

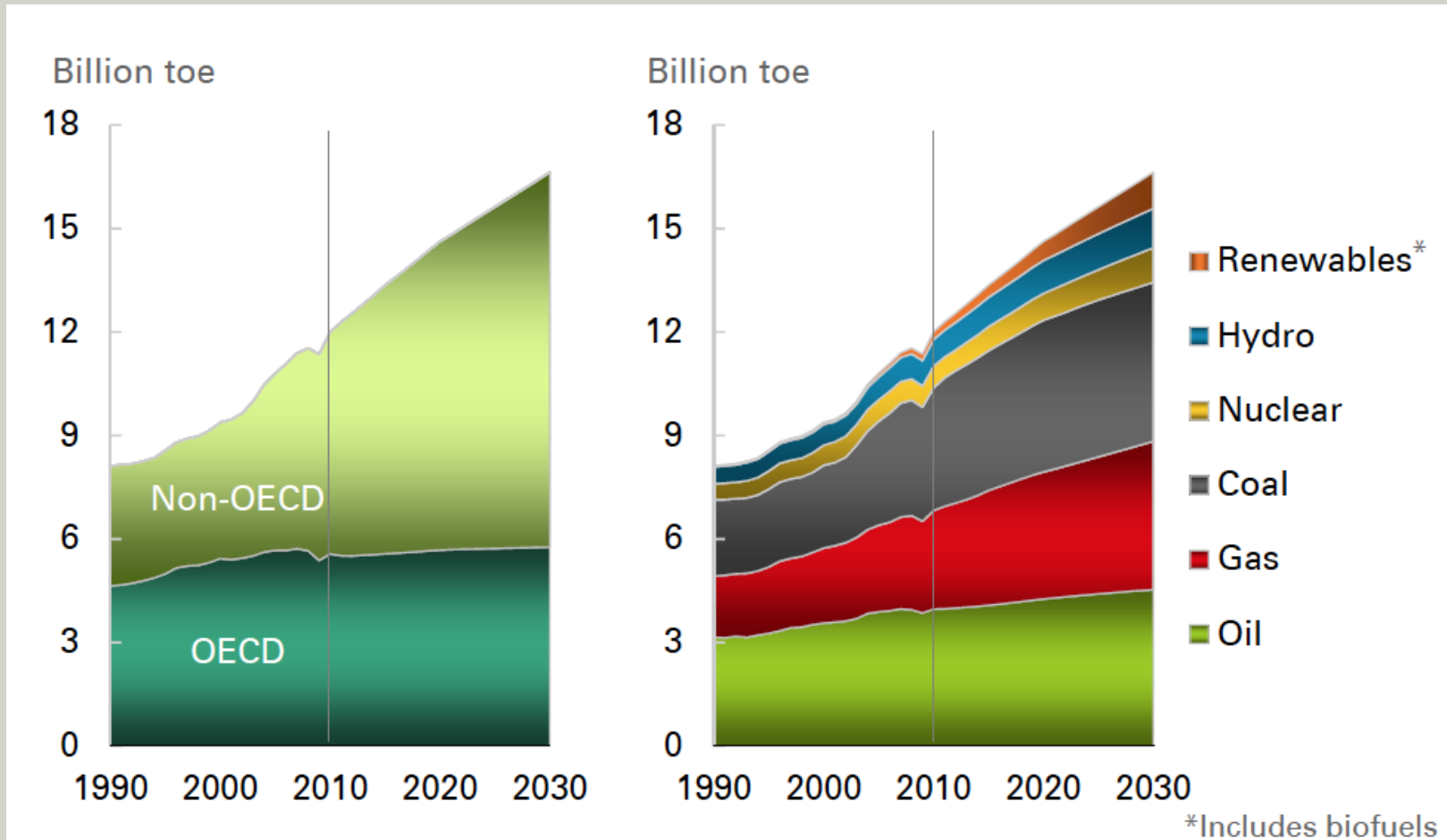
Developments in Energy

Lucia van Geuns

The Hague,

10 December 2013

Non-OECD economies drive energy consumption growth...



Source: BP energy Outlook 2030, 2012

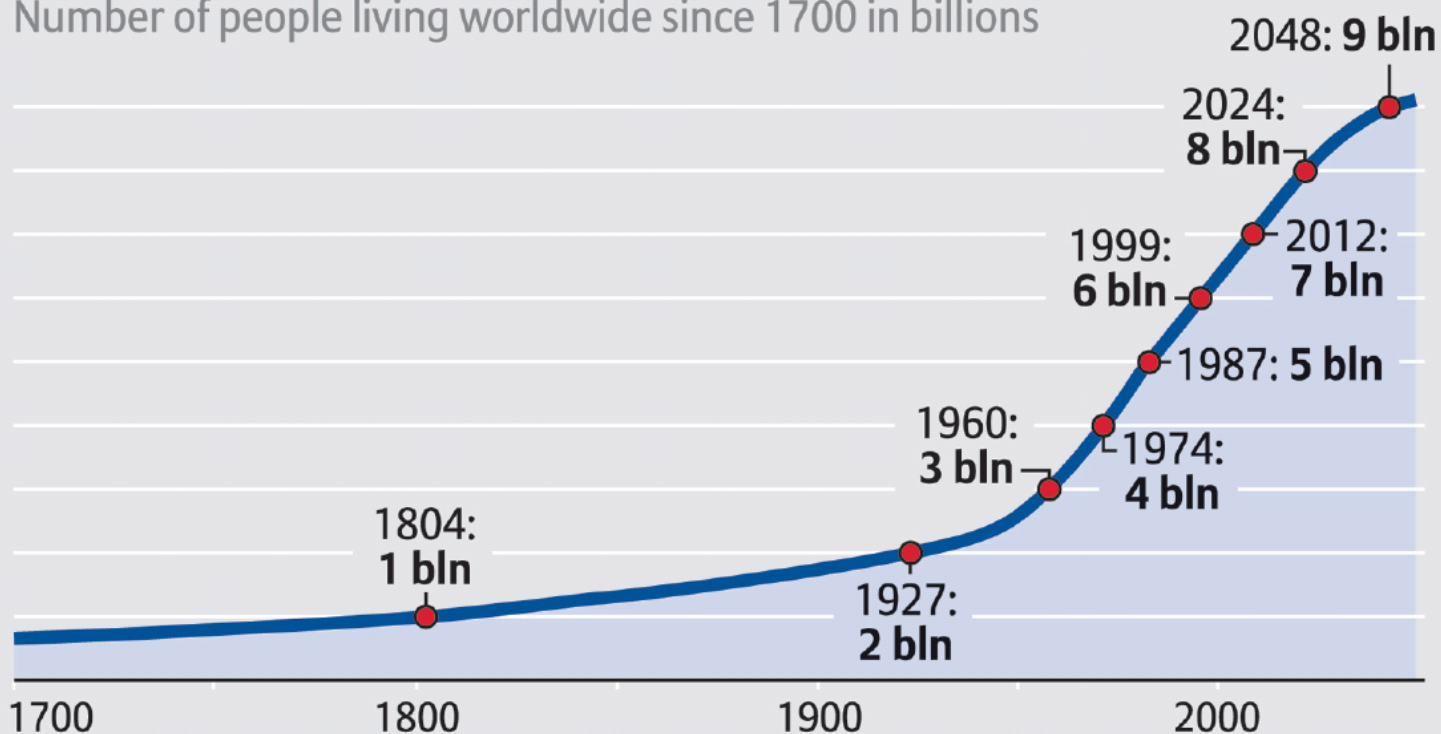
Accelerating Energy Demand

Driven by population growth and economic development

POPULATION OF THE EARTH

Allianz 

Number of people living worldwide since 1700 in billions



Source: United Nations World Population Prospects, Deutsche Stiftung Weltbevölkerung

