



Natural Gas Security: Policy and Emergency Measures in Select OECD Countries

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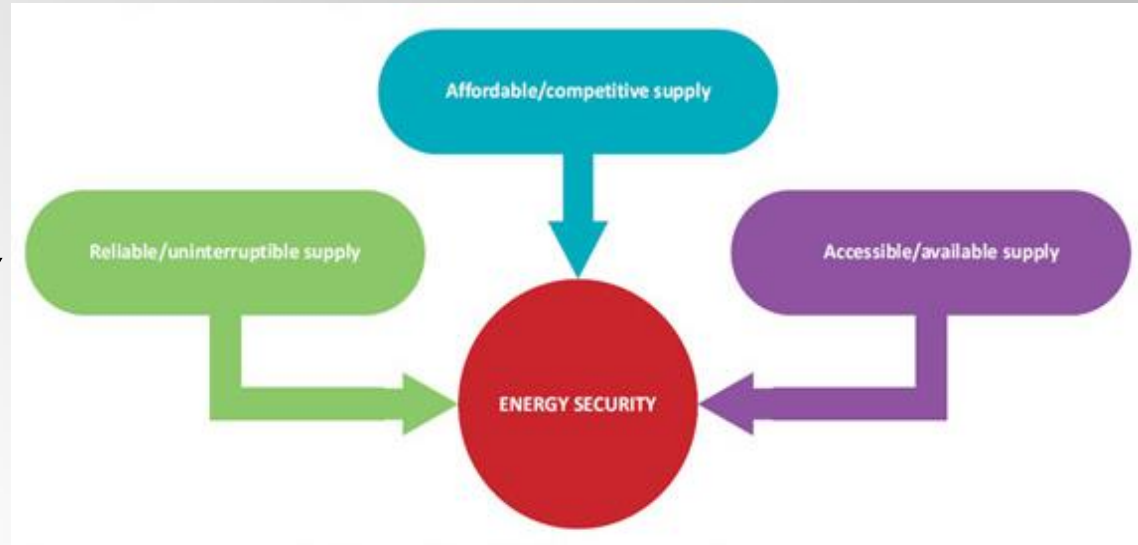




What is Energy Security

- IEA Definition

“the uninterrupted availability of energy sources at an affordable price”



