Energy Security in the Transition to Low Carbon Society

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University of Tokyo, 17 October 2017

IEA

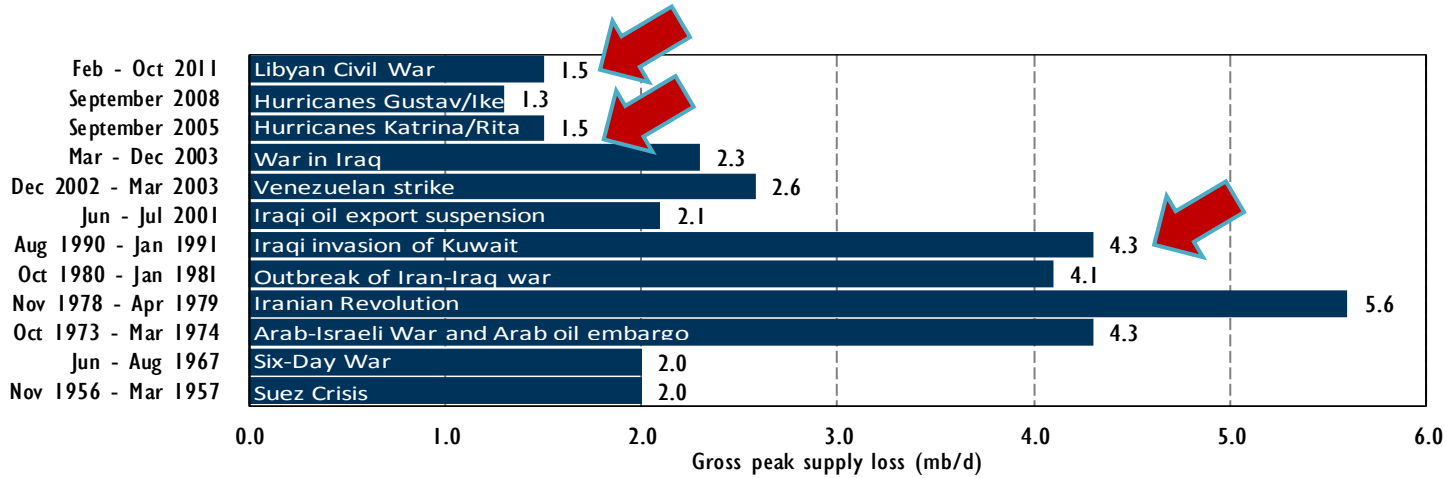
- Who are we?

The IEA was set up after the 1974 oil crisis to coordinate a collective response to major disruptions in oil supplies through the release of emergency oil stocks

Our mission

Today, the IEA is at the heart of the global energy dialogue and the transition to a clean energy future

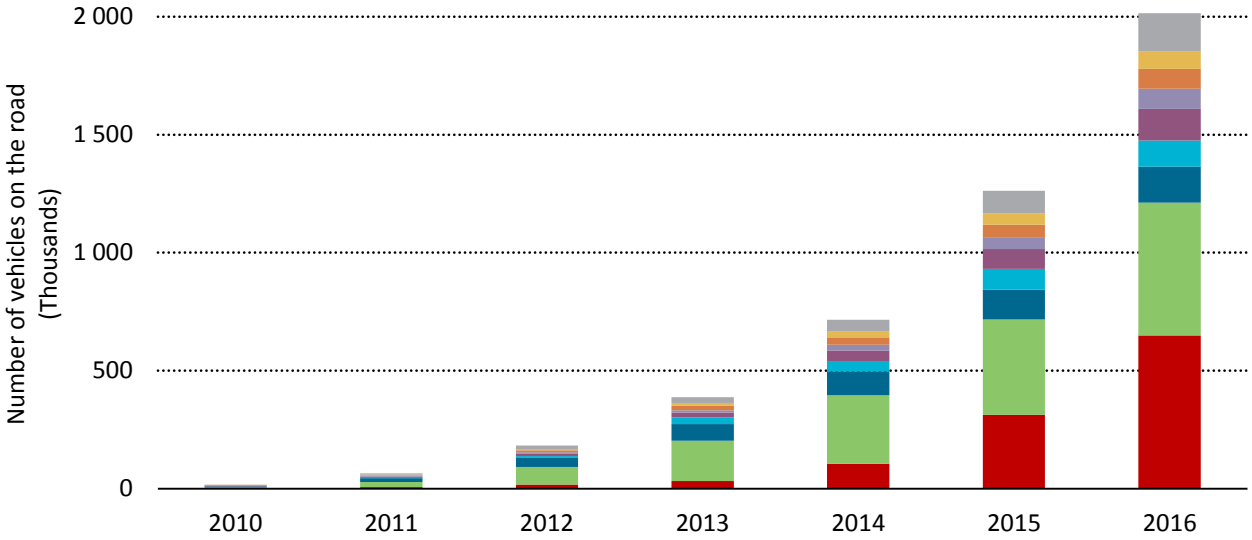
Major oil supply disruptions



- Disruption severity is not (only) measured in oil lost
  - Other factors are key in evaluation:
    - Level of commercial inventories, likely duration, available spare capacity, quality of lost crude, seasonality, logistics etc.
  - Each disruption must be assessed individually – market context is critical

On-track: Electric mobility is breaking records, but policy support remains critical