For further information please visit: www.knowledge.allianz.com

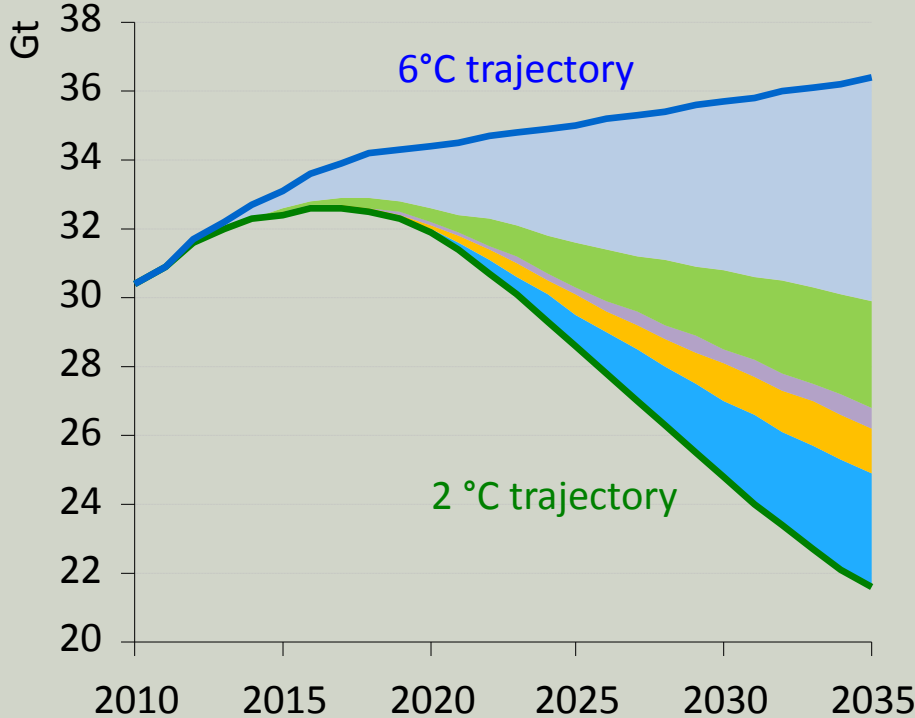
Energy Solutions



Bron: Exxon Mobil 2008

Efficiency gains can contribute most to emissions reductions

World energy-related CO₂ emissions abatement



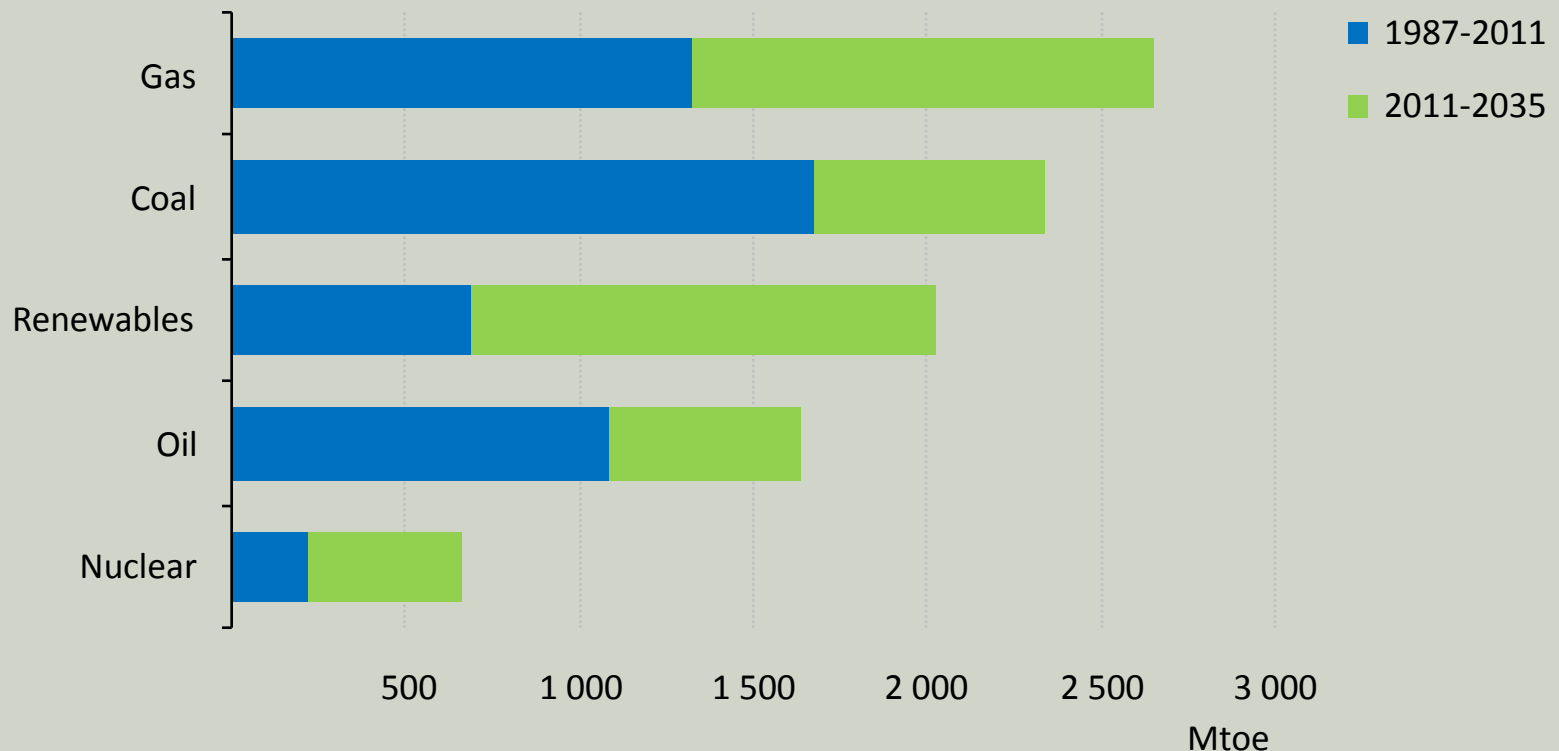
	Abatement	
	2020	2035
Efficiency	72%	44%
Renewables	17%	21%
Biofuels	2%	4%
Nuclear	5%	9%
CCS	3%	22%
Total (Gt CO₂)	2.5	14.8

