40th IAEE International Conference

Meeting the Energy Demands of Emerging Economies:
Implications for Energy and Environmental Markets

Energy Security: From access to subsurface energy resources to the mastery of technologies

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Energy Security

- **ES cut across a number of global issues**, such as environmental issues, geopolitics, development, economics and more.

- **Key non resources challenges and threats** to ES
  - Civil society
  - Environment and the threat of climate change
  - Use of FF as a geopolitical weapon and supply/price manipulation
  - Dependence on conflict and politically unstable regions
  - Energy/fossil fuels subsidies, bill collection, non technical energy losses and sabotage
  - Investors Risk & Business Environment

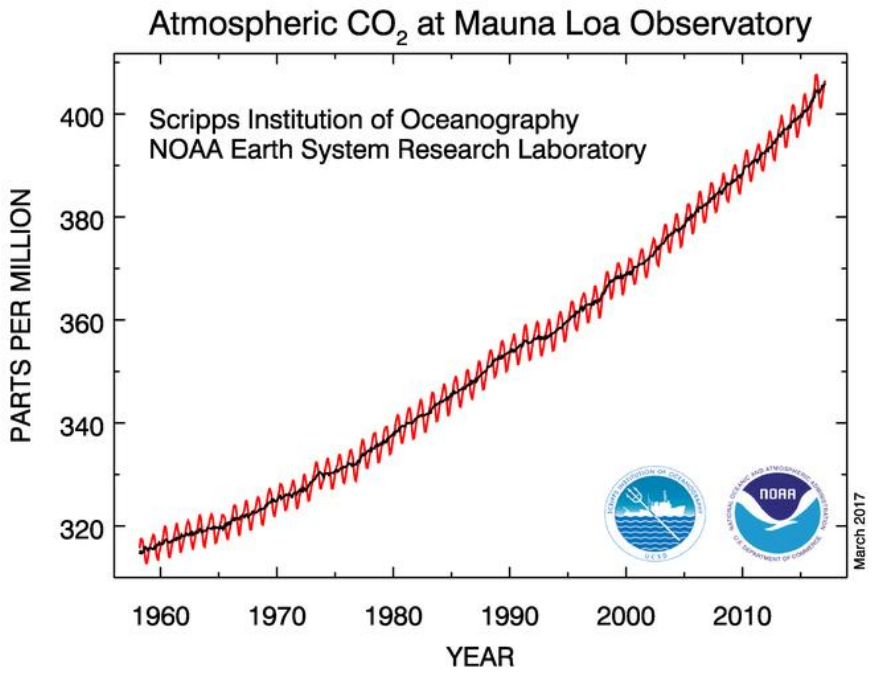
Civil Society

- Change in the Civil Society and Change in Power
  - We are more
  - More educated
  - And more powerful

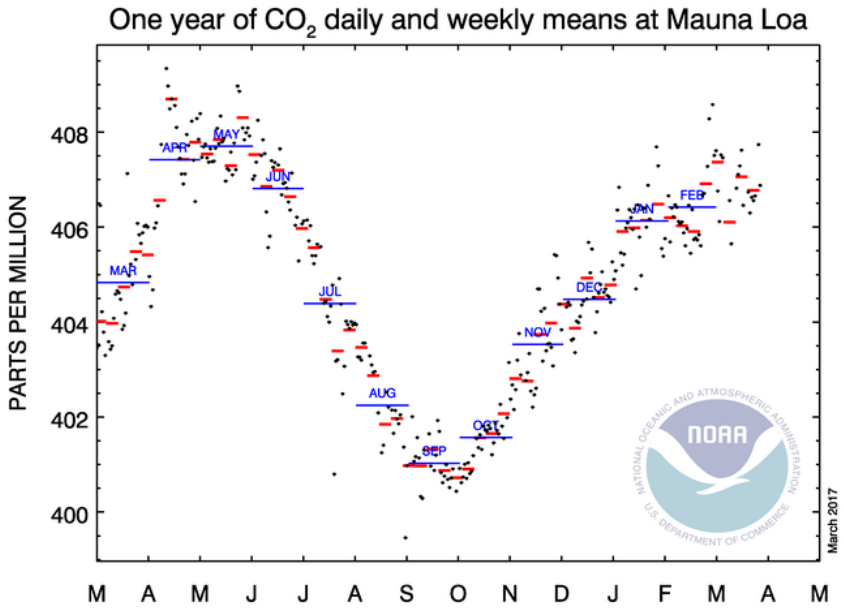
Increasing concern to environmental issues

- NIMBY – Not In My Back Yard.
- LULU – Locally Unwanted Land Use.
- NOPE – Not On Planet Earth (!).
- BANANA – Build Absolutely Nothing Anywhere Near Anything.
- CAVE – Citizens Against Virtually Everything

The environment and climate change



Stabilizing greenhouse gas concentrations at 450 ppm would only result in a 50% likelihood of limiting global warming to 2 °C



Preliminary weekly (red line), monthly (blue line) and daily (black points) averages at Mauna Loa for the last year.