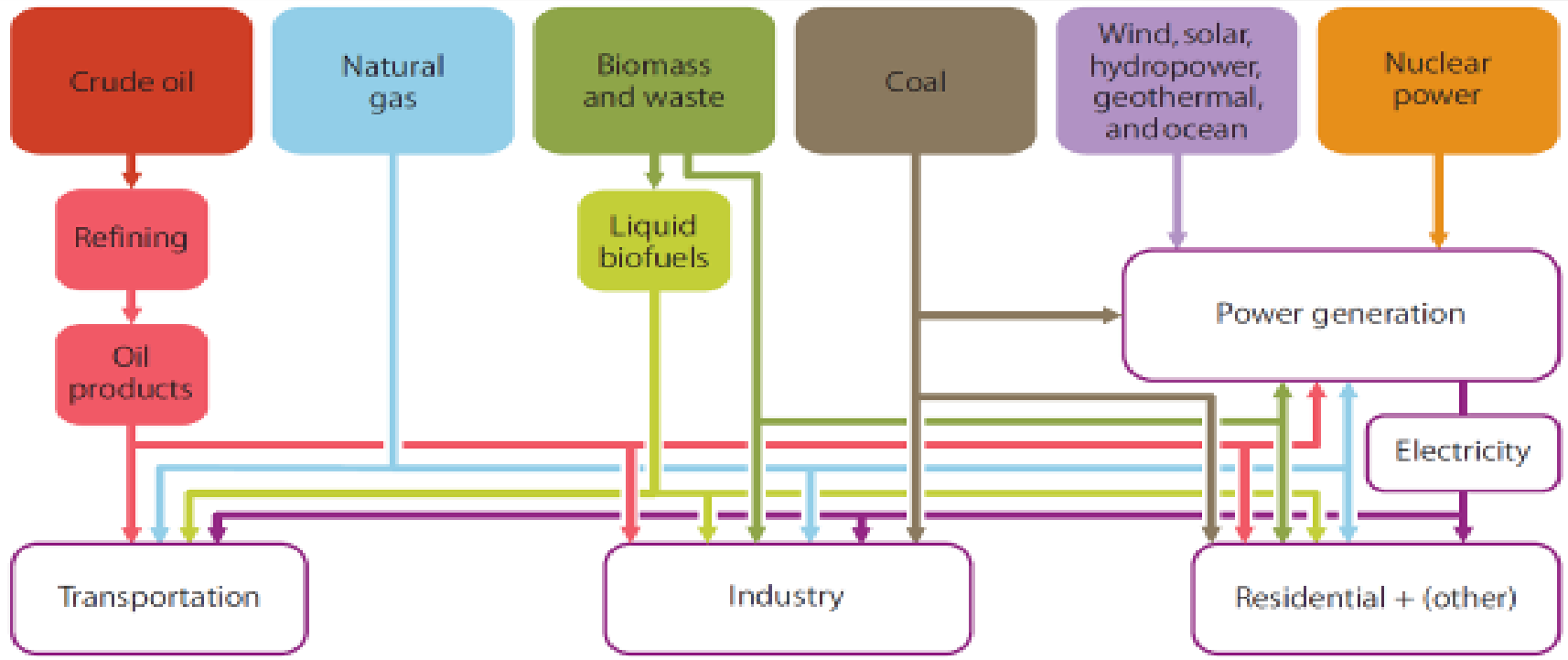
- Energy Security Aspects

- *Short-term*: ability of the energy system to react promptly to sudden changes in the supply-demand balance
- *Long-term*: timely investments to supply energy in line with economic developments and environmental needs





Factors in Energy System Risk



Source: IEA MOSES working paper 2011)

- Number and diversity of suppliers
- Transport modes
- Regulatory framework and supply points
- Commercial and political stability in the countries of origin





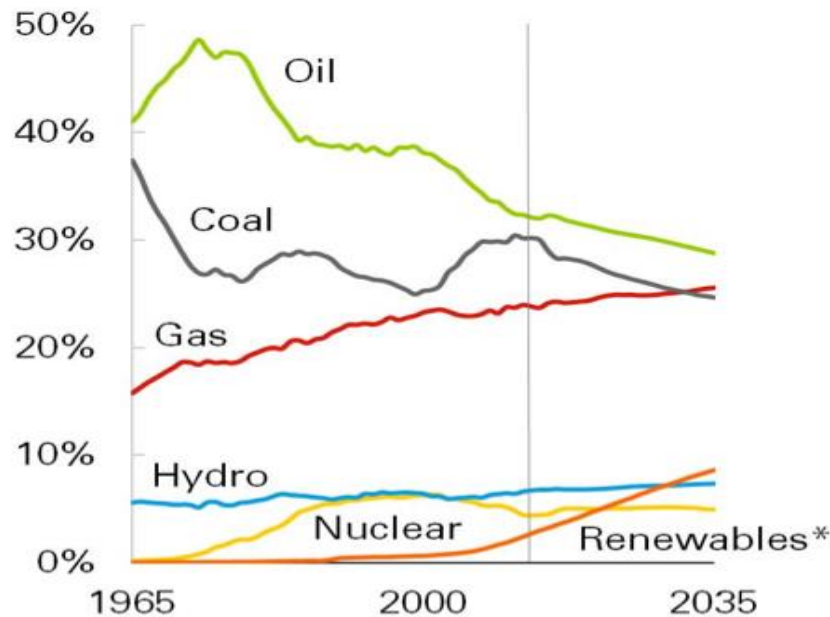
Expected Changes in The Fuel Mix

Base case: Primary energy



The fuel mix is set to change significantly...