Source: IEA WEO 2011

A mix that is slow to change

Source: IEA, WEO 2013

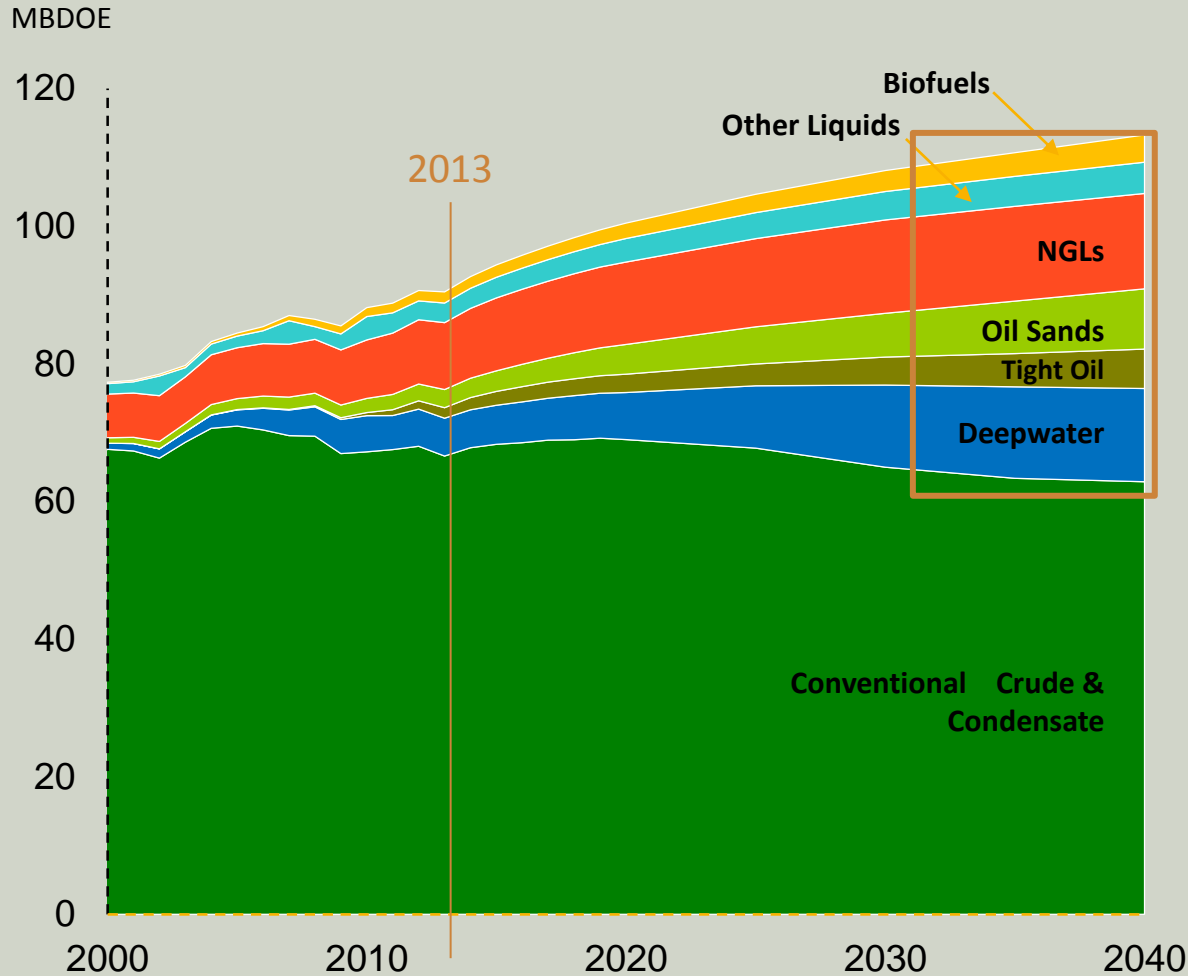
Growth in total primary energy demand



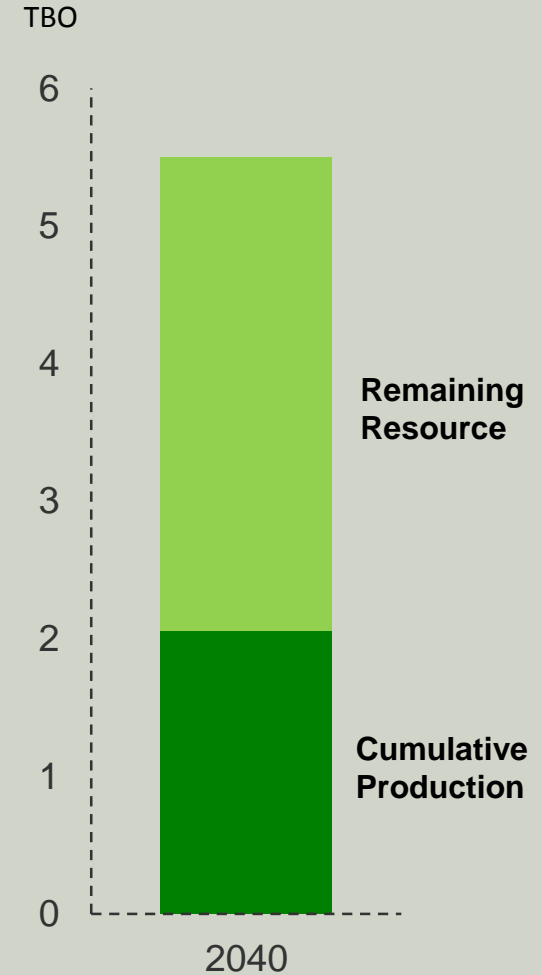
Today's share of fossil fuels in the global mix, at 82%, is the same as it was 25 years ago; the strong rise of renewables only reduces this to around 75% in 2035

