



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Nuclear Energy International Engagement

Edward McGinnis
Deputy Assistant Secretary for International Nuclear
Energy Policy and Cooperation
U.S. Department of Energy

U.S.-Poland Energy Roundtable
April 24, 2013



Nuclear Energy: Part of the U.S. “All-of-the-Above” Strategy



“With rising oil prices and a warming climate, nuclear energy will only become more important. That’s why, in the United States, we’ve restarted our nuclear industry as part of a comprehensive strategy to develop every energy source.”

President Obama, Seoul, Korea - March 2012

Key Drivers:

- Energy security/long-term security of supply.
- More than 1.3 billion people globally are without access to electricity.
- *Clean, base-load source of energy.*
- Significant source of jobs and economic benefits.



Nuclear Energy: Plays an Important Role in US Energy Supply

■ Nuclear power is clean, reliable base load energy source

- Provides 19% of U.S. electricity generation mix
- Provides over 61% of U.S. emission-free electricity
- Avoids about 700 million metric tons of CO₂ each year
- Helps reduces overall NOx and SOx levels

■ U.S. electricity demand projected to increase ~24% by 2030

■ 100 GWe nuclear capacity - 103 operating plants

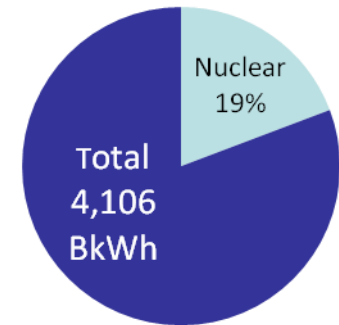
- Fleet maintaining approximately 90% average capacity factors
- Most expected to apply for license renewal for 60 years of operation.

■ Five nuclear plants under construction:

- Vogtle 3 and 4, V.C. Summer 2 and 3, and Watts Bar 2

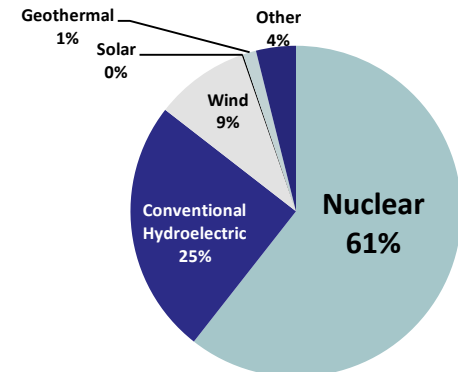
U.S. Electricity Net Generation (2011)