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Threat for FF

The Carbon Budget

With current emission rates (2014), the remaining 'quota' to surpass 2°C of global warming will be used up in around 30 years (one generation)

COP 21

INDCs - Intended Nationally Determined Contributions

Market manipulation

Dec 10-2016: OPEC, non-OPEC agree first global oil pact since 2001

Lock-In

http://in.reuters.com/article/opec-meeting-idINKBN13Z077

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Conflict and violent scenarios

The Oil Curse: A Remedial Role for the Oil Industry

Level of instability mid-2015:
Green "stable"
Yellow "economically dysfunctional"
Orange "risky"
Red "insecure"
Black Highly insecure signifying that oil companies have experienced significant losses due to attacks, conflict, or theft—bunkering.

Over half of oil-producing countries are "orange," indicating significant risk that conditions will change in ways that negatively impact oil operations.

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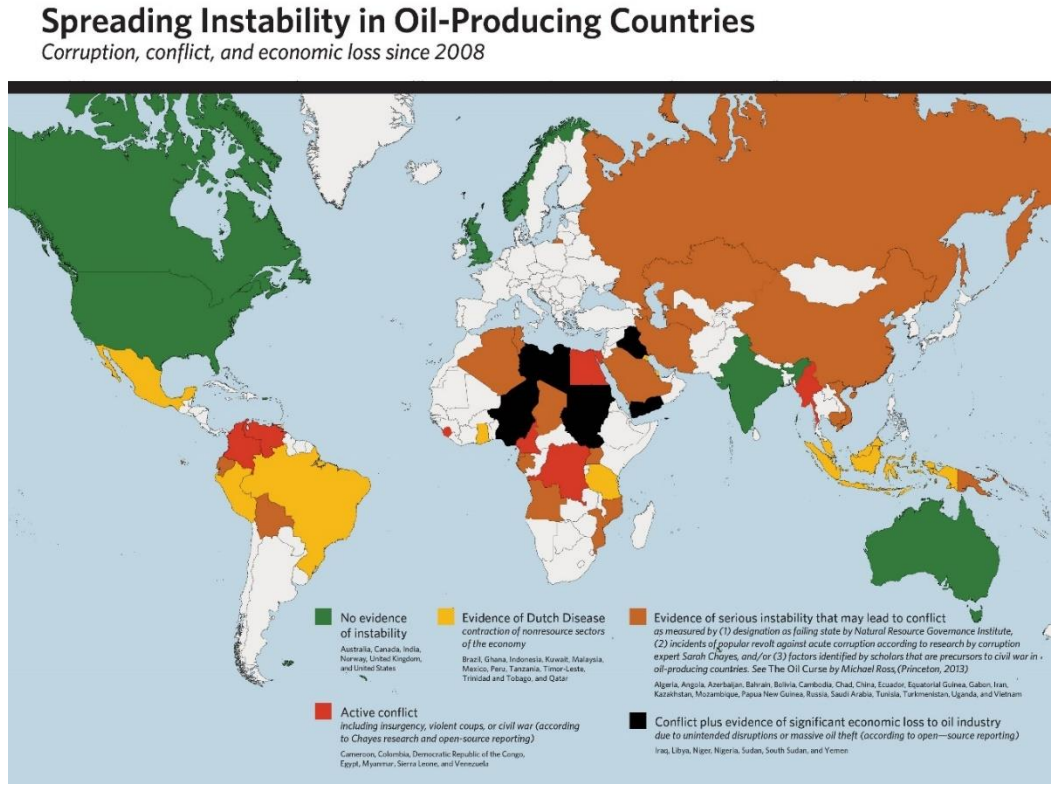
Uncertain supply

Countries with oil are twice as likely to experience civil war as those without.