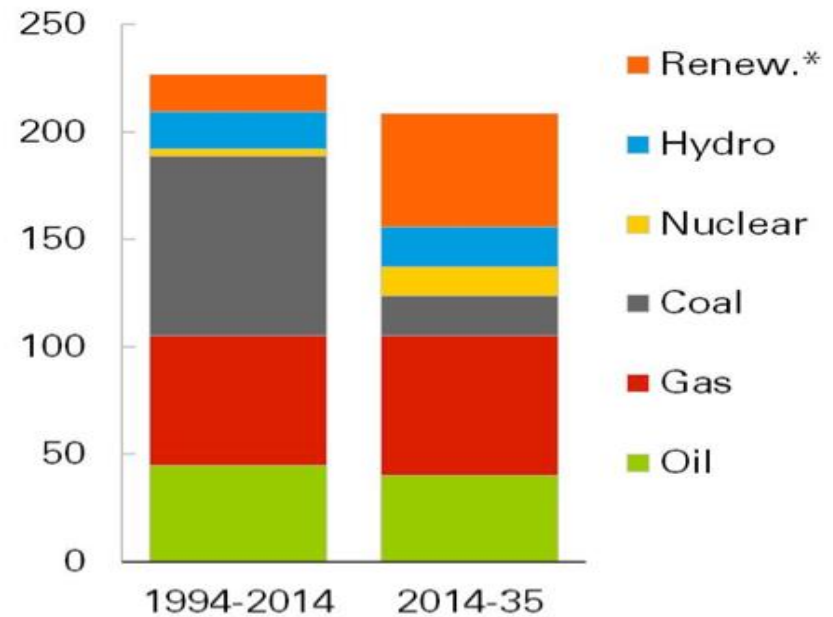
Shares of primary energy



*Includes biofuels

Annual demand growth by fuel

Mtoe per annum





The Growing Role of Natural Gas in Energy Security

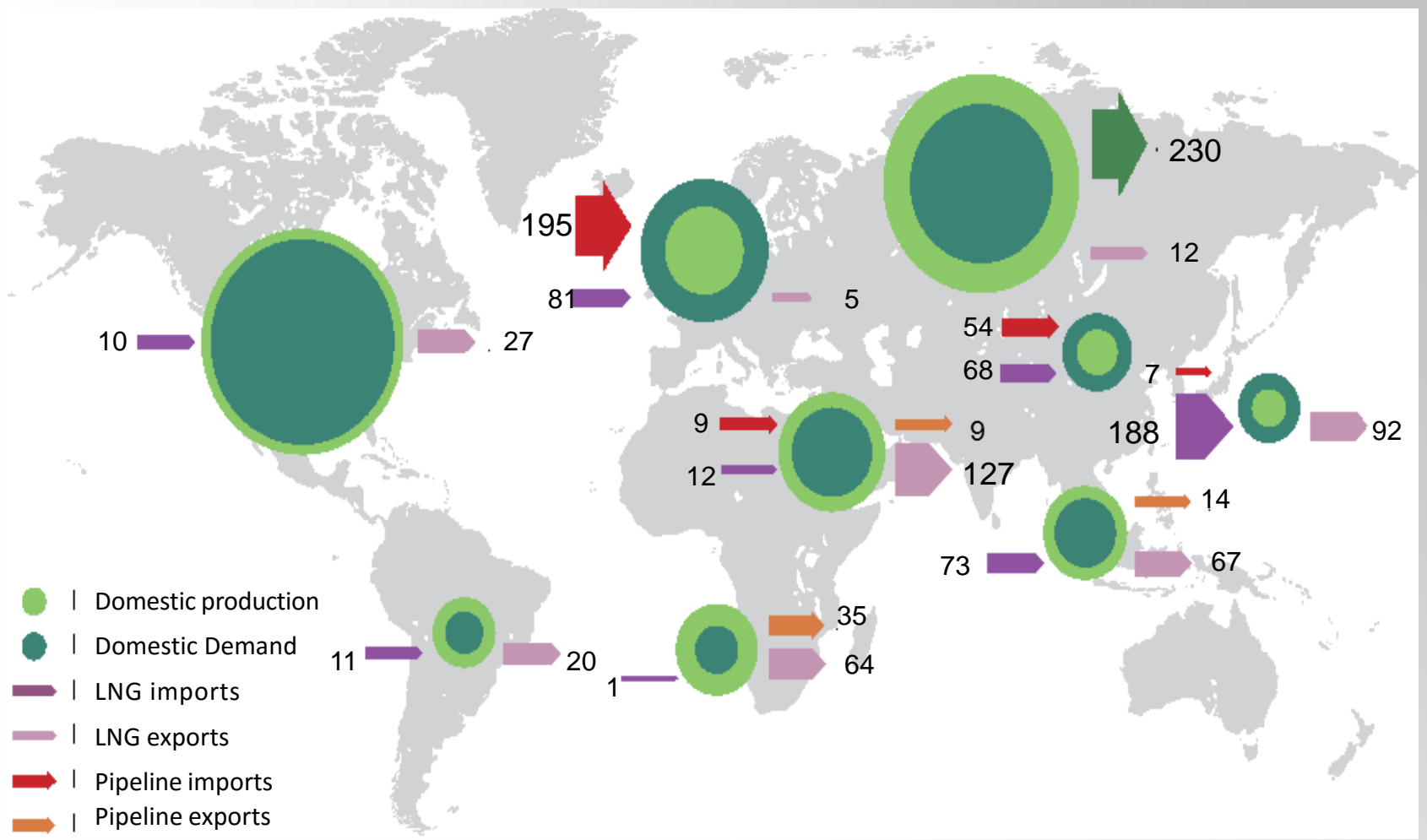
- Share of natural gas in IEA countries has increased from 19% in 1973 to 26% in 2012
- Natural gas has become the fuel of choice for electricity production.
 - in Europe, the share of natural gas in the power generation mix soared from 6% in 1990 to 24% in 2012
 - About 25% of European natural gas demand is for residential heating
- The natural gas market is becoming more global due to longer pipelines and the availability of LNG
 - Natural gas supply traded between regions is expected to grow by 30% between 2012 and 2018