Source: Energy Information Administration



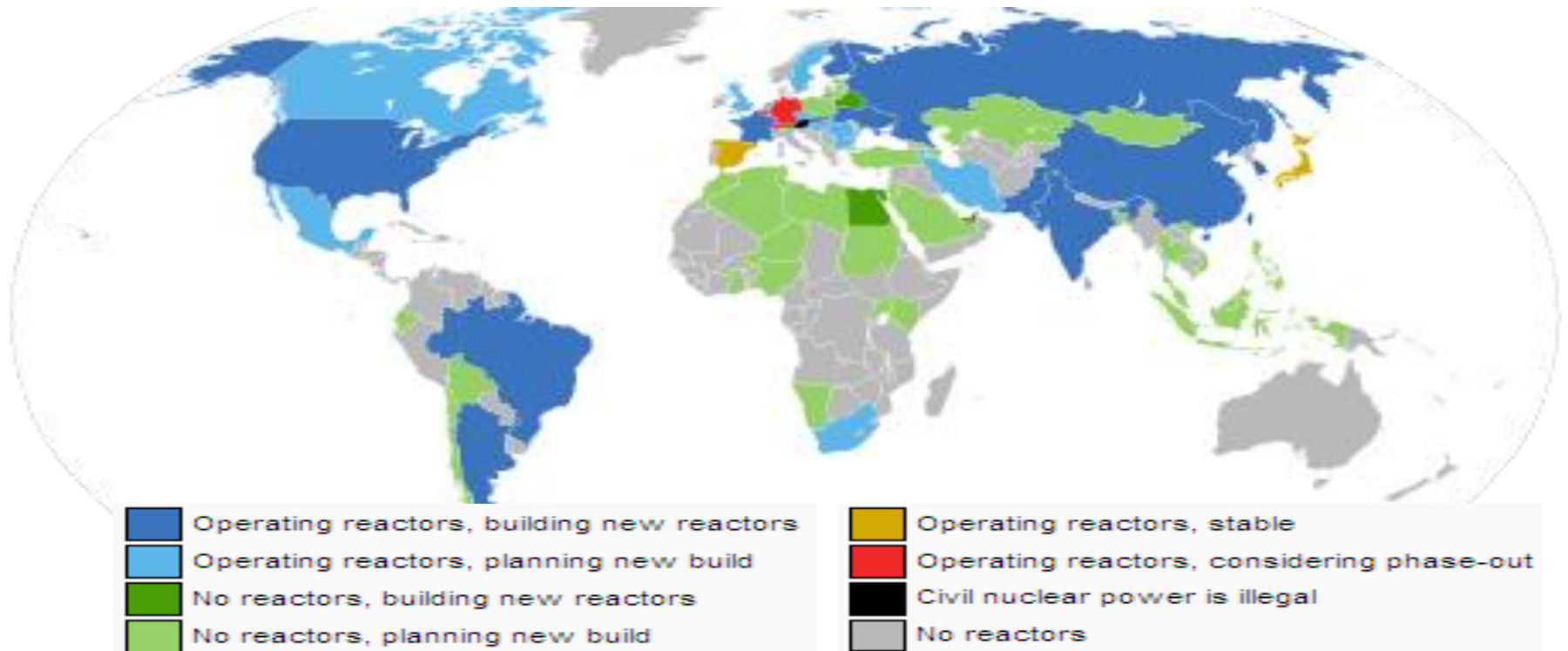
Net Non-emitting Sources of Electricity

Source: Energy Information Administration





Global Status of Nuclear Energy & National Objectives by 2040



http://en.wikipedia.org/wiki/File:Nuclear_power_station.svg

- **437 Nuclear Reactors Operating in 30 Countries**
- **68 reactors under construction in 16 countries**
- **154 reactors planned in 27 countries over next 8-10 years**
- **331 reactors proposed in 37 countries over next 15 years**



Key Global Drivers/Challenges

Key Drivers:

- Energy security/long-term security of supply.
- Clean, base-load source of energy.
- Significant source of skilled and jobs and economic benefit.
- Long-term energy source/Low operating costs.

Key Challenges:

- Infrastructure development – safety, security, nonproliferation.
- Financing, up front costs, liability.
- Waste management.



A Global Industry and Changing Landscape

- Much of the nuclear industry is globally integrated and therefore increasingly inter-dependent, such as the supply chain and workforce.
- Power plant construction projects without some form of international partners and stakeholders rare.
- Vendors and service providers increasingly dependent on success in foreign market penetration.
- R&D communities also become increasingly integrated and inter-dependent. Few if any governments have all R&D facilities needed.
- Markets are shifting from US and Western Europe to China, East Asia, Central Europe.
- THEREFORE: Global system-wide and stakeholder-wide approaches are necessary.



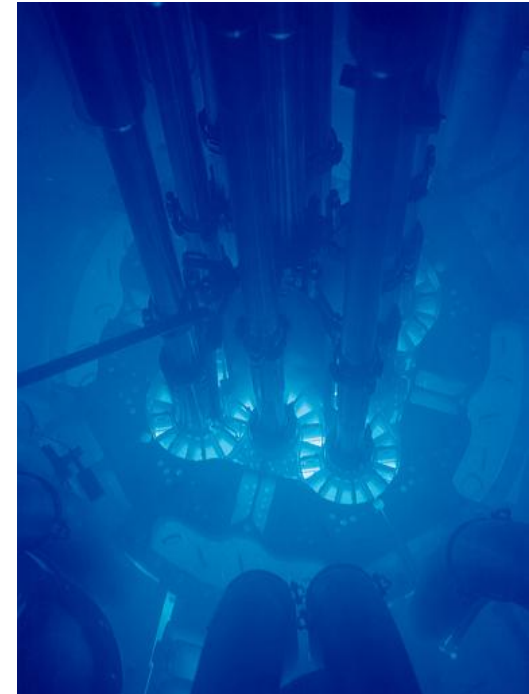
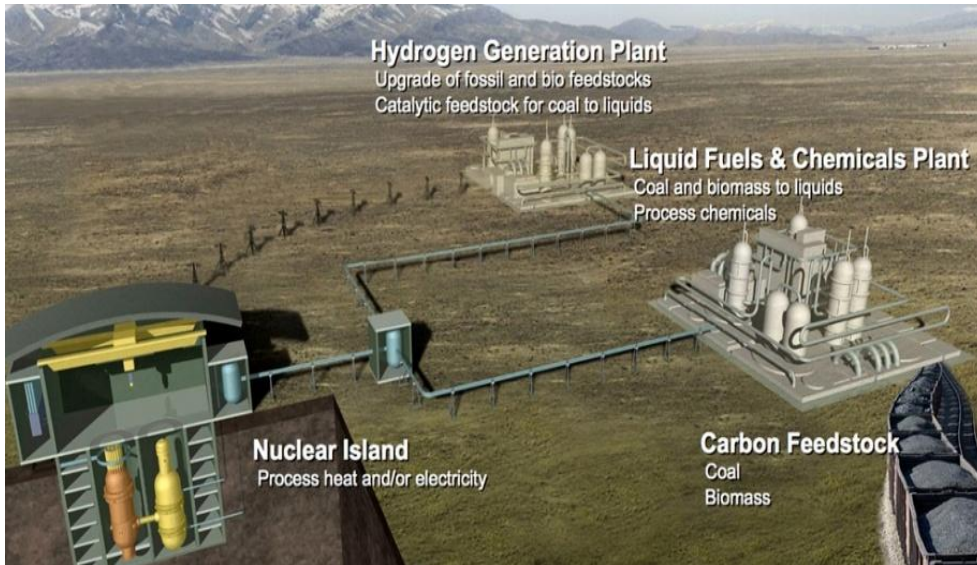