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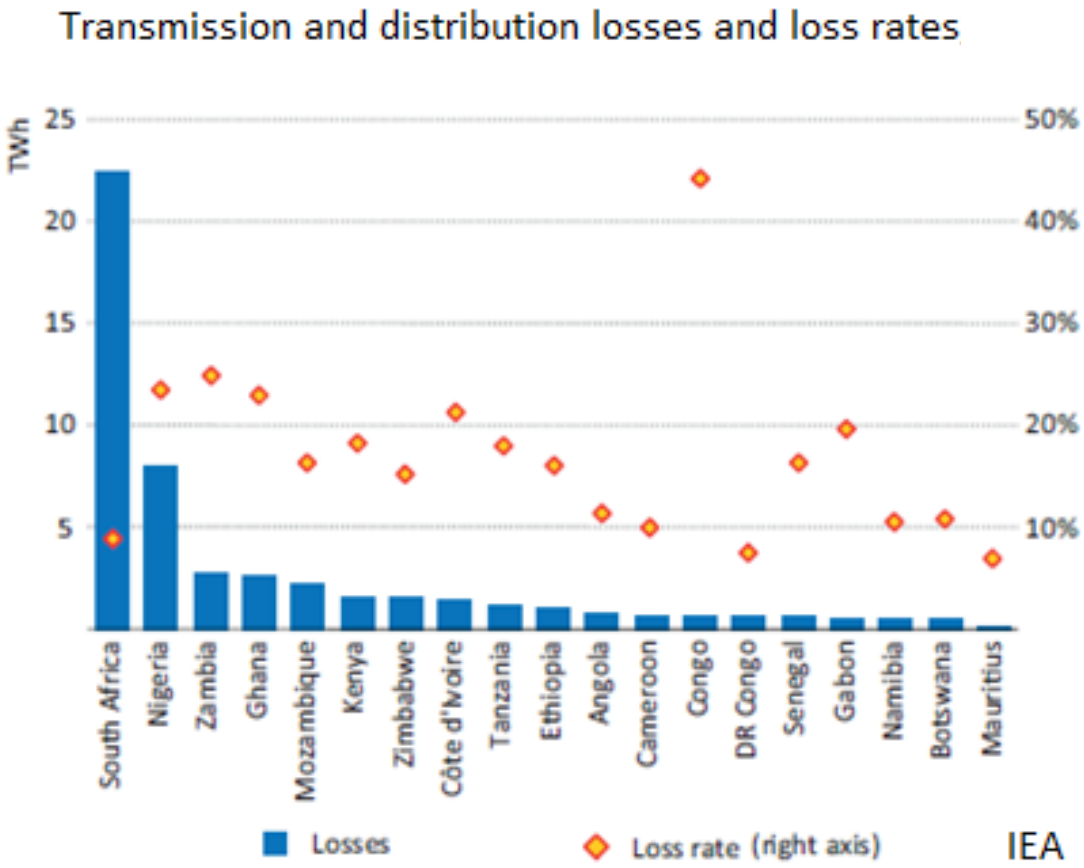
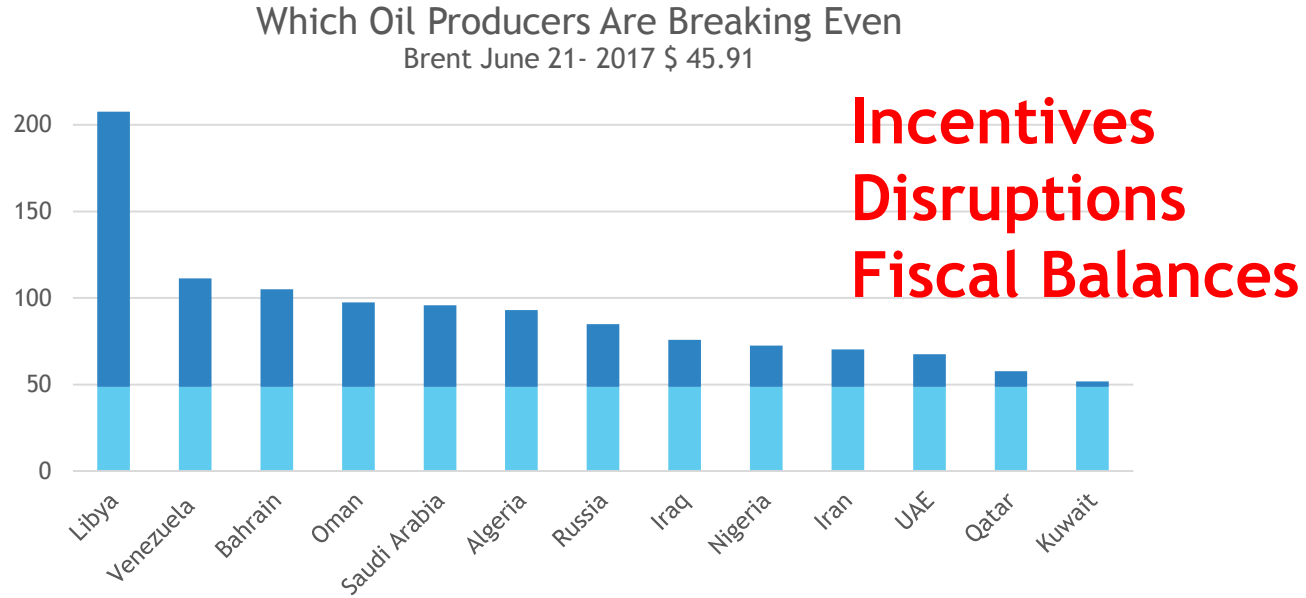
SARAH PECK, SARAH CHAYESPaper September 30, 2015