Growing inter-linkages may increase the impact of natural gas supply disruptions





Inter-regional Anticipated Natural Gas Trade by 2018 (bcm)



Source: IEA, Medium-Term Gas Market Report, OECD/IEA, Paris, 2013





Emergency Response Measures Relating to Natural Gas

- Emergency response measures to ensure natural gas supply should be consistent with the unique characteristics of natural gas
 - Natural gas is capacity-bound to a highly capital-intensive transportation and distribution infrastructure
 - Downstream gas always utilizes fixed infrastructure (i.e. pipelines) for transport/delivery
 - Repairs to natural gas pipelines are costly due to the high pressure of the gas system
- Planning should address potential gas supply disruptions caused by:
 - Weather, accidents, and contractual disputes





Possible Natural Gas Emergency Response Measures

- Emergency natural gas stocks
 - Underground gas storage (depleted oil/gas reservoirs, aquifers or salt caverns)
 - Aboveground (in liquid form as LNG)
 - It is likely that a mix of fast and slow withdrawal gas storage methods are needed for different contingencies
- Other measures
 - Supply response by redundant infrastructure
 - Interruptible supply contracts to limit consumption
 - Fuel switching for temporary relief



The variable cost of maintaining enough gas in emergency storage (90-day net) across the IEA countries is estimated at between 10% and 20% of the capital cost of the facilities per year





EU Energy Security Strategy

- The February 2016 energy security package addresses global energy transition and preparation for possible energy supply interruptions:
 - Security of natural gas supply regulation
 - Compatibility of Intergovernmental energy agreements
 - Strategy for LNG access and natural gas storage
 - Removing barriers for decarbonization of heating and cooling for buildings and industry