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- **Leverage U.S. R&D funds through joint work with other advanced nuclear energy states**
 - **Promote safe, secure and peaceful use of nuclear power as a clean energy source to combat climate change and gain energy security**
 - **Post-Fukushima: Nuclear Safety**
 - **Respond to geo-political policy drivers**
 - **Support President's call for a new framework for civilian nuclear cooperation, including comprehensive nuclear fuel services**
 - **Advocate for U.S. nuclear industry in international markets**



Office of Nuclear Energy Mission

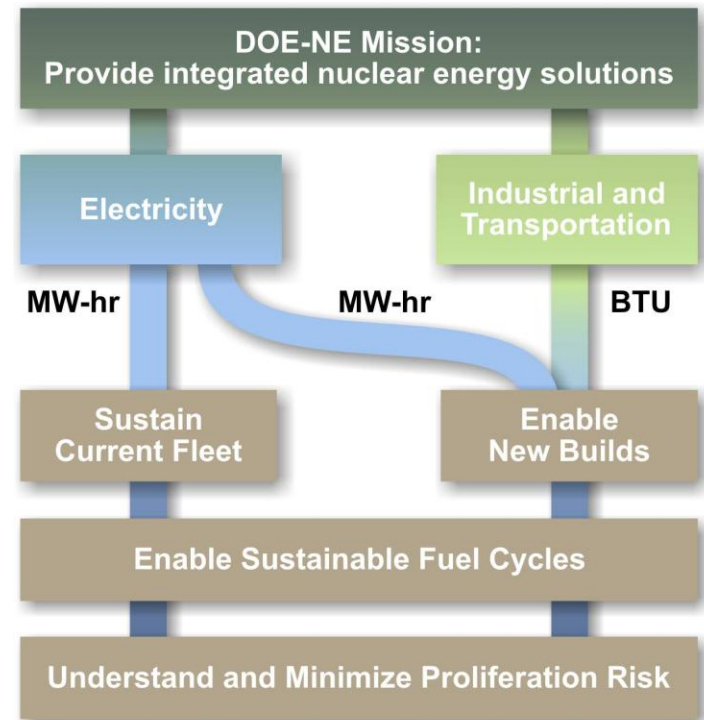
- The primary mission of NE is to advance nuclear power as a resource capable of making major contributions in meeting the nation's energy supply, environmental, and energy security needs by resolving technical, cost, safety, security and regulatory issues, through research, development, and demonstration (RD&D).





Nuclear Energy Objectives

- Develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors
- Develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals
- Develop sustainable nuclear fuel cycles
- Understand and minimize the risks of nuclear proliferation and terrorism





Multilateral Engagement

■ Generation IV International Forum (GIF)

- U.S. currently serves as GIF chair
- U.S. participates in the Very-High-Temperature Reactor and Sodium-cooled Fast Reactor Systems

■ International Atomic Energy Agency (IAEA)

- General Conference, Peaceful Uses Initiative (PUI), INPRO, technical meetings

■ International Framework for Nuclear Energy Cooperation (IFNEC)

- 63 Countries and Three Inter-governmental Organizations
- Three-tiered: Executive Committee, Steering Group, Expert Working Groups

■ OECD/Nuclear Energy Agency (NEA)

■ Trilateral MOU on Sodium-cooled Fast Reactor Research (U.S., France, Japan)

■ Other :

- Nuclear Security Summit
- Central Europe Nuclear Safety Workshop



GIF Policy Group, November 2012



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Prague Vision: A New Framework for Civil Nuclear Cooperation



"...we should build a new framework for civil nuclear cooperation, including an international fuel bank, so that countries can access peaceful power without increasing the risks of proliferation. That must be the right of every nation that renounces nuclear weapons, especially developing countries embarking on peaceful programs. And no approach will succeed if it's based on the denial of rights to nations that play by the rules. We must harness the power of nuclear energy on behalf of our efforts to combat climate change, and to advance peace opportunity for all people."