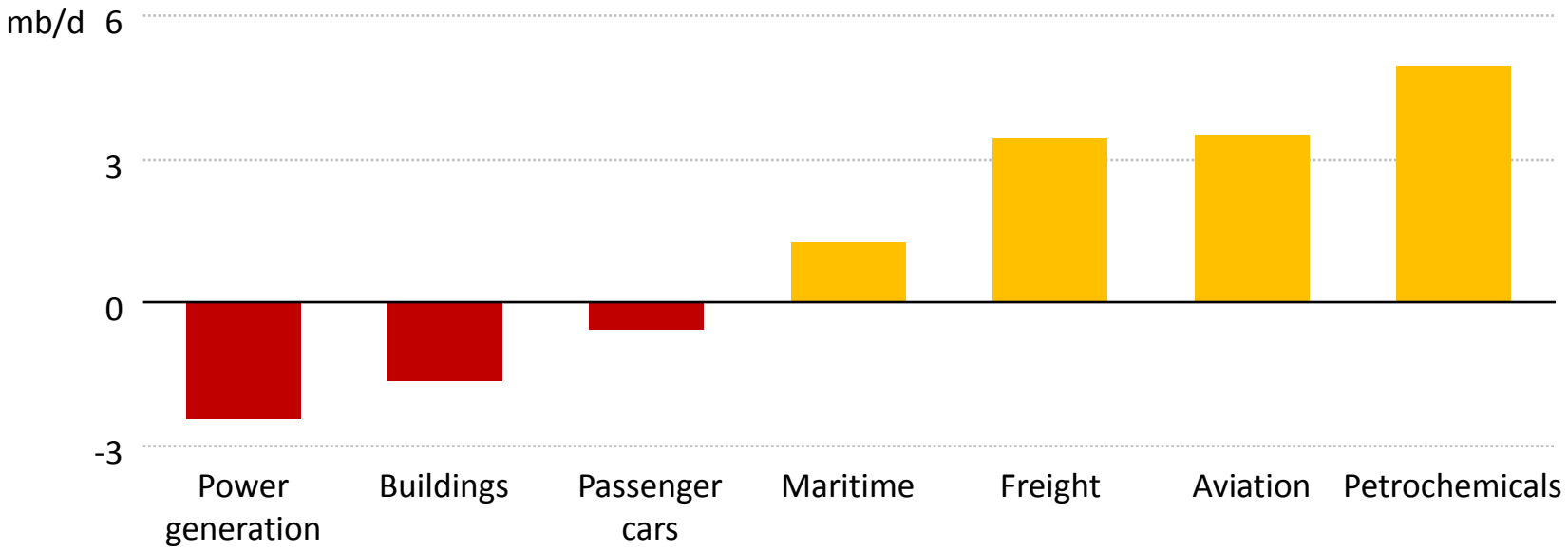
Global electric car fleet



The global electric car fleet passed 2 million last year, but sales growth slipped from 70% in 2015 to 40% in 2016, suggesting the boom may not last without sustained policy support

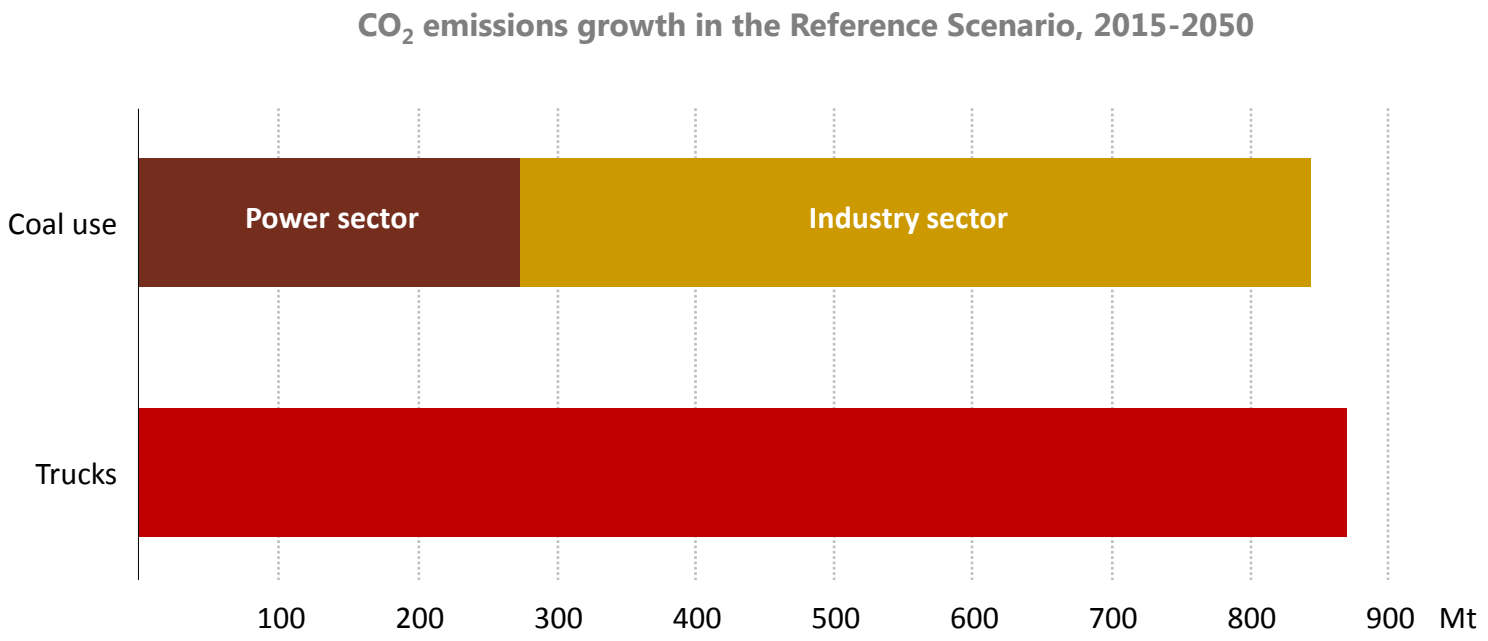
No peak yet in sight, but a slowdown in growth for oil demand

Change in oil demand by sector, 2015-2040



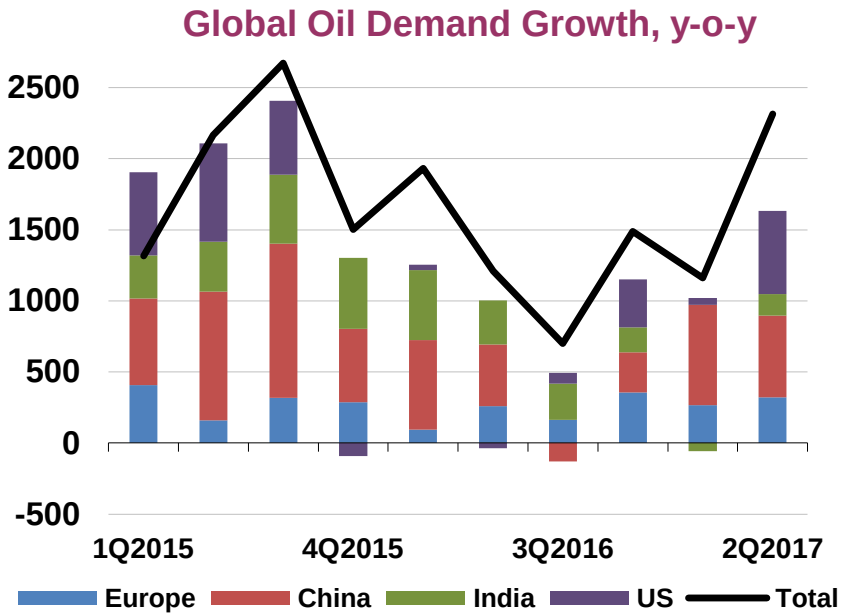
The global car fleet doubles, but efficiency gains, biofuels & electric cars reduce oil demand for passenger cars; growth elsewhere pushes total demand higher