EU Energy Security Standard

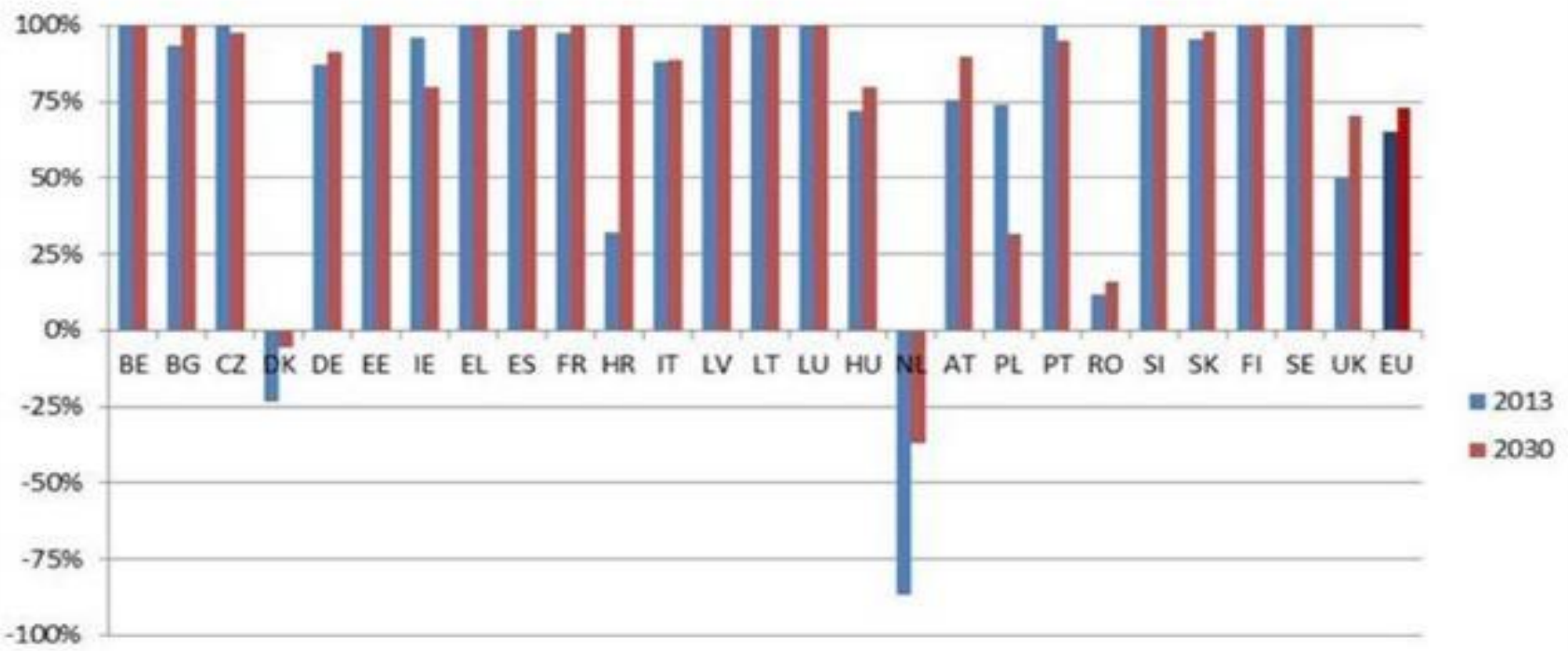
- Establishes a common indicator for gas security – N1
 - Defines a supply standard that EU countries must prepare to meet even in the case of a disruption
 - *The standard means that countries must be able to supply at least 30 days' worth of natural gas to private households and other vulnerable consumers like hospitals*
- Refers to a situation where the most significant element of a country's gas network is out of operation
 - Import pipeline or Production facility
- Requires EU countries to create a Preventive Action Plan
 - Assess supply risks and propose preventative measures such as investment in new pipelines





Forecast of EU Percentage of Imported Natural Gas

Gas import dependency in 2013 and 2030*



*import dependency in 2013 based on EU statistical pocketbook and in 2030 based on the PRIMES 2013 reference scenario