Energy/fossil fuels subsidies, bill collection, non technical energy losses and sabotage





Incentives
Disruptions
Fiscal Balances

http://graphics.wsj.com/oil-producers-break-even-prices/

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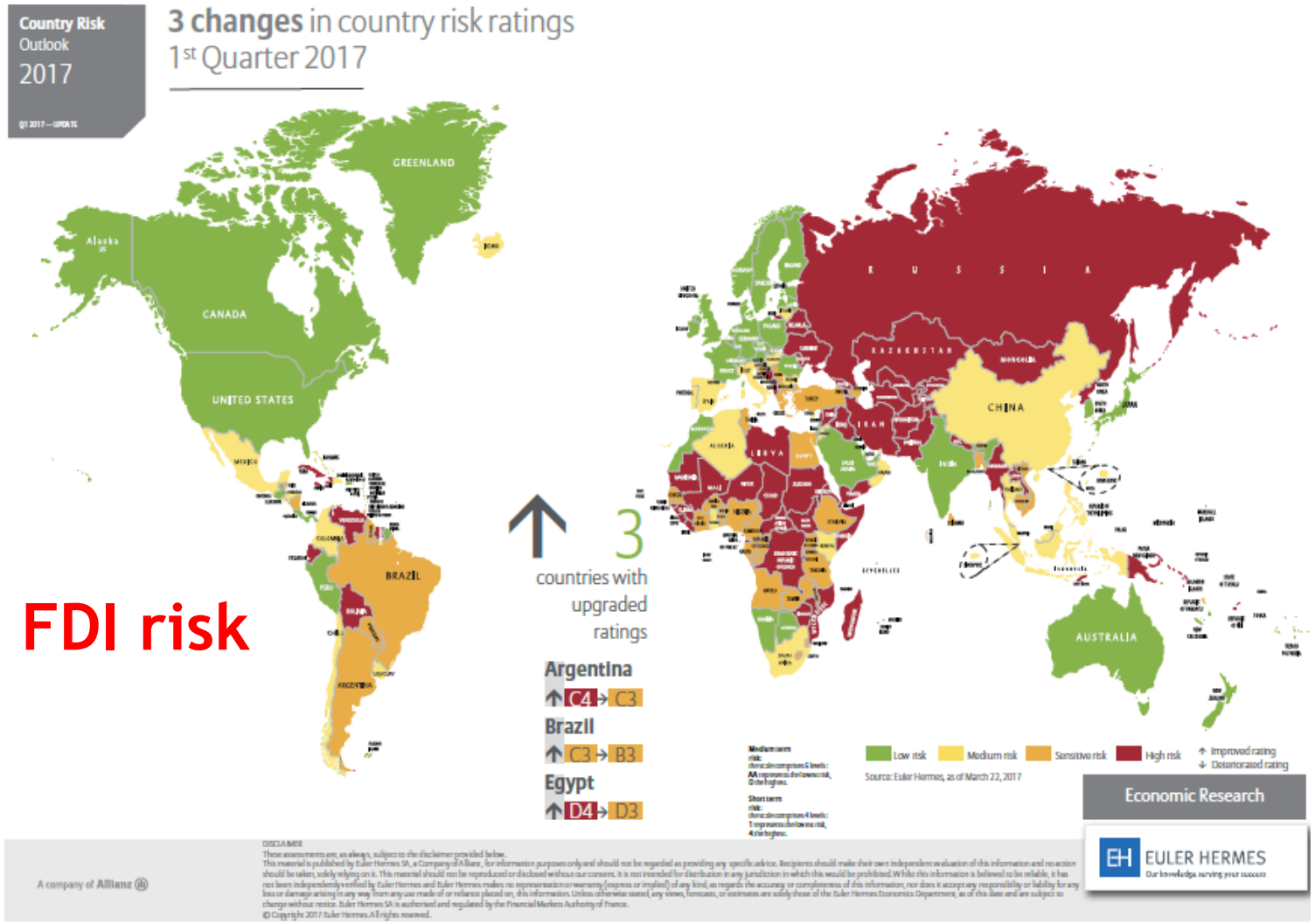
Investors risk & business environment