A modern truck sector is still a long haul away



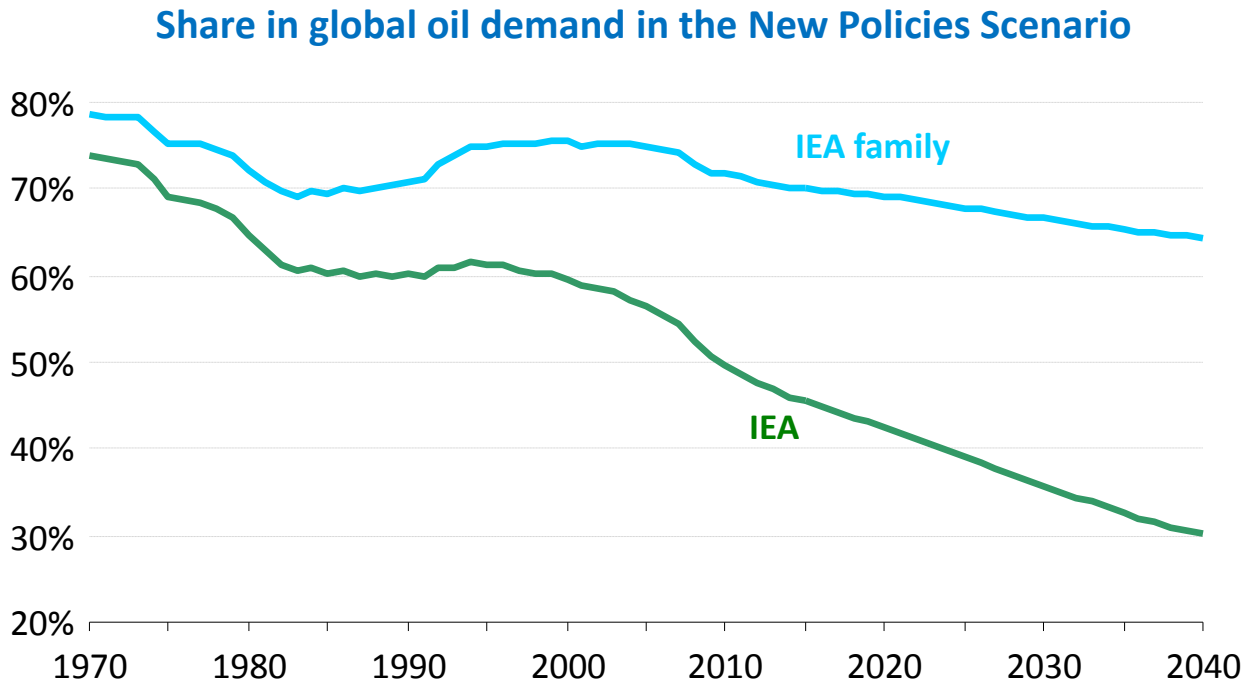
Without further policy efforts, trucks will account for 40% of the oil demand growth to 2050 and 15% of the increase in global CO_2 emissions

Global Demand rose by 2.3 mb/d y-o-y in 2Q17



Very strong growth by historical standards

Growing importance of partnership

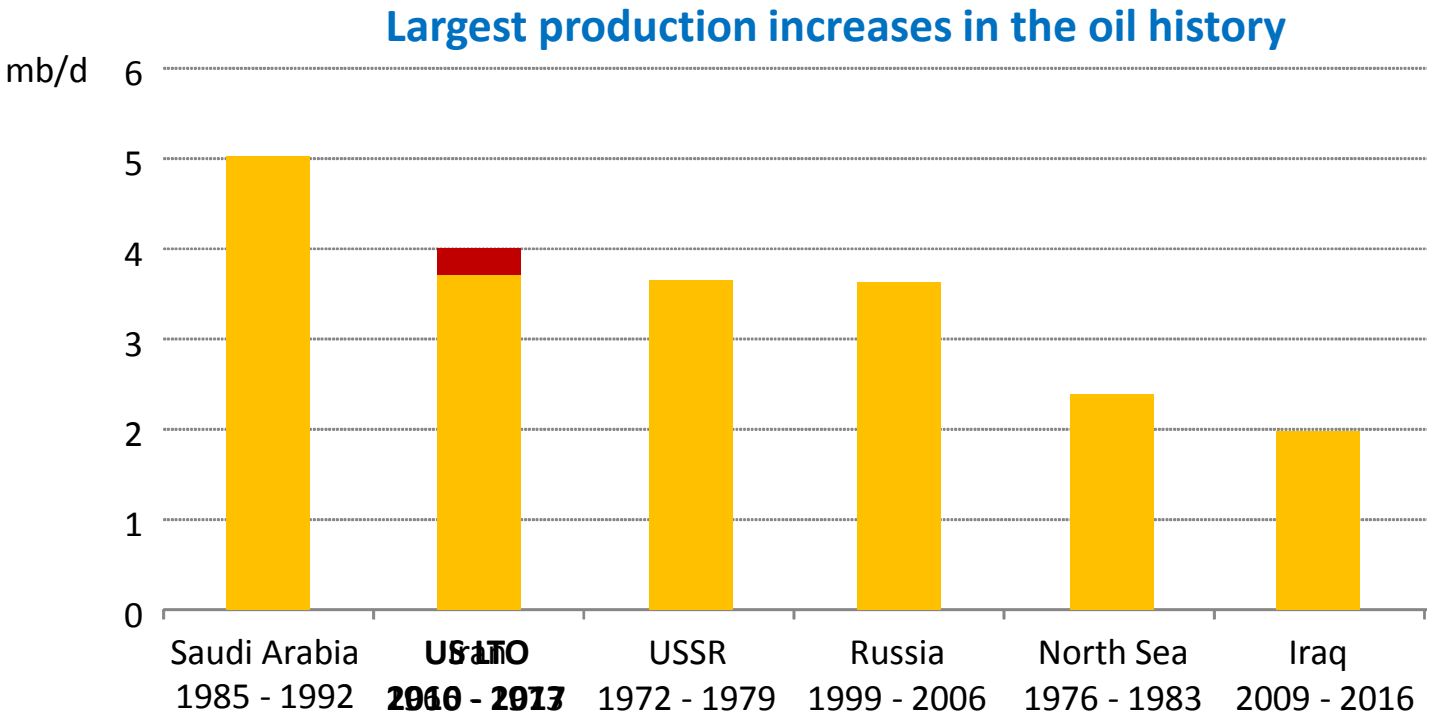


IEA along with partner countries will account for 65% of global oil demand in 2040