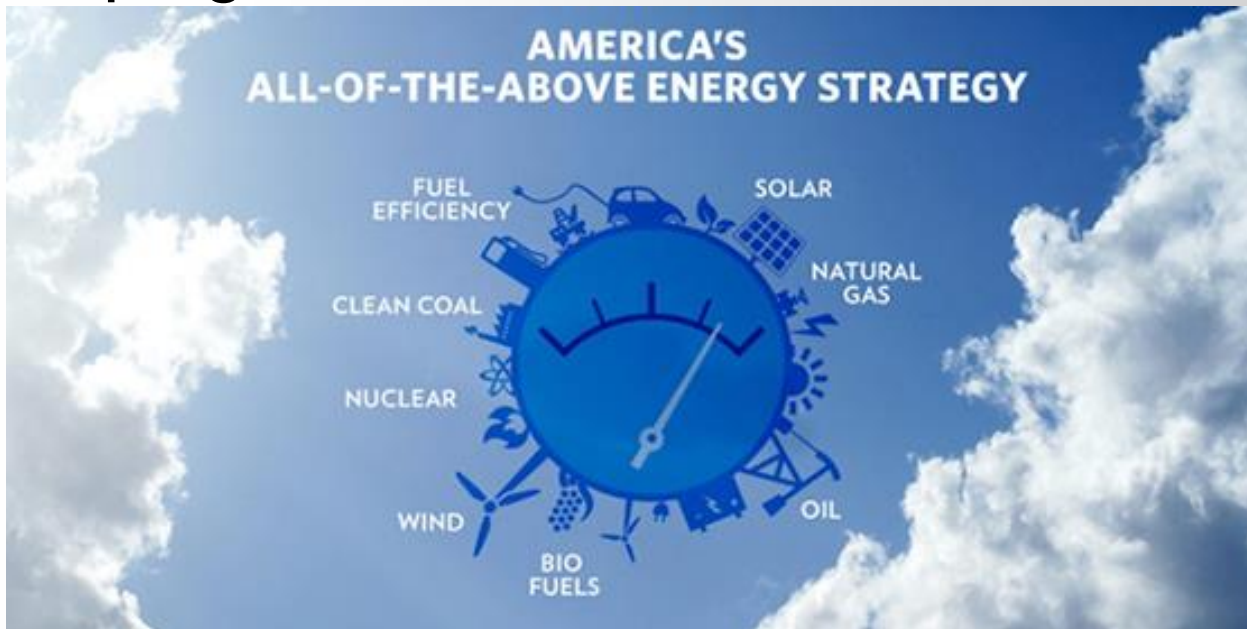
Cyprus not included (no gas market in 2013 and expected to be a major exporter (>500%) in 2030).