Liquids Supply Continues to Diversify

Supply by Type



Resource*

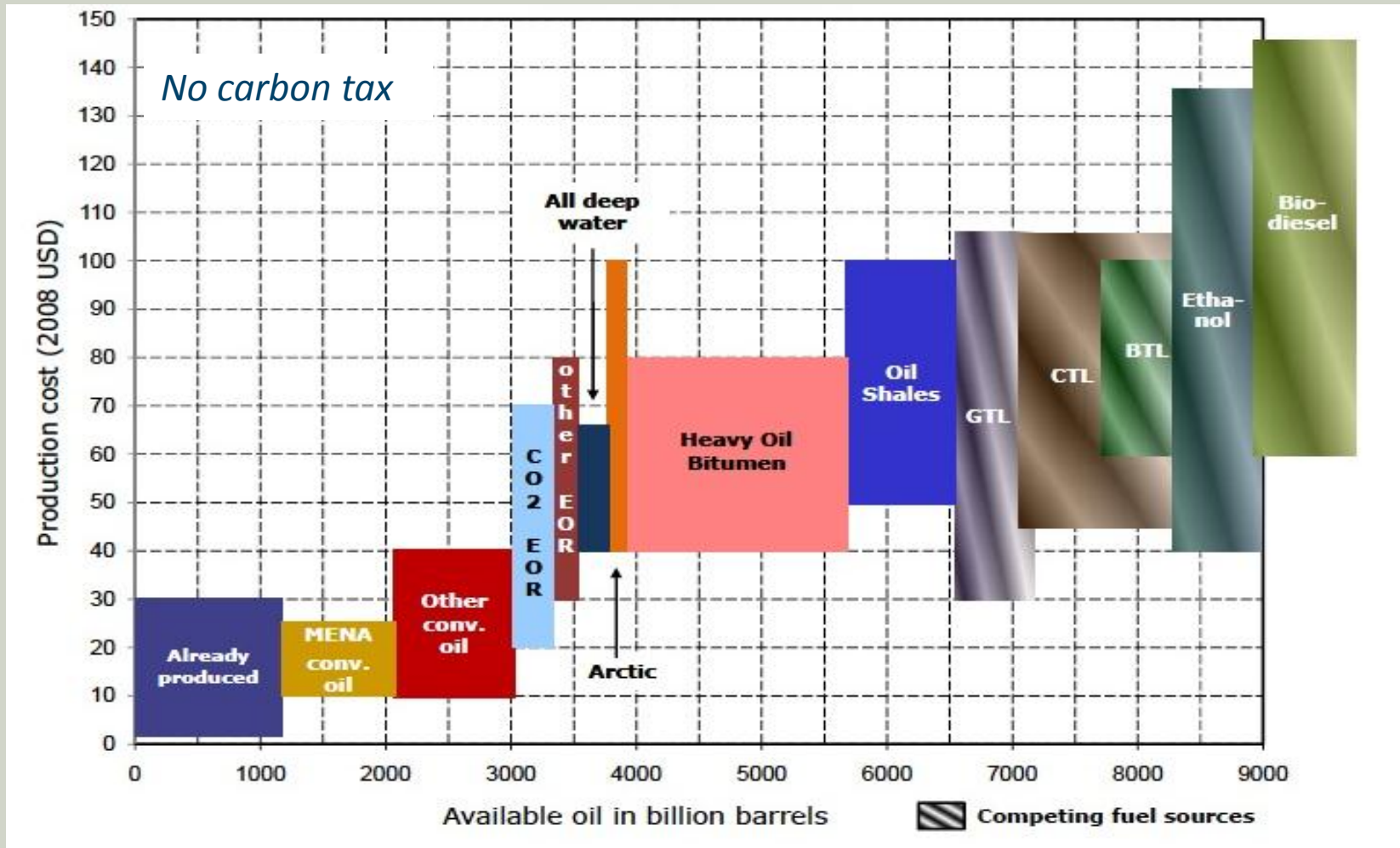


* Source: IEA

ExxonMobil 2013 Outlook for Energy

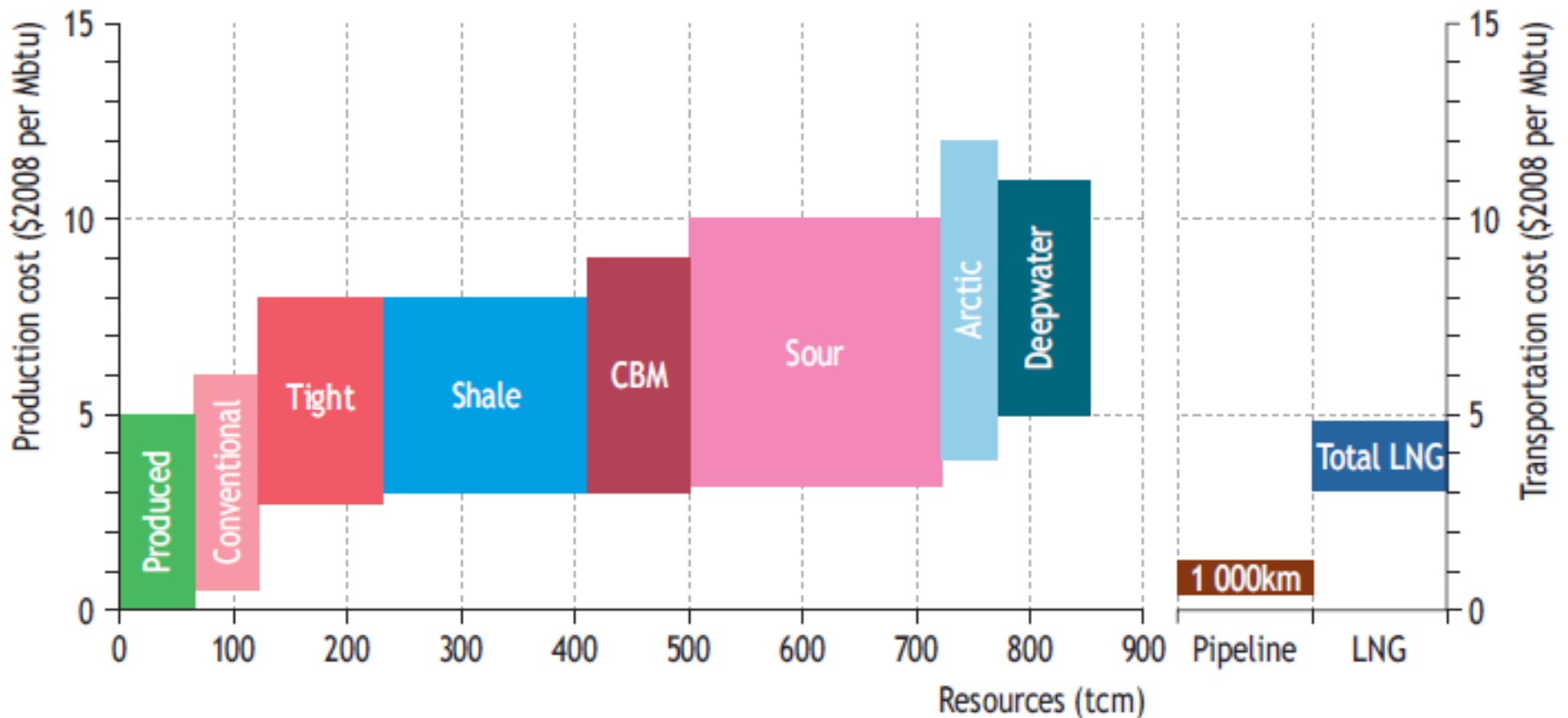
Long-term oil-supply cost curve

Source: IEA 2012



The total recoverable oil-resource base is estimated at 9 trillion barrels (including 2.5 trillion barrel of GTL/CTL) of which we have so far produced 1.1 Tb

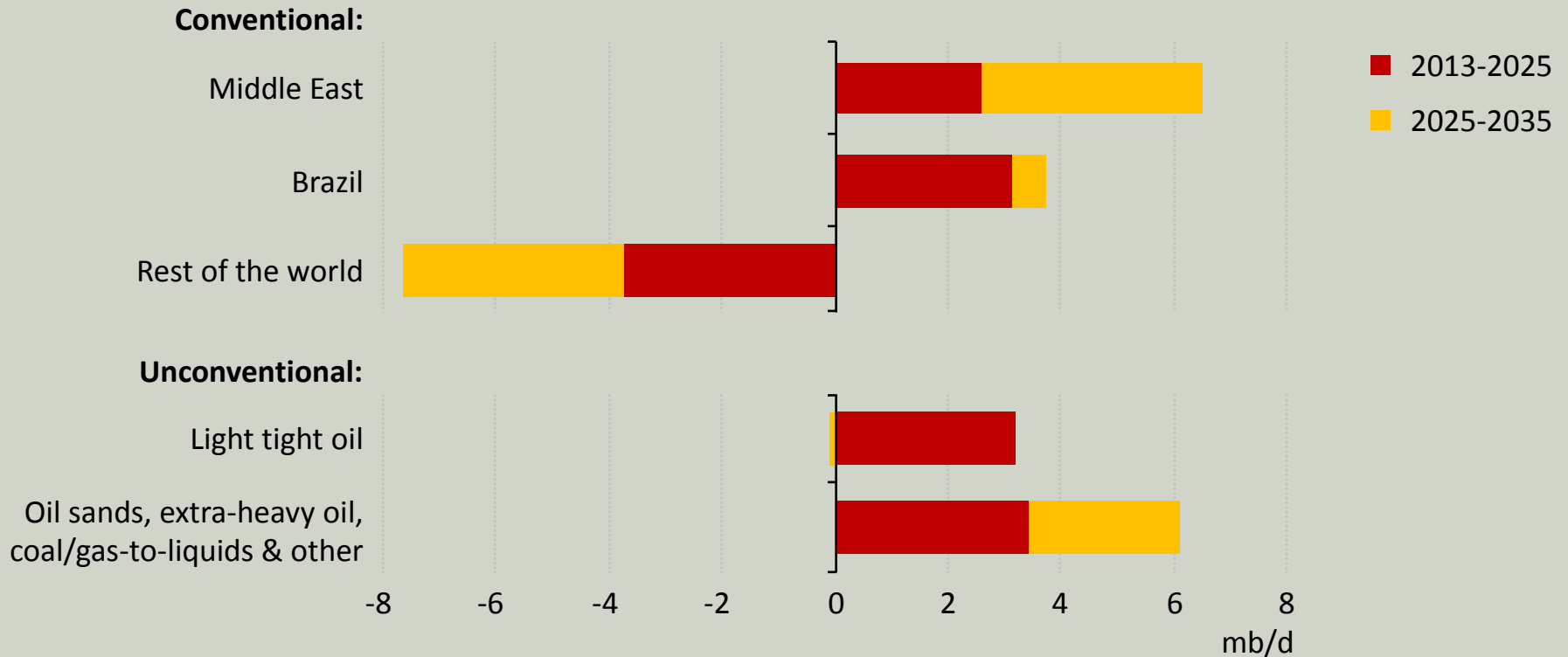
Long-term gas supply cost curve



The total long-term recoverable gas resource base is more than 850 tcm, only 66 tcm of which has already been produced or flared

Two chapters to the oil production story

Contributions to global oil production growth



The United States (light tight oil) & Brazil (deepwater) step up until the mid-2020s, but the Middle East is critical to the longer-term oil outlook