IEA & Association - Cooperation on Energy Security

- Emergency Response Exercises
  - Participation since 2004 in IEA exercises
  - IEA participated in China, India, Thailand, APEC
- Emergency Response Assessments
  - Thailand (2010), India (2013), Indonesia (2014)
- Participation in IEA countries reviews
  - China (3), Indonesia (1), Thailand (1), India (1)
- Advice on building capacity and resilience
- Hotlines / Contacts
  - Established / tested with China, India, Indonesia Morocco and Thailand

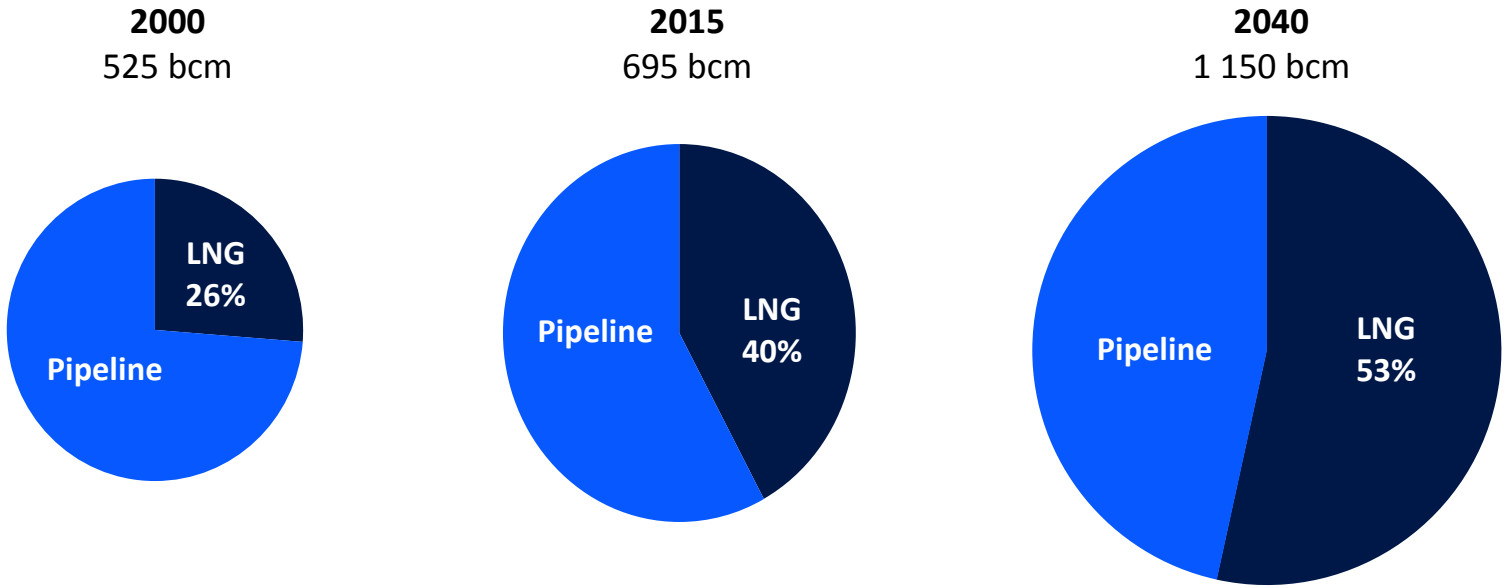
US shale the most successful story in the oil history outside Saudi Arabia



Differently from all other regions, US shale oil growth results from technological and market progress rather than the discovery and deployment of huge oil resources

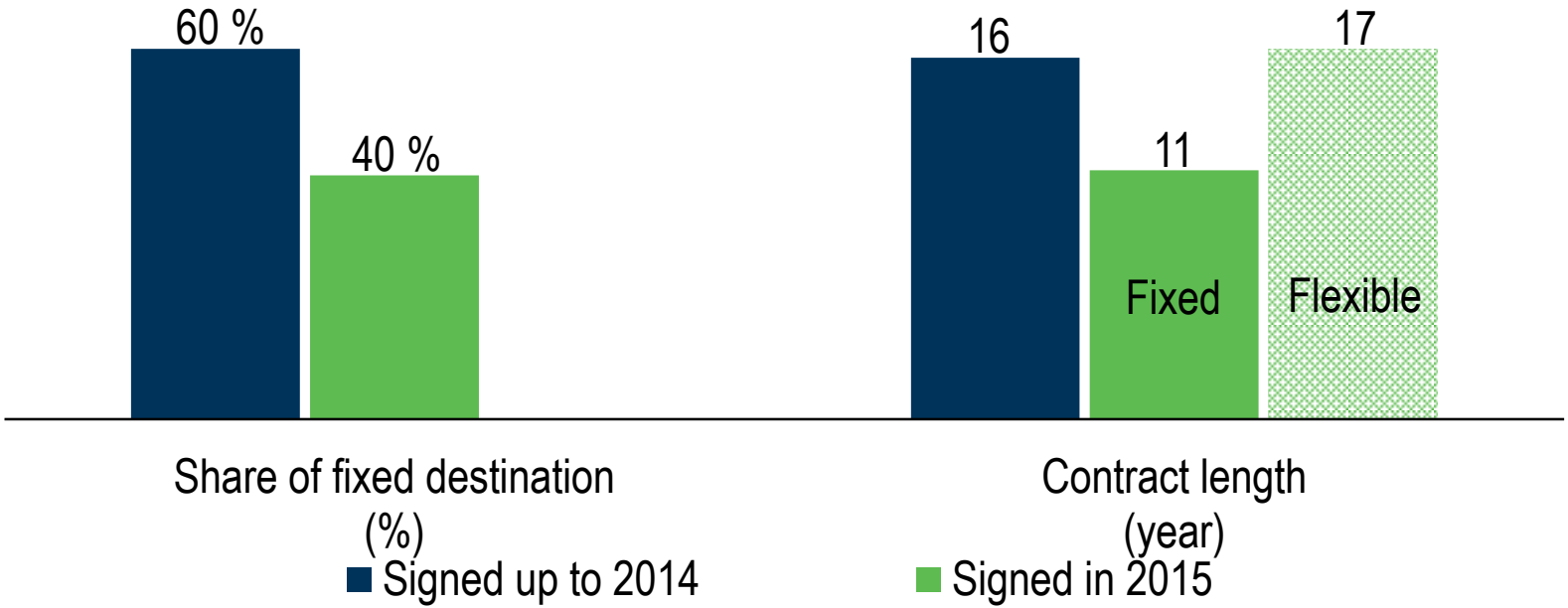
A 2nd natural gas revolution is changing the gas security equation