U.S. 'All-of-the-Above' Energy Strategy

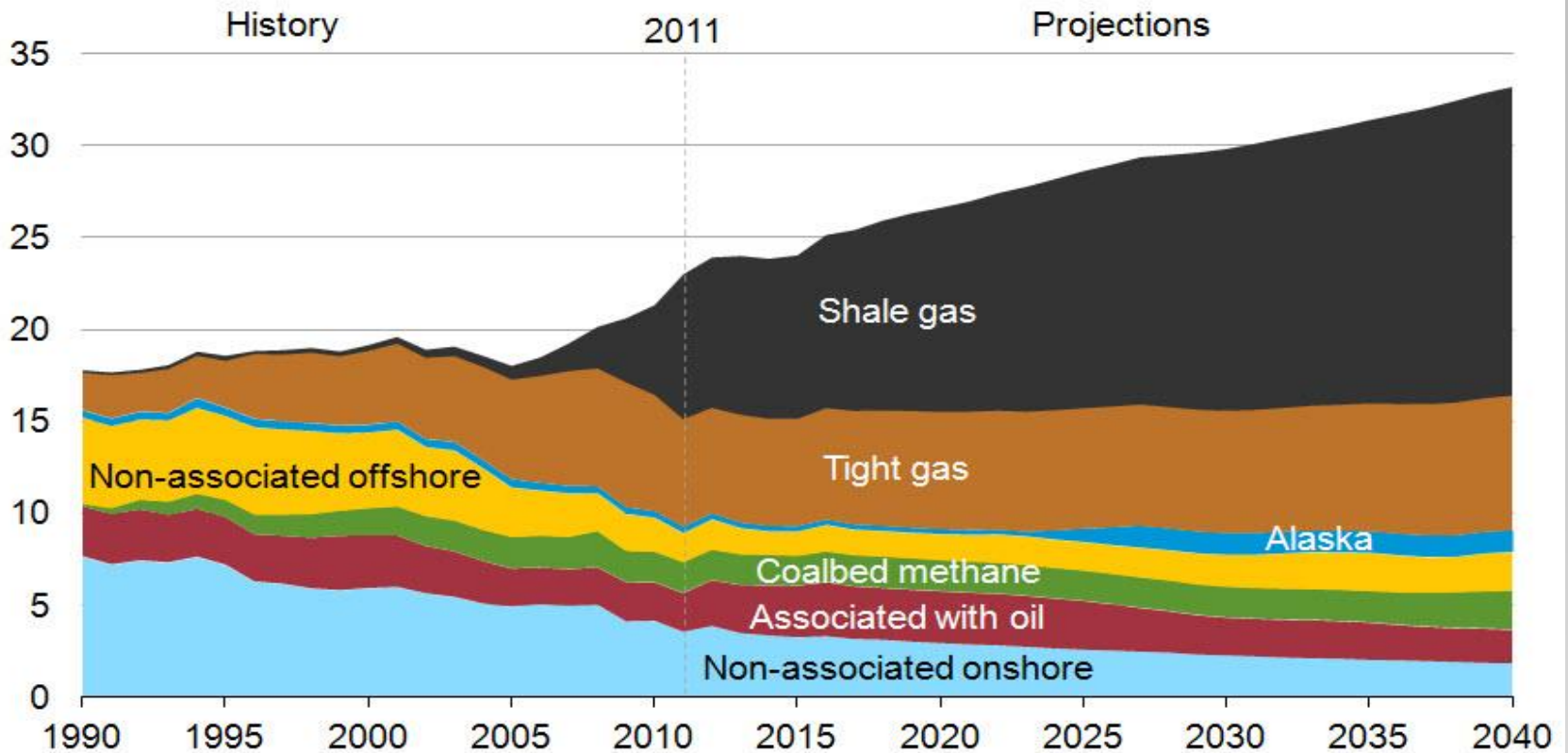
- Reducing dependence on foreign oil
- Safe and responsible domestic oil and natural gas production
- Carbon Capture and Sequestration technologies
- Developing clean fuels





U.S. Natural Gas Production is Growing

**U.S. dry natural gas production
trillion cubic feet**



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2013 Early Release*





U.S. National Infrastructure Protection Plan 2013: Key Concepts

- Updated approach to critical infrastructure security and resilience
- Focus on integration of cyber and physical security efforts
- Alignment with national preparedness efforts
- Increased emphasis on cross sector and cross jurisdictional coordination
- Integration of information-sharing as an essential component of the risk management framework
- Based on integrated all-hazards analysis in specific areas
- ***Coordinated efforts by all levels of government, private, and nonprofit sectors in accordance with the President's Policy Directive 21***





Current Event: Aliso Canyon Gas Leak

- A massive natural gas leak started in October 2015 in a storage well in Aliso Canyon (near Los Angeles)
 - Construction of a relief well was completed by mid-February 2016 to capture the gas and stop the leak
- Estimated impact: over 90,000 metric tons of methane leaked (valued at \$19 million, based on \$3/mcf of gas)
- Gas storage field is kept at about one-fifth of its full capacity:
 - Power plants could run short of natural gas to burn for power
 - State law permits power plants' gas service to be cut off when supplies run short, preserving gas for homes and small businesses.
- The L.A. Basin and surrounding counties could face up to 14 days this summer and 32 days in the coming year when utilities might order limited power outages to avoid larger blackouts





Conclusions

- Energy supply security revolves around the properties of energy stocks, material flows, infrastructure, markets and prices
- Increased interoperability of facilities and remote control operations requires increased cyber security and on-going threat analysis
- Energy security ought to be
 - tailored to country (and region) political situation,
 - based on institutional framework and coordinated actions
 - linked to long term perspectives and goals

The traditional four
A's of Energy
Security Include:

Availability
Accessibility
Affordability
Acceptability





Thank you for your attention

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