Country Risk



FDI risk

Ranking Doing Businness 2017 (WBG)	
United Arab Emirates	26
Qatar	83
Saudi Arabia	94
Kuwait	102
Ecuador	114
Iran, Islamic Rep.	120
Algeria	156
Gabon	164
Iraq	165
Nigeria	169
Equatorial Guinea	178
Angola	182
Venezuela, RB	187
Libya	188

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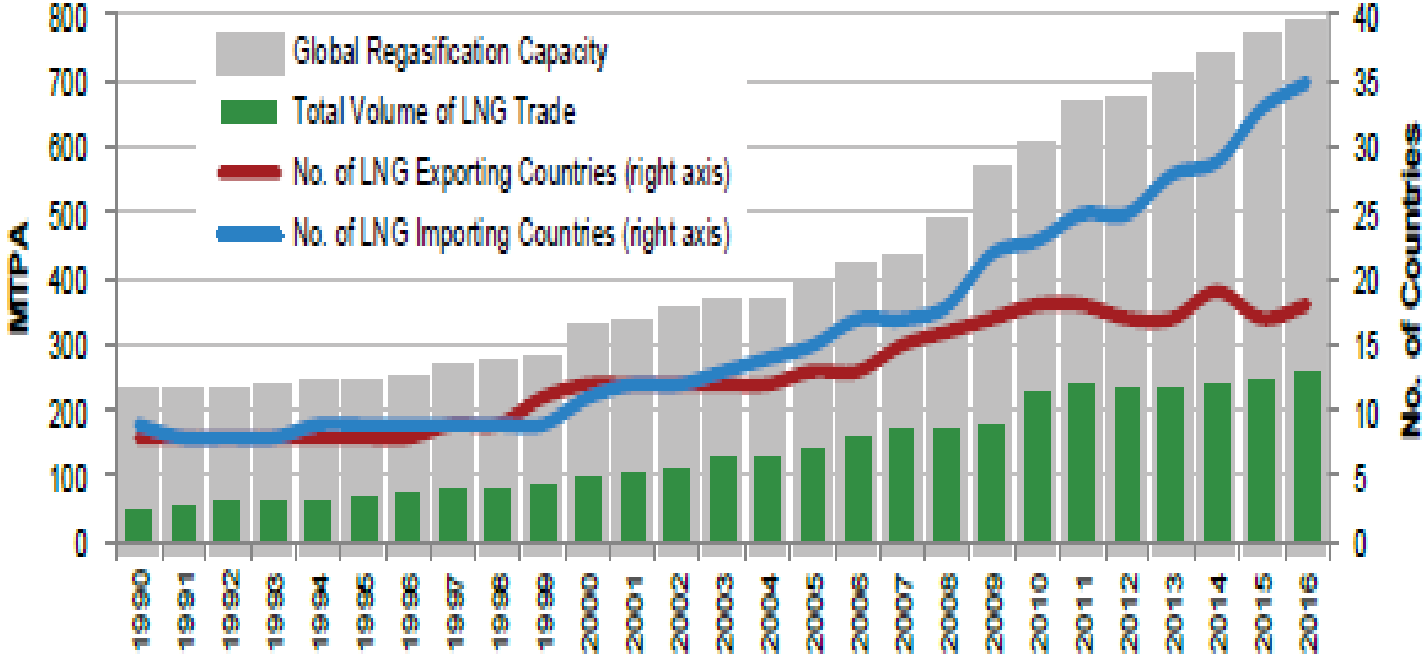
Energy security enablers

- Enabling business environment
  - Rule of law, strong institutions and absence of corruption
  - Well functioning and competitive energy markets
  - Rol of the private sector is key
- Well designed and resilient energy system
  - Adequacy of infrastructure
  - Diversification
  - EE
- Access to energy resources
- **Innovation, enable new energy sources and access to additional resources**