Source: IEA, WEO, 2013

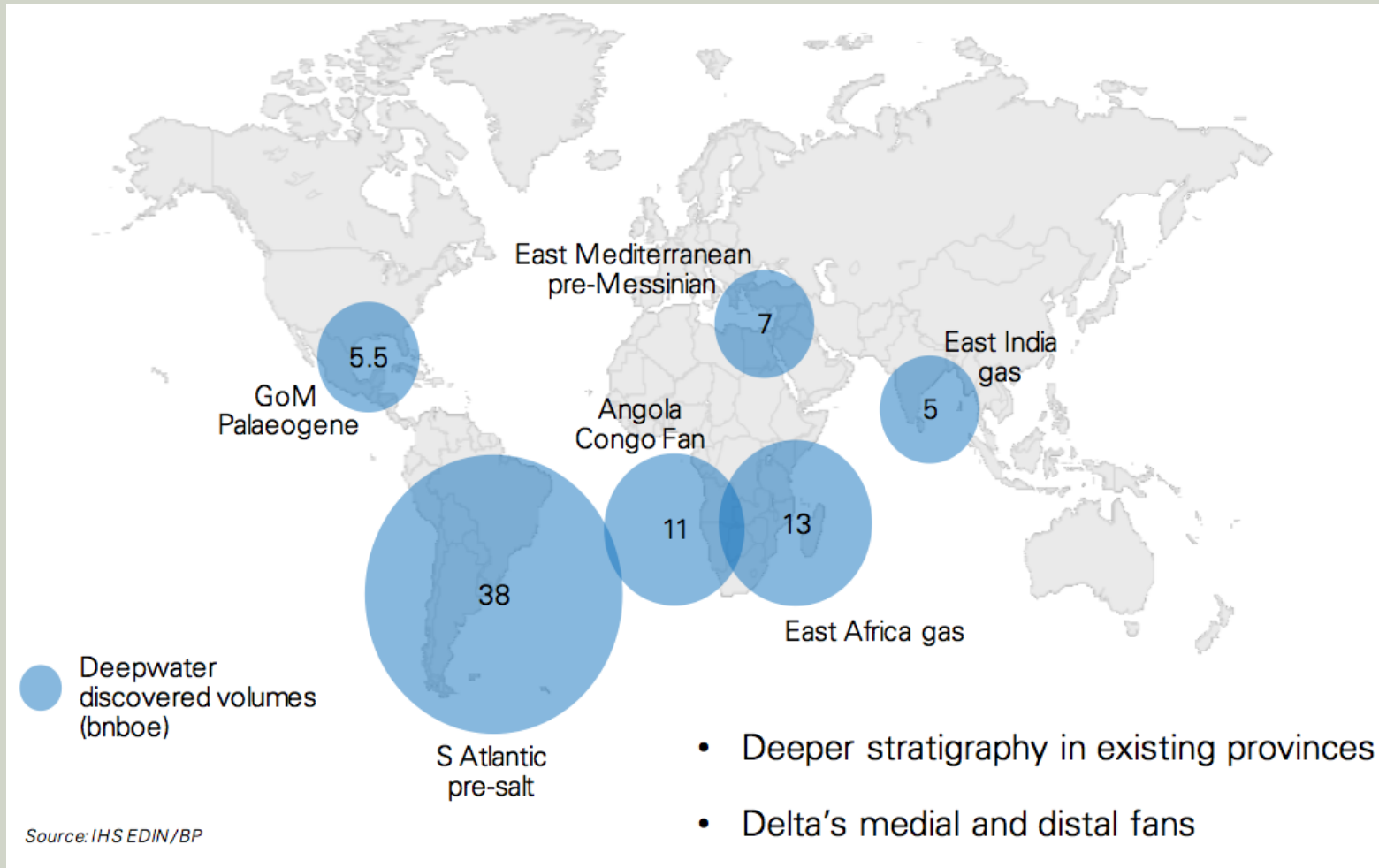
Diverse future trends in E&P

- Deepwater: passive margins and deltas
- Arctic: ice-bound offshore
- Re-exploration of *onshore* basins and *shallow* waters:
 - Unexplored Rock Volume
 - Tight oil in old giants
 - Shale plays
 - EOR/EGR

Needs new technology, images and ideas

Source: BP, 2013

New plays of the past decade –all deepwater

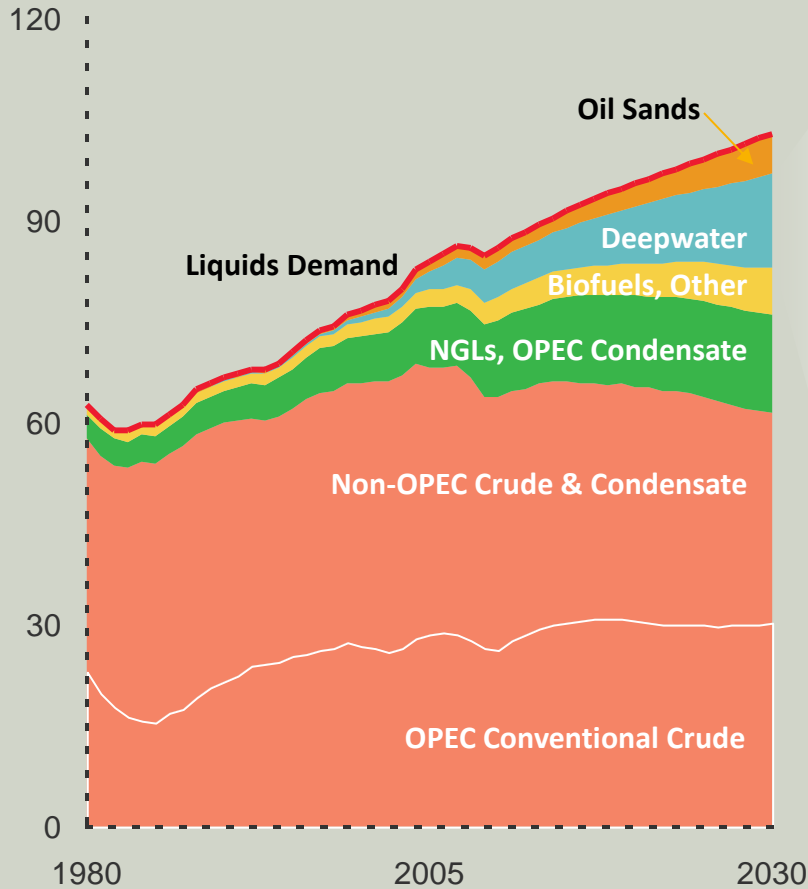


Deepwater Supply Expands Globally

Sources: IEA, Exxon Mobil, 2010

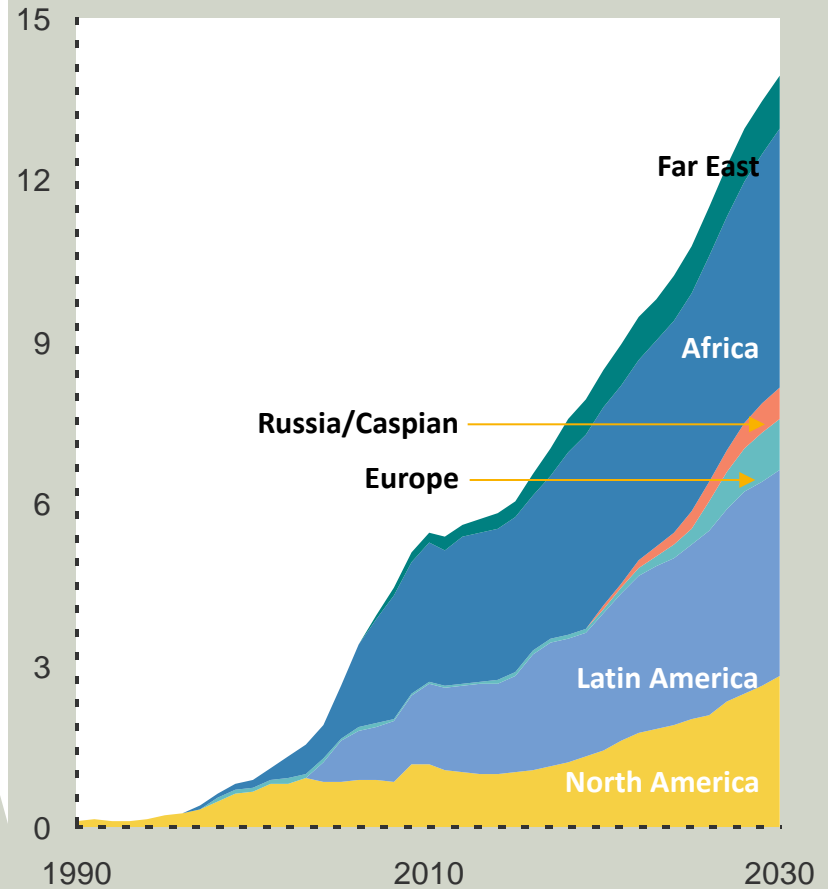
Global

MBDOE



By Region

MBDOE



Risk management of new technologies



Is H&S management & regulation up to speed with space age oil and gas technology?

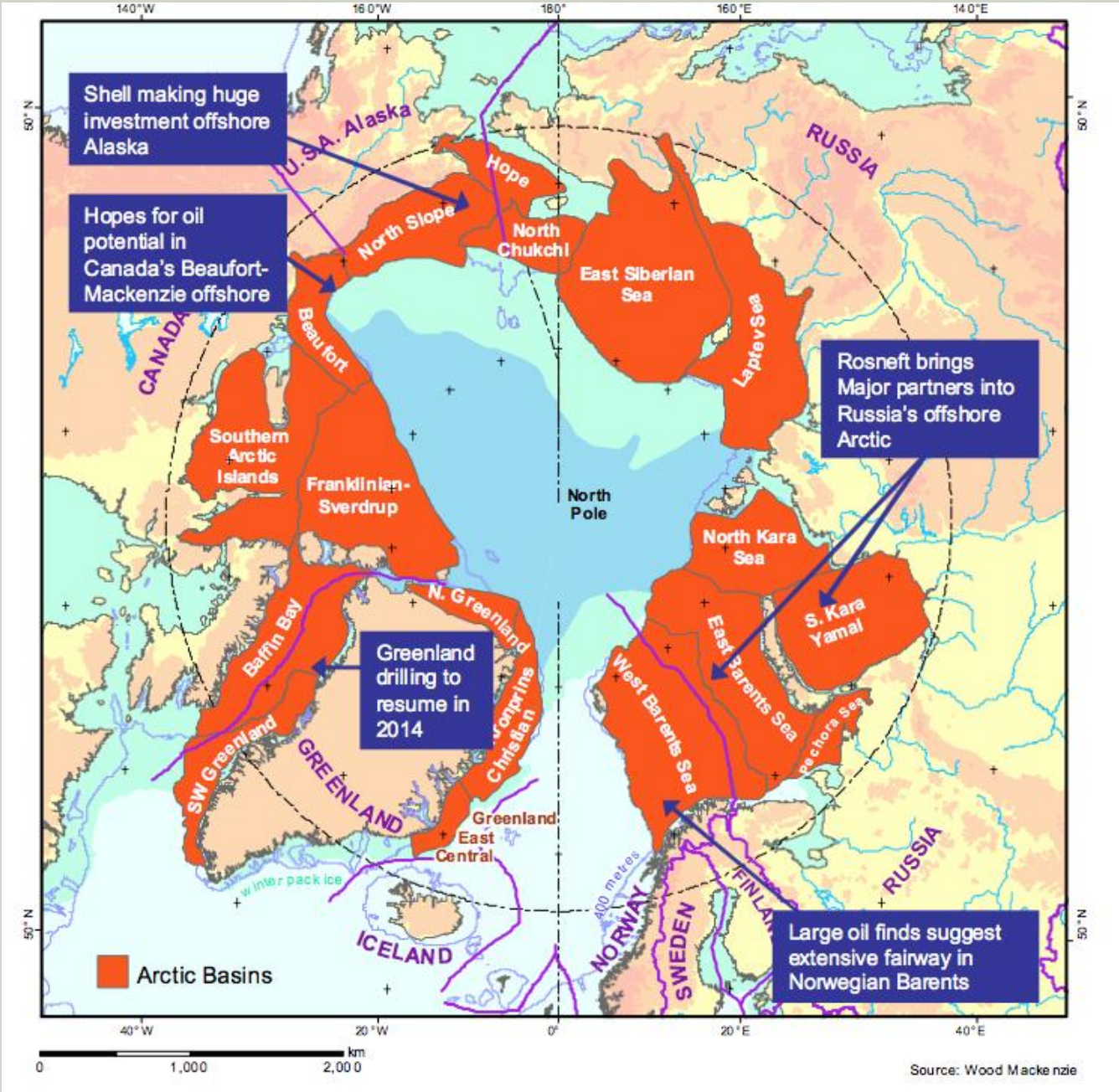
The Arctic

The last great, almost unexplored, frontier area on the planet

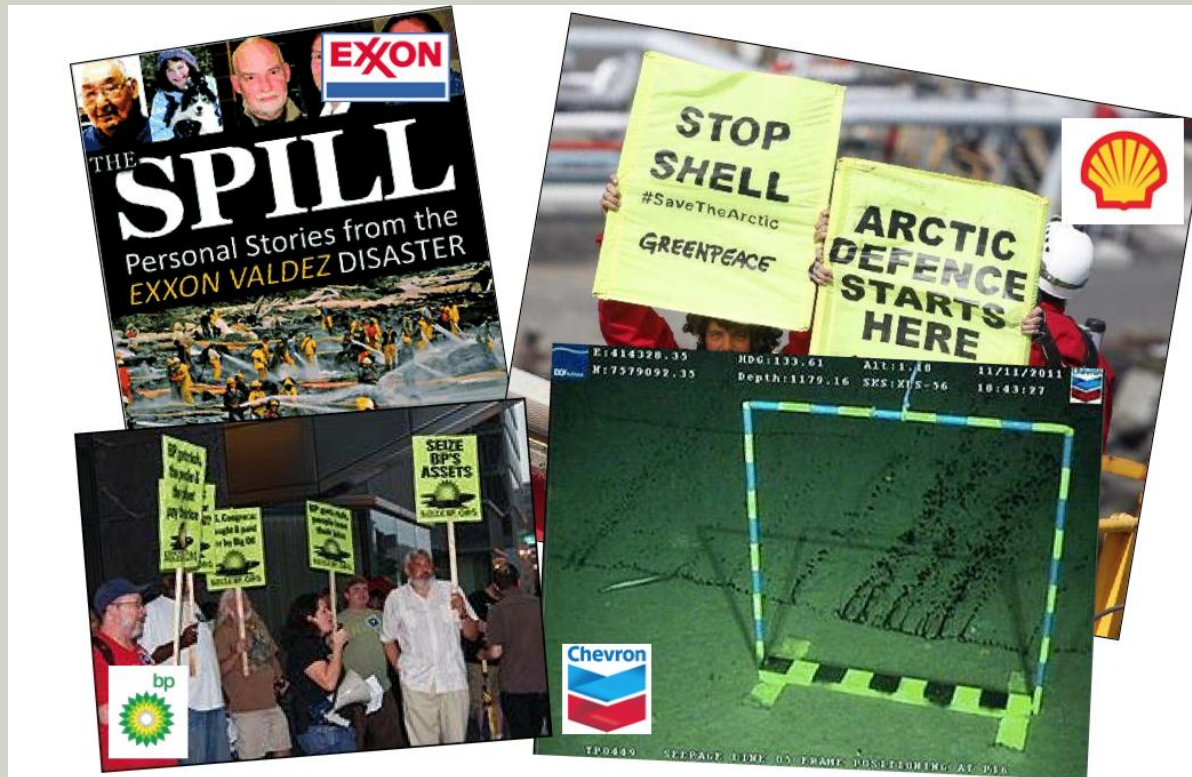
CARA/USGS 2009 appraisal: 530 Billion bbl
of oil equivalent undiscovered resources
**(North of the Arctic Circle; no hydrates, no
bitumen, no oil shales)**

*> 5% world oil reserves; > 20%
known gas reserves in the Arctic;
25% undiscovered oil & gas*

Offshore arctic basins and exploration hotspots



And the public response to arctic exploration?



Source: BP, 2013

Yet many arctic coastal states and the communities want investment and development

The Arctic: robust risk management essential

- Potential rewards comes with huge *technical* (climate, remoteness) and *commercial* challenges (costs, reputation)
- Operations under the *highest-possible standards* to protect the vulnerable environment
- *Remoteness* means mobilisation of logistics and services across long distances
- Explorers need to contract two rigs to ensure *back up for relief wells* in an emergency

Investment in science and research (governments, companies) is essential to close knowledge gaps, reduce uncertainties and manage risks (ref. Lloyd's, 2012)

Arctic drilling: industrial challenge

For Arctic drilling to be a success, collaboration across the oil industry is key

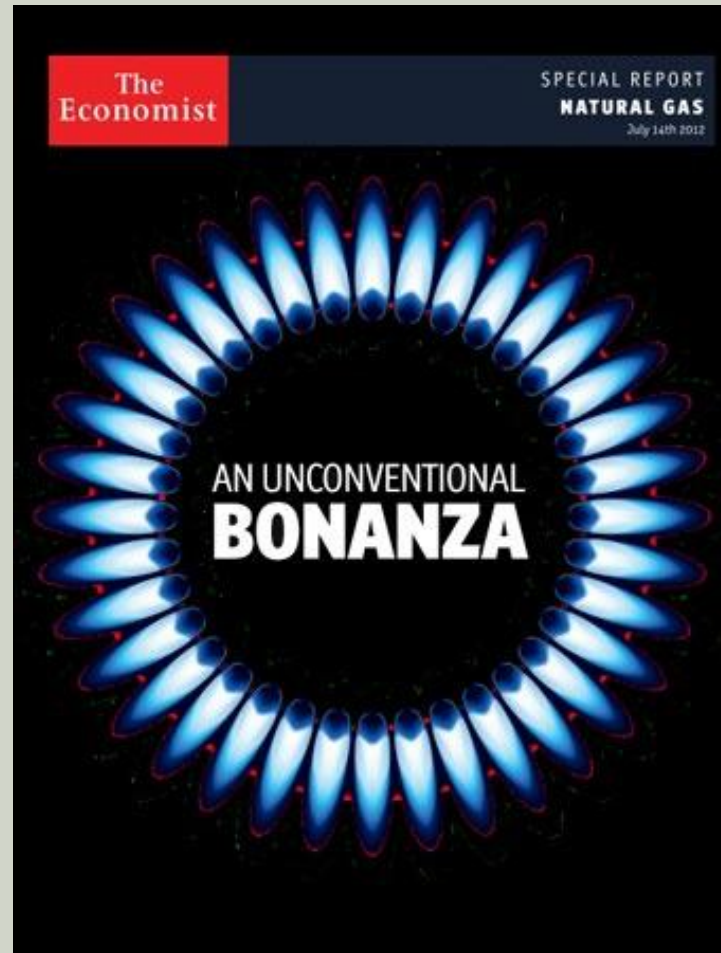
"What we're facing is an industrial challenge, it's not a company challenge. If one of us fails, we all fail"

"We don't envisage production from several of these areas before 2030 at the earliest. More likely 2040, probably not until 2050"

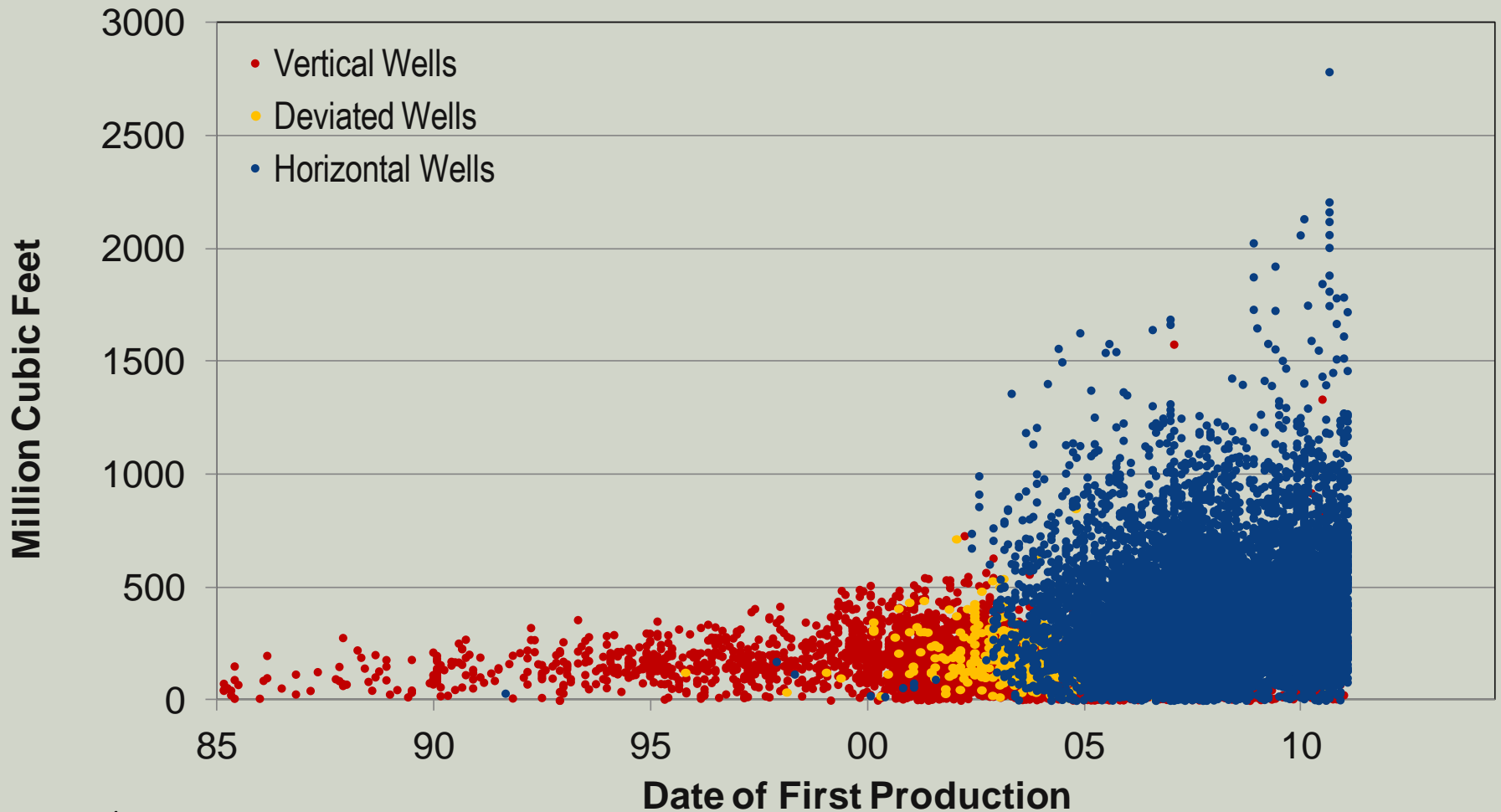
*"There's almost no prospectivity on this planet that can support drilling exploration levels for **half a billion dollars each.**"*

Tim Dodson, Exploration Statoil

The US Shale Revolution



The Barnett Story – Technology Makes the Difference

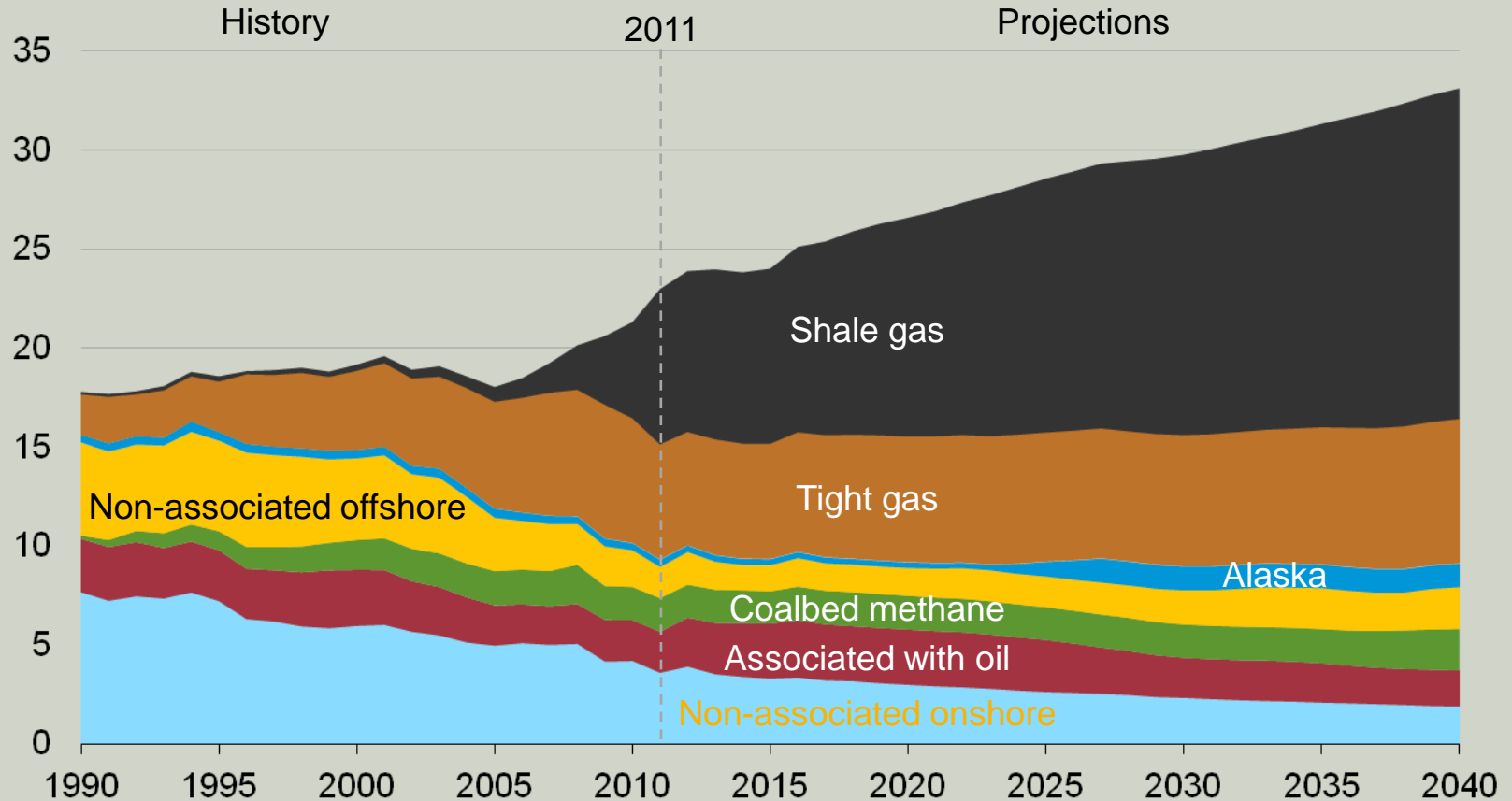


*IHS Database

Source: Schlumberger, 2013

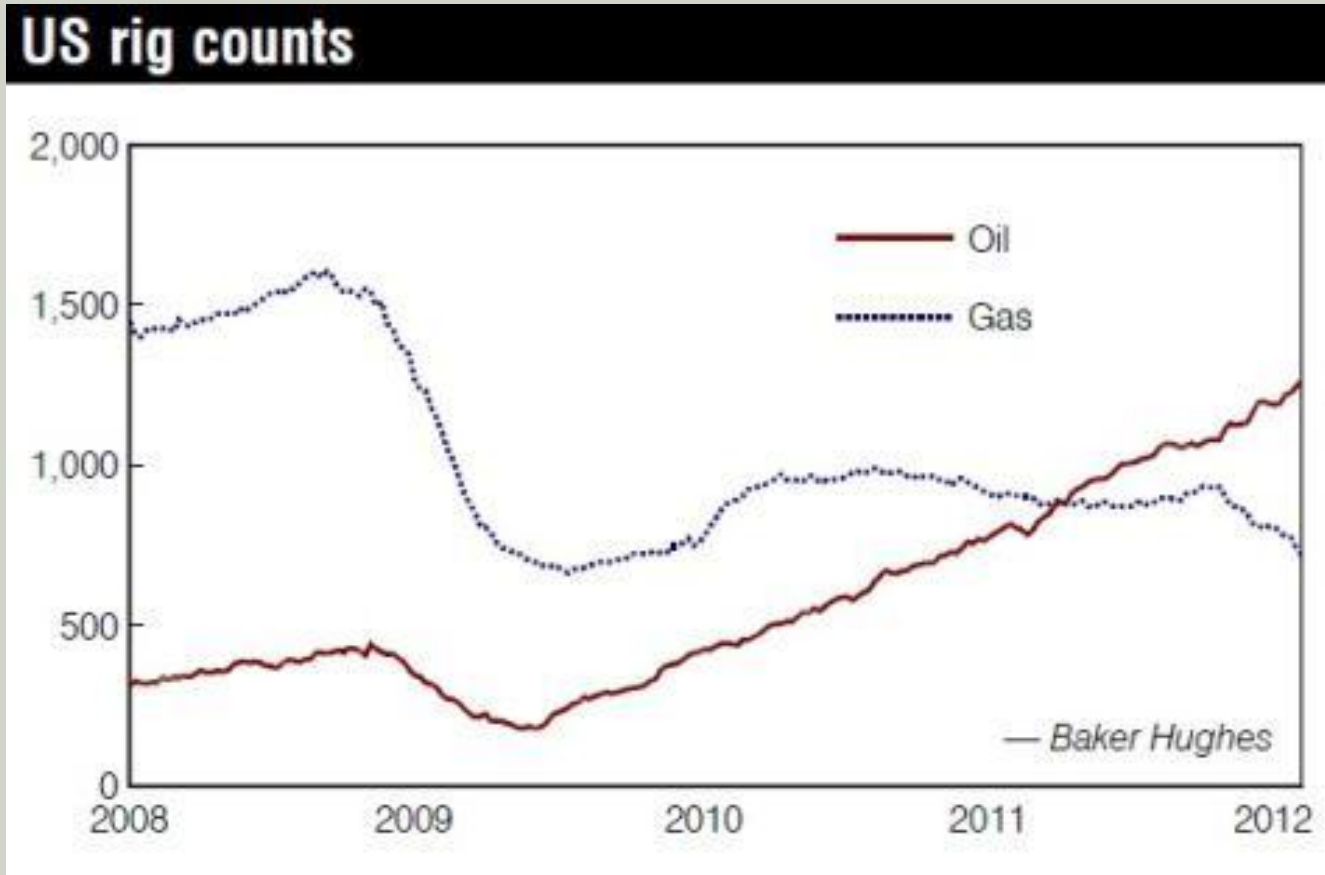
Shale gas production leads growth in production through 2040

U.S. dry natural gas production
trillion cubic feet



Source: EIA, Annual Energy Outlook 2013 Early Release

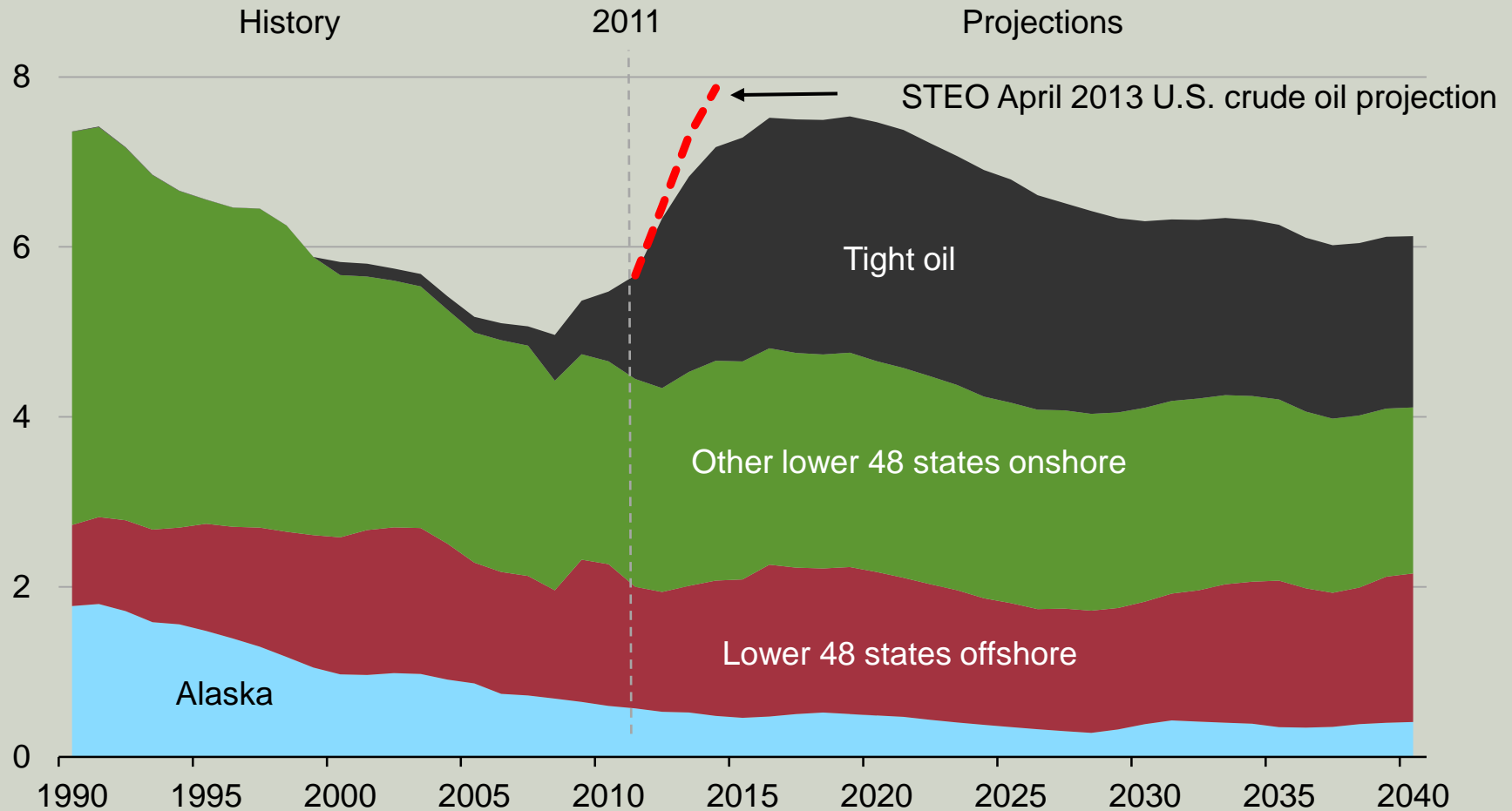
US oil production and rig counts



Source: Argus

U.S. tight oil production leads a growth in domestic production of 2.6 mb/d between 2008 and 2019

U.S. crude oil production
million barrels per day



Source: EIA, Annual Energy Outlook 2013