Share of LNG in global gas trade



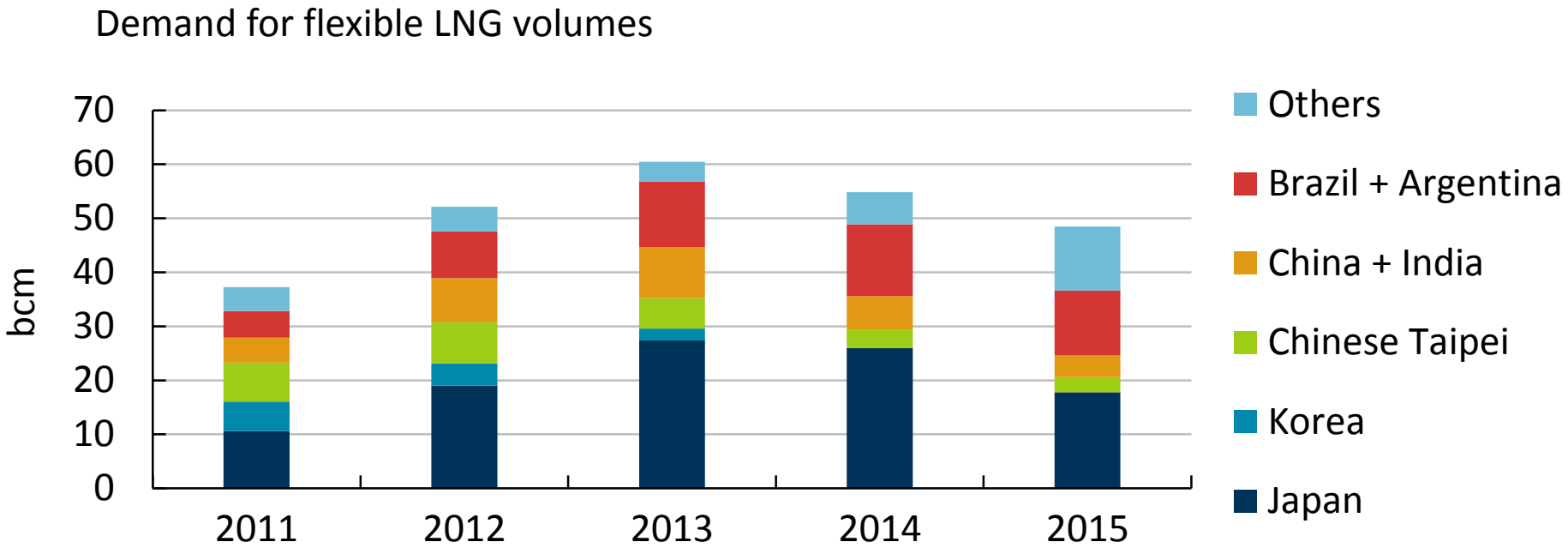
A wave of new LNG supply, led by Australia and the US will improve the ability of the system to react to potential demand or supply shocks, but security of gas supply still a concern

But LNG contract structures are becoming less rigid – increasing market efficiency



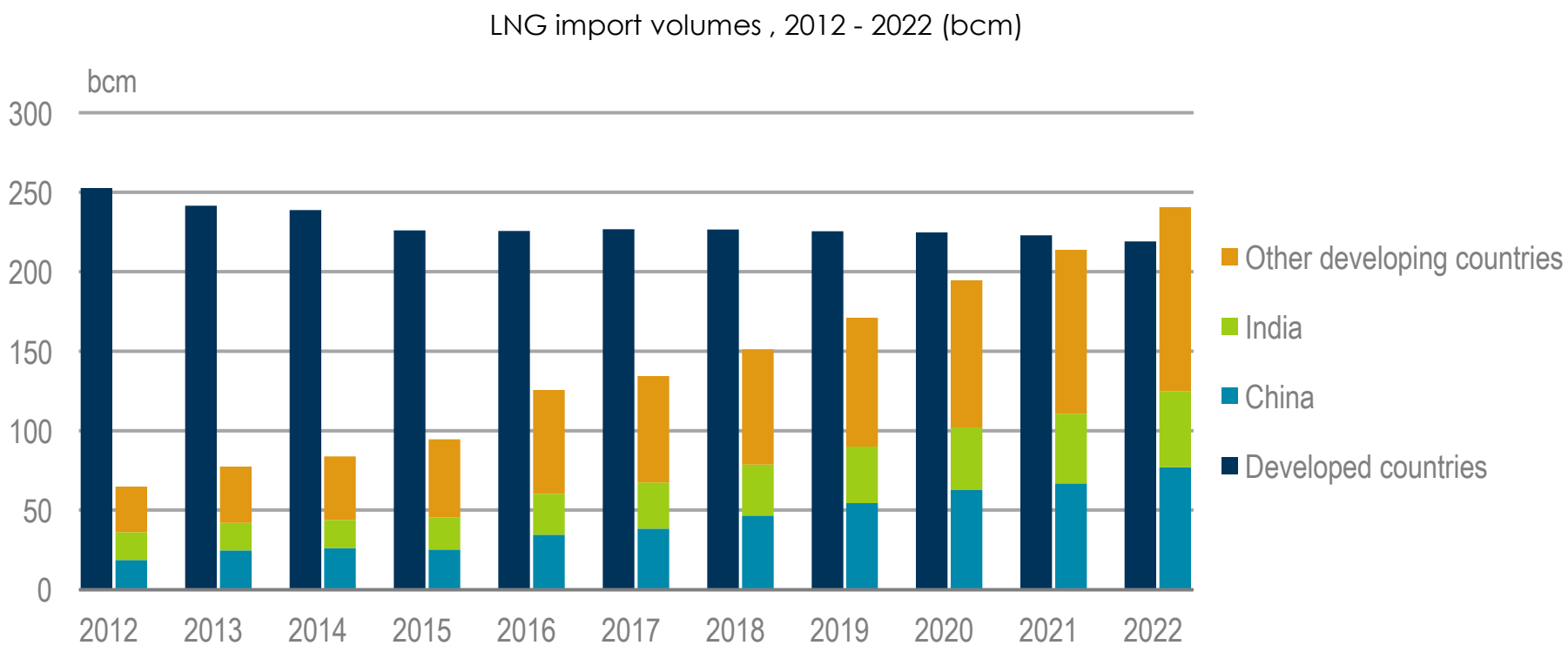
Contracts with flexible destinations & shorter terms are becoming more common; buyers will accept longer contracts in exchange for increased destination flexibility

