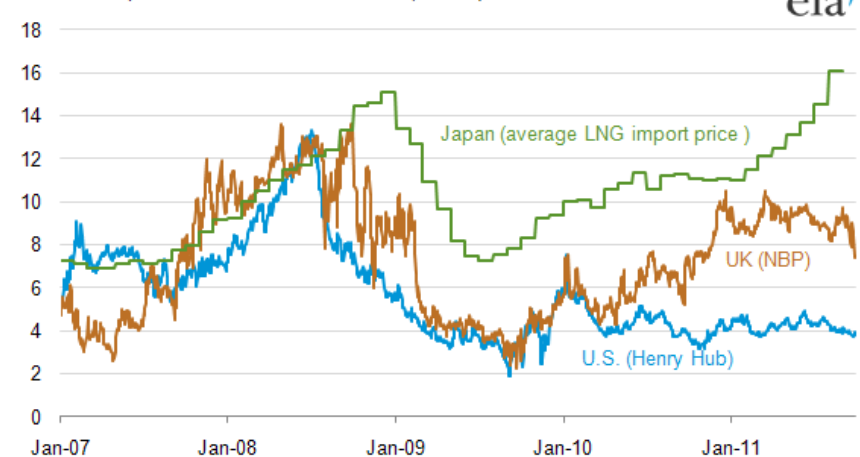
The water-energy nexus

# The rise of natural gas

- Major increases in US production from shale gas
  - EIA projects US production to increase 44% by 2040
- Dramatic price differentials
  - Factor of x2-4 less than other major economies
  - April 2012 low < \$2/Mcf
  - Likely to rise, but relatively slowly
- Uncertainty around exports
  - DOE has approved one LNG export application (Sabine Pass)
  - DOE is reviewing many others (~30 Bcf/d)



Trends in natural gas spot prices at major global markets  
U.S. dollars per million British thermal units (MMBtu)



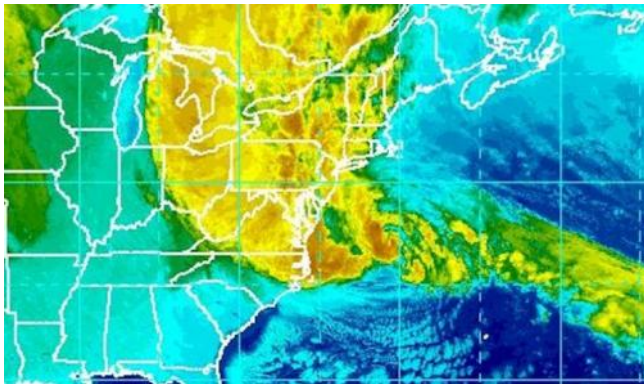
# The rise of natural gas

- Impacts on manufacturing on-shoring
  - Feedstocks: announcements by BASF, Dow, etc
  - Energy-intensive manufacturing
- Interaction with renewables
  - Potential competition for renewables
  - Potential impacts on fuel switching
- Concerns about fugitive emissions and flaring
  - Very high global warming potential (20-100x CO<sub>2</sub>)
  - Significant effort to measure emissions ongoing
  - Flaring concerns





# New models for the grid



- Grid-scale energy storage
  - Transform electricity from a “just-in-time” commodity
  - Business models and roles unclear
  - Buildings: behind-the-meter storage, thermal storage
- Resiliency and distributed generation
  - New focus on grid resiliency from Sandy
  - Costs of outages are large
  - Investment models are challenging
  - Buildings: individual, neighborhood microgrid
- Transactive energy
  - Potential for “emergent” efficiencies
  - Potential for “deep” building-to-grid interaction
  - Performance vs. central optimization?
  - Interaction with the “industrial internet”

# The water-energy nexus

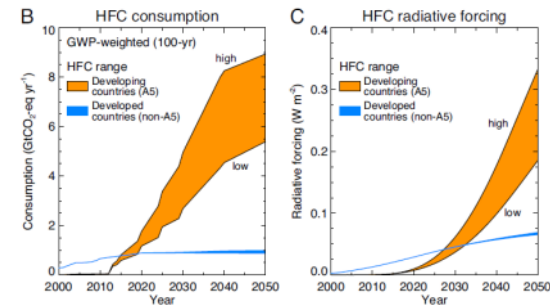
- Impacts on thermoelectric power generation
  - Millstone nuclear plant (2012)
  - EPA Section 316(b) (June 2013)
  - Potential for DOE HX technology
- Impacts on fuels production
  - Water use in fossil extraction
  - Water use in biofuel production
- Energy consumption for water treatment, movement
  - Pumping energy
  - Treatment technology
  - Potential role in grid flexibility
  - Appliances
- Data and modeling efforts
- DOE Integrated Tech Team





# Global trends

- Major construction booms in emerging economies
  - US has 300 billion square feet
  - China will build 300 billion square feet in the next 15-20 years
- Growing contribution of HFCs from developing countries to climate forcing
- The emerging middle class in developing nations
  - Major global spending share (>50% by 2030)
- Role of DOE National Labs in supporting national energy strategies



Velders et al., PNAS (2009)



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THANK YOU

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