Natural Gas Trade

LNG Trade Volumes, 1990 - 2016



Source: IHS Markit, IEA, IGU

Source: IGU World LNG Report 2017

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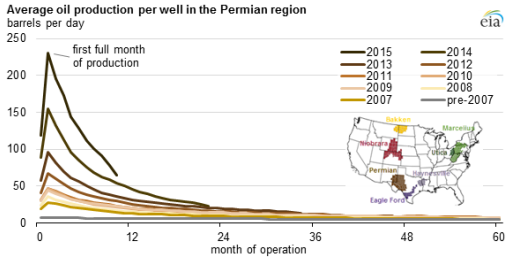
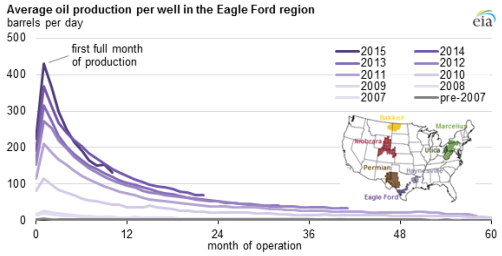
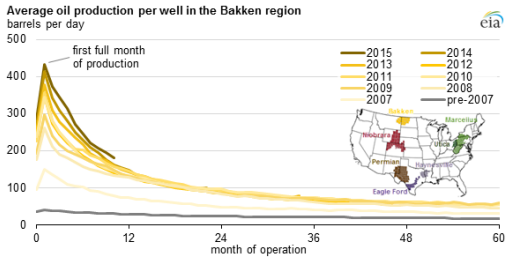
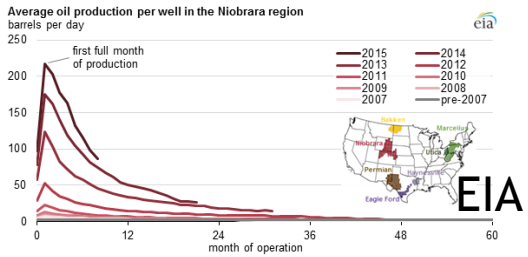
Oil exploration and production technology