Demand for flexible LNG volumes remains above pre-Fukushima levels



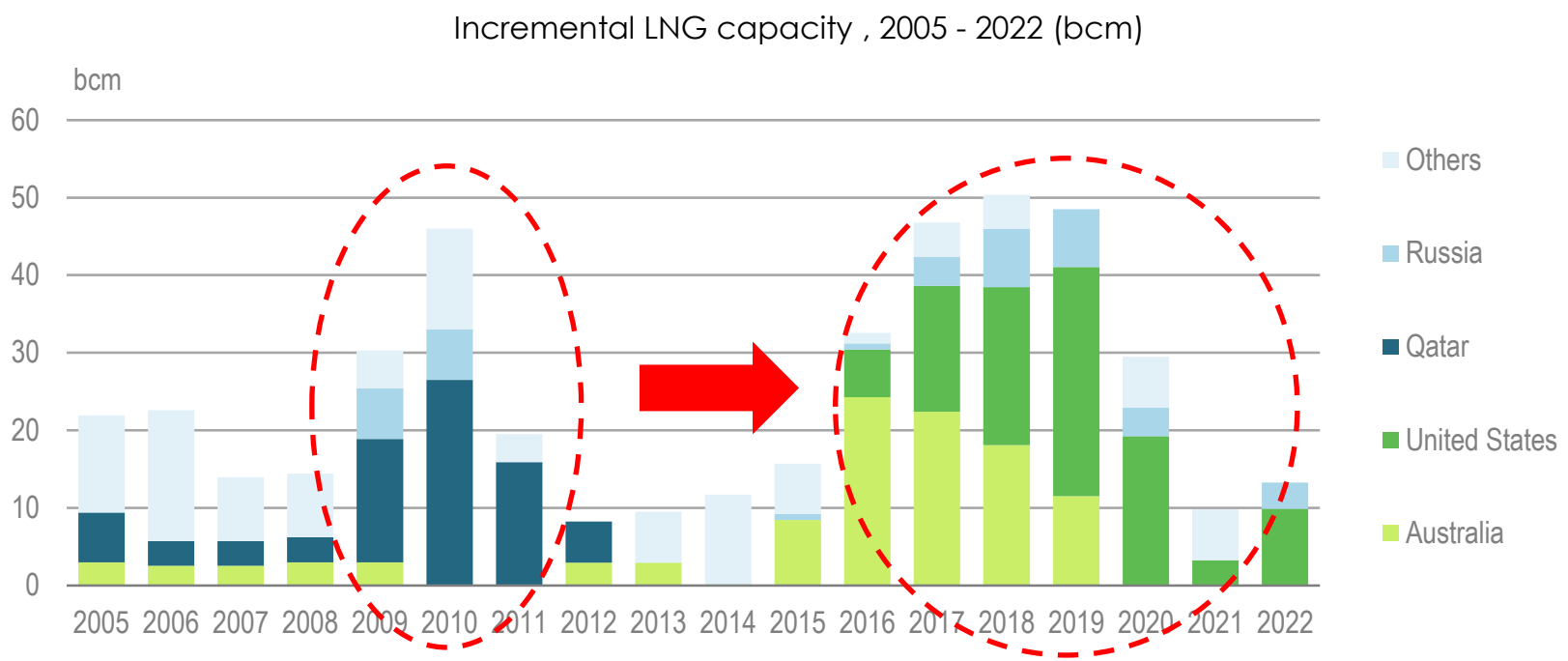
Demand for flexible LNG volumes peaked in 2013 at around 20% of global LNG trade; new buyers are offsetting some of the slack left by Japan

Demand in developing countries reshaping the LNG market



LNG demand in developing countries will import more LNG than developed countries from 2022
China and India are main drivers and account for more than half of the LNG import increase in developing countries

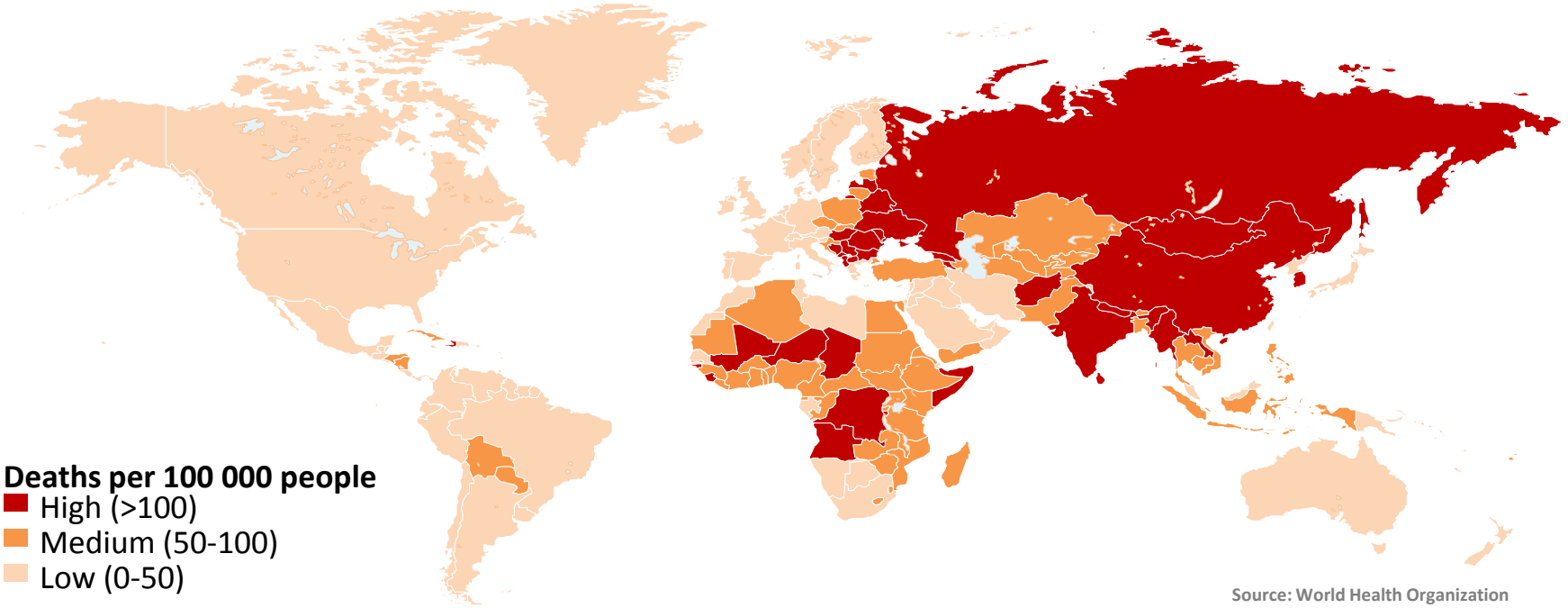
Second wave of additional LNG supply is already coming online



15 new projects with total export capacity of around 140 bcm are now under construction
Australia and the United States account for 75% of them

Air pollution is a universal problem, especially in emerging economies

Premature deaths due to air pollution

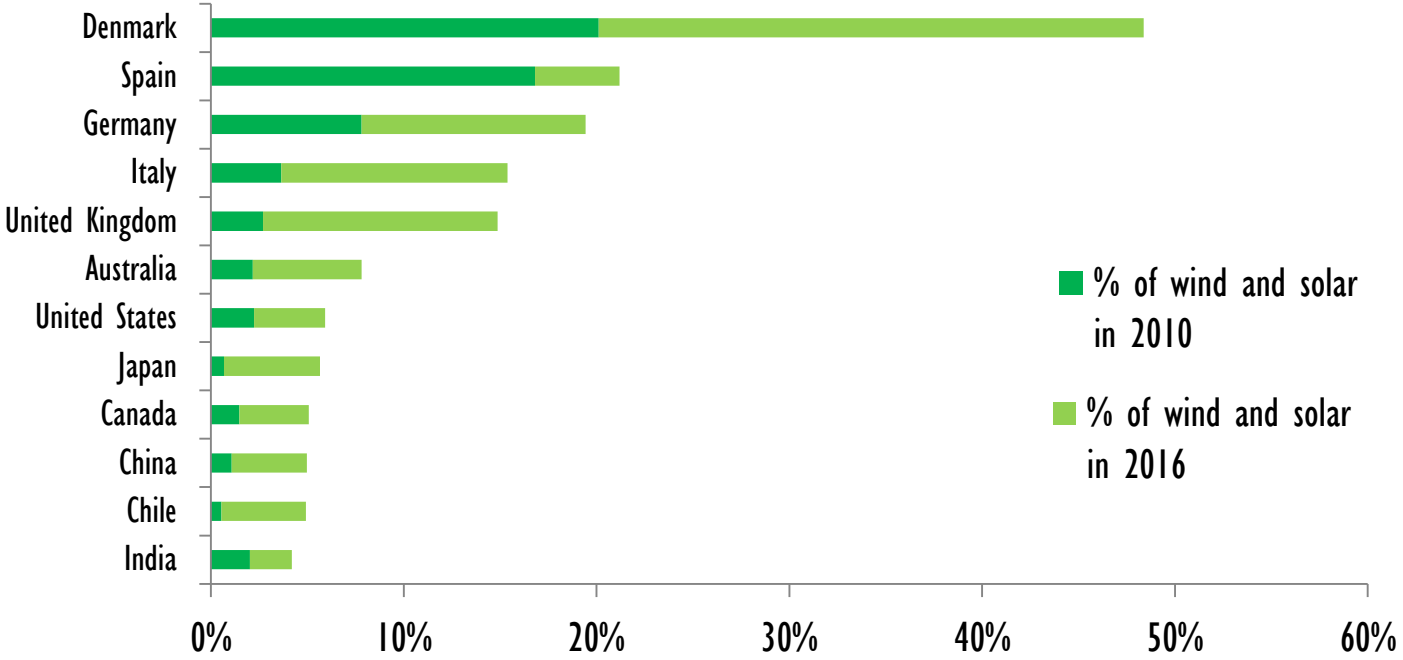


Source: World Health Organization

6.5 million premature deaths every year are caused by pollution from power plants, factories, cars and trucks globally. Air pollution related health risks are largest in cities around the world.

Wind & solar transforming the power sector: system integration is key

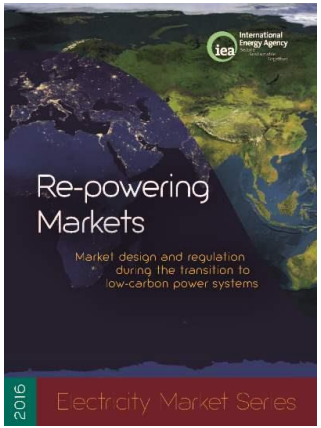
Share of wind and solar in total electricity generation in selected countries

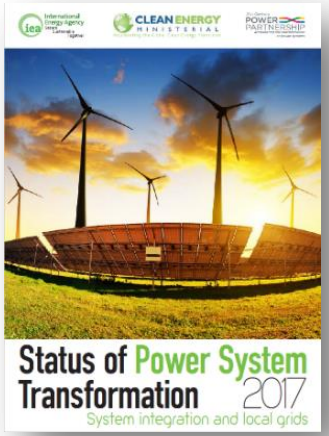


Better grids, more flexible power plants and storage & demand side response will be needed to integrate larger shares of wind & solar in a secure and cost-effective way

Policy, regulatory & market frameworks for system transformation

Efficient operation of the power system	• Ensuring least-cost dispatch • Trading close to real time • Market integrations over large regional areas
Unlocking flexibility from all resources	• Upgrade planning and system service markets • Generation, grid, demand-side integration and storage
Pricing security of electricity supply	• Improve pricing during scarcity/capacity shortage • Possibly capacity mechanisms mechanism as safety-net
Sufficient investment in clean generation capacity	• Sufficient investment certainty • Competitive procurement (with long-term contracts)
Pricing of externalities	• Reflecting the full cost (i.e. environmental impacts)



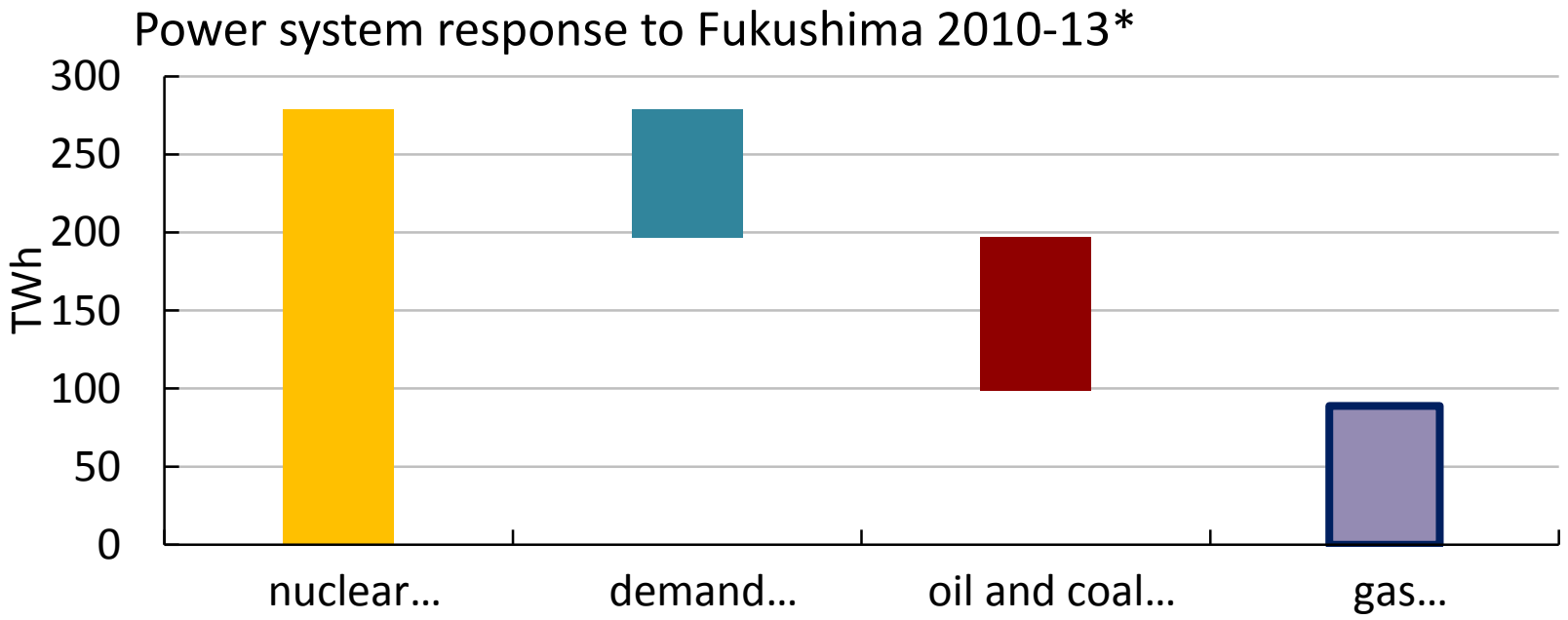


Why focus on power plant flexibility?

- Flexible power plants currently major source of flexibility in all power systems
- Technical potential is often poorly understood and/or underestimated
- Significant barriers hinder progress:
  - Technical solutions not always known
  - Market design favors running 'flat-out'
  - Inflexible contracts with manufacturers
- IEA coordinating new imitative to promote enhanced power plant flexibility

Example North-America
From baseload operation to starting daily or twice a day (running from 5h00 to 10h00 and 16h00 to 20h00)
Source: NREL

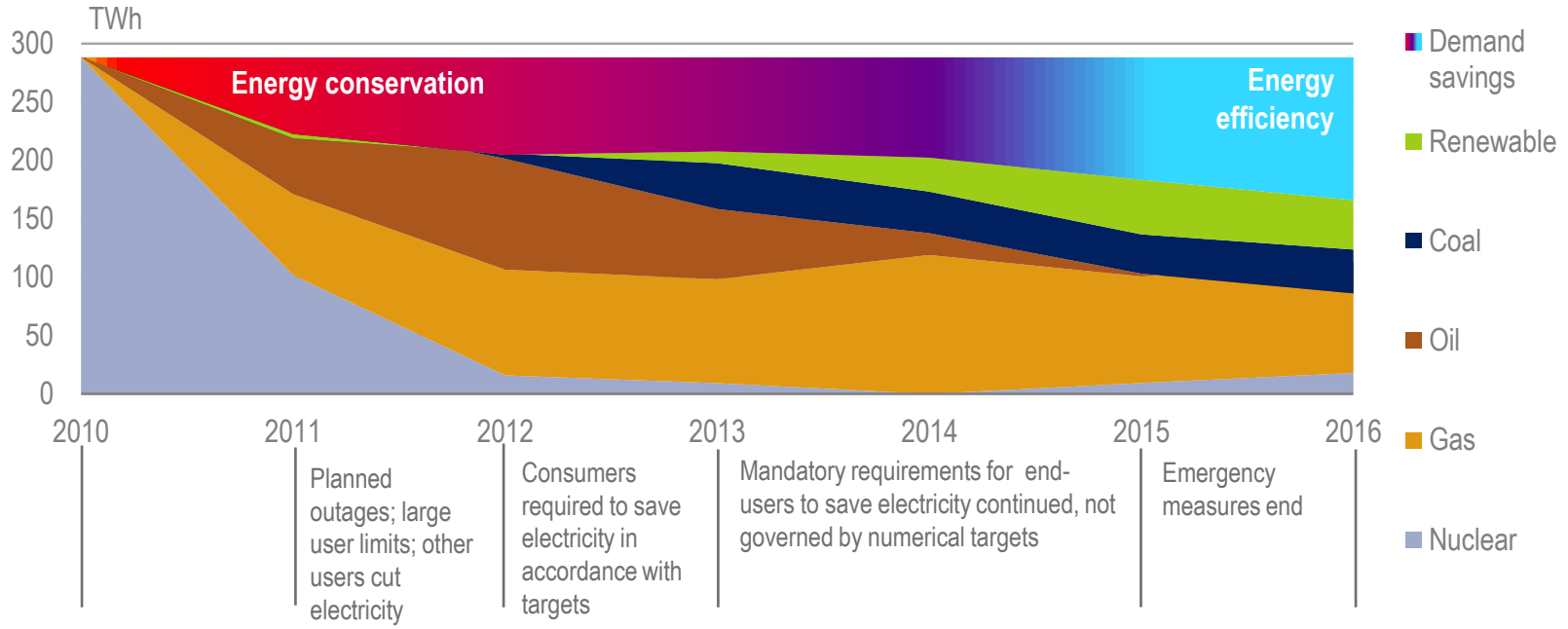
Flexible LNG volumes played a role in safeguarding energy security after Fukushima



Gas replaced one-third of the nuclear loss, similar to the contributions of oil and coal, highlighting the importance of a diversified demand-structure

Energy conservation and efficiency drives security

Replacement of nuclear electricity generation capacity in Japan after shutdown



Demand savings from conservation and efficiency measures provided the greatest single contribution (39%) to the replacement of nuclear generation capacity after Fukushima.

Power system flexibility can mitigate energy security risks

Benefits of renewables

- **Diversification**
  - Balanced generation portfolio
  - Diversify fuel mix
- **Domestic supply**
  - Reduce import bills and lower fossil fuel price risks
- **Environment**
  - Greenhouse gas and local pollution reduction

Risks of renewables

- **Variable and uncertain**
  - Outputs depend on weather and climate

System flexibility


Grids


Generation


Storage

Demand shaping

More secure and resilient system

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