President Obama, April 2009

- **International Framework for Nuclear Energy Cooperation (IFNEC)**
- **Comprehensive Nuclear Fuel Services**



IFNEC: 63 Countries and 3 International Organizations

Participants

1. Argentina
2. Armenia
3. Australia
4. Bahrain
5. Bulgaria
6. Canada
7. China
8. Estonia
9. France
10. Germany
11. Ghana
12. Hungary
13. Italy
14. Japan
15. Jordan
16. Kazakhstan
17. Kenya
18. Republic of Korea
19. Kuwait
20. Lithuania
21. Morocco

22. Netherlands
23. Oman
24. Poland
25. Romania
26. Russia
27. Senegal
28. Slovenia
29. Ukraine
30. U.A.E.
31. U.K.
32. U.S.

Observer Organizations

1. International Atomic Energy Agency (IAEA)
2. Generation IV International Forum (GIF)
3. Euratom

Observer Countries

1. Algeria
2. Bangladesh
3. Belgium
4. Brazil
5. Chile
6. Czech Republic
7. Egypt
8. Finland
9. Georgia
10. Greece
11. Indonesia
12. Latvia
13. Malaysia
14. Mexico
15. Moldova
16. Mongolia
17. Nigeria
18. Philippines
19. Qatar
20. Saudi Arabia
21. Singapore
22. Slovakia
23. South Africa
24. Spain
25. Switzerland
26. Sweden
27. Tanzania
28. Tunisia
29. Turkey
30. Uganda
31. Vietnam

www.ifnec.org





International Framework for Nuclear Energy Cooperation (IFNEC)



- **Consensus-based approach has proven to be key to IFNEC's success.**
 - Business approach; each country has unique set of challenges and needs.
- **Focus on what countries agree on – not what we disagree on.**
- **Neutral approach to the fuel cycle while emphasizing safe, secure and responsible use also key.**
 - IFNEC's approach of respecting each country's right to decide whether to use nuclear energy while emphasizing the safe, secure and responsible use is now becoming firmly established and recognized.
- **Stakeholders and system-wide approach.**
 - Stakeholders include governmental entities, commercial suppliers and utilities, finance sector, private innovators; challenges and opportunities are cross-cutting.



IFNEC Finance Workshop



- Expert-based public/private stakeholder workshop held in May 2012 in London
- Created forum to understand challenges and opportunities in financing nuclear power projects
- Interactive scenario-based discussions and breakout sessions produced set of recommendations for IFNEC countries to consider, individually or collectively
- Key Findings included
 - Importance of an effective and independent regulator
 - Essential role of government commitment and support
 - Need for a sound business and project plan
- Summary Report at:
www.ifnec.org/docs/Appendicies/IFNEC_Finance_Workshop_Final_Summary_Report_-_October_4_2012.pdf





IFNEC's Comprehensive Fuel Services Activities



- IFNEC began examining Comprehensive Fuel Services in 2009.
- A CFS approach would provide reliable and commercially-based services on a global basis in a manner that is flexible and tailored to the unique requirements of the specific users and service providers.
- Suppliers would offer a set of options for fuel supply, used fuel management, and ultimate disposal services.
- Key challenges:
 - Lack of a commercially-based and competitive back-end fuel removal, storage and disposal industry, similar to the front end.
 - Lack of location where such global storage and disposal services could be established.
- IFNEC Actions: Developed an overall harmonized CFS paper in 2012. In 2013, will develop a model agreement and hold a workshop with IFNEC government experts and industry.



Summary

- **The U.S. and Poland:**
 - **Have many common needs and challenges;**
 - **We share unique historical bonds;**
 - **Are in a position to further strengthen our partnership for mutual benefit.**
- **Bilateral and multilateral approaches to the safe, secure, and economically viable use of nuclear energy is crucial.**
- **Civil nuclear energy is at an important turning point and the U.S. is committed to working with key partners such as Poland.**