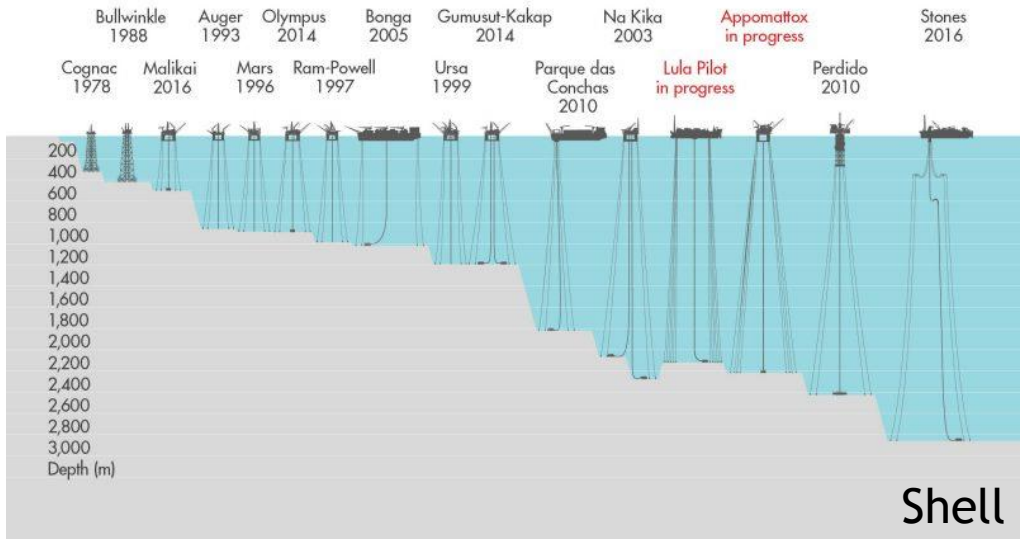








EIA



Shell

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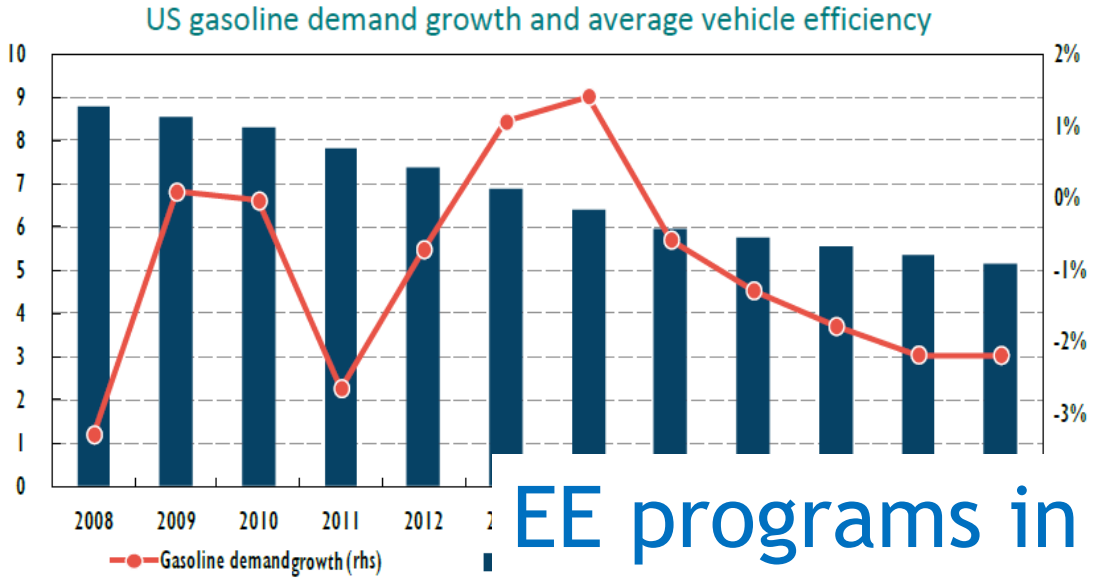
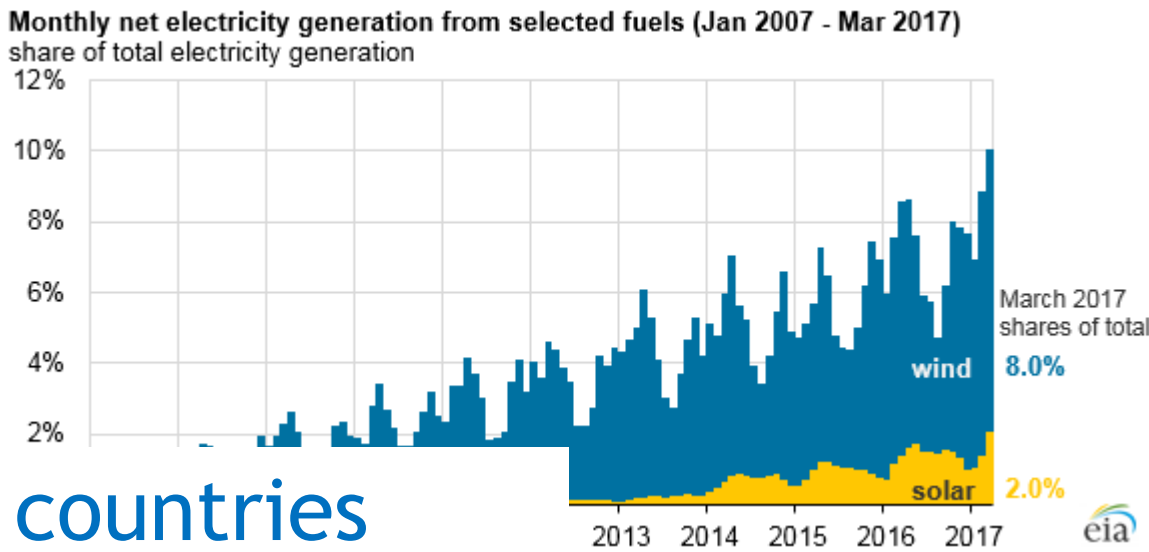
RE/EE and new technologies

OECD/IEA/EIA

http://www.ft.com/intl/cms/s/0/770f13d6-1925-11e6-bb7d-ee563a5a1cc1.html#axzz49ThWVptK

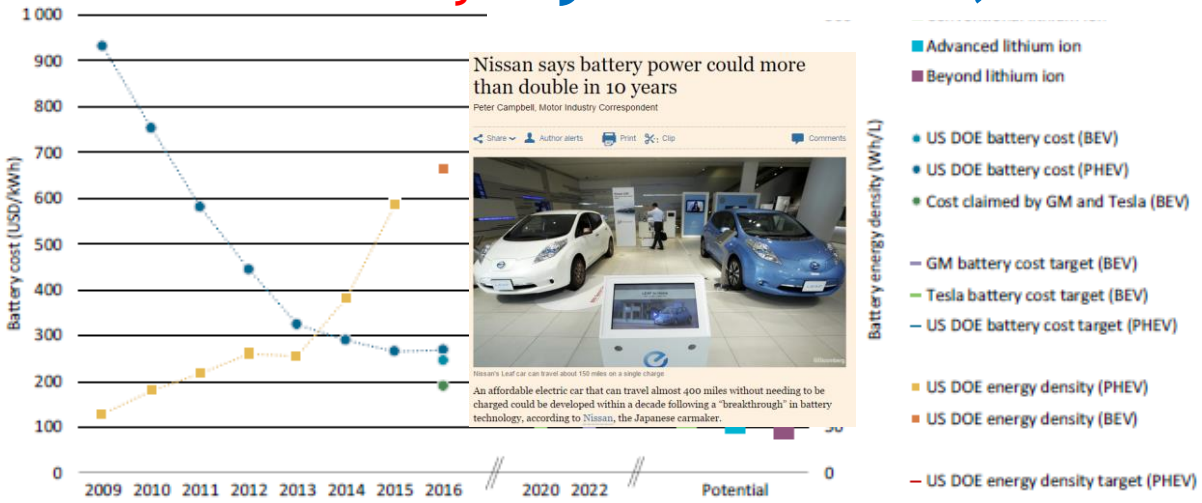


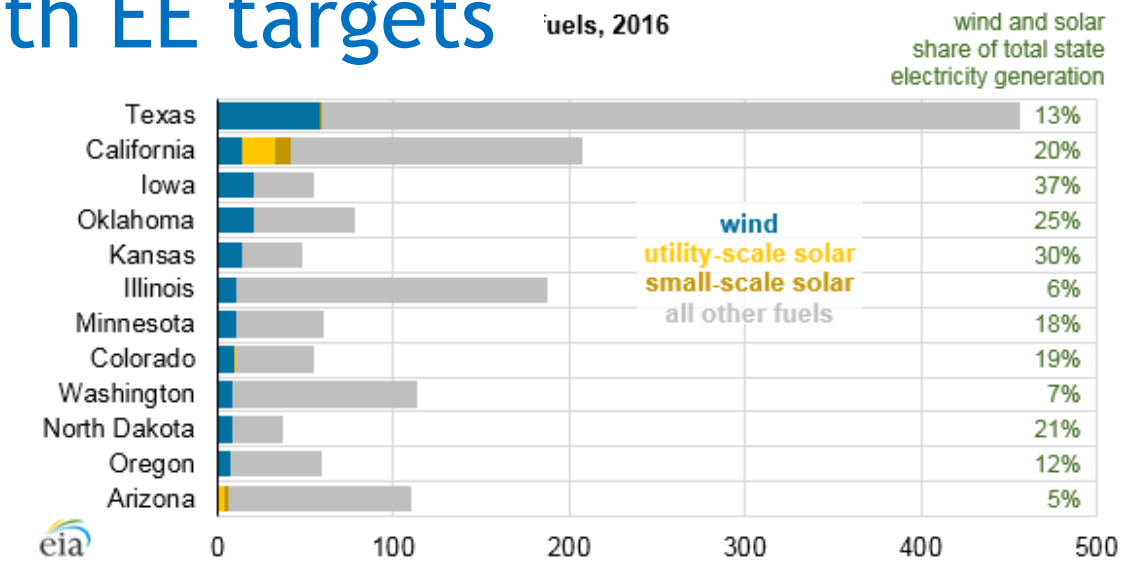
Solar and Wind US



EE programs in 146 countries by end 2015, 128 with EE targets

Evolution of battery





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Advance energy sources key for national security

As new energy options emerge to meet global demand, nations that lead stand to gain; should the U.S. sit on the sidelines, it does so at considerable risk to our national security.

We identify advanced energy as a national security priority

We find that a U.S. energy stance centered on fossil fuels should not delay our planning for, development of, and investment in advanced energy systems at home and abroad.

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ADVANCED ENERGY AND U.S. NATIONAL SECURITY
US CNA Military Advisory Board | June 2017
Group of retired flag and general officers from the Army, Navy, Air Force, and Marine Corps

The way ahead

- **New technologies are reshaping the energy sector**, from a centralized structure to a decentralized one
- The **renewed path of the energy sector is innovation and disruption**.
- The advancement of drilling and other energy technologies has allowed the **access to new** subsurface **resources**, of non-conventional energy sources, and the harness of energy from the wind, sun, and oceans, among others.
- **Change in the geopolitical balance**
- **New challenges** such as greater communications, smarter metering and the management of larger data, where demand side management and storage can become a key contributor on the systems levels of energy security.
- A need for a clear leadership on **where investments should go**.

The way ahead

- Governments, industry, research organizations and the scientific community have a key **role in advancing the frontier** of what is feasible and on the understanding of the most proper technologies and business models to manage the transition to a more decentralized system.
- The **levels of commitment** of an economy to **a low carbon economy** need clarity and stable **long-lasting rules** from government authorities.
- **New business models** will emerge as well as **new technologies**. And **how the government authorities manage the transition**, will be key in speeding or slowing innovation and technological change.
- The **countries** that become the **front-runners** in this technological revolution, will take the **industrial lead** and will become the **partner of choice**.

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Thanks for your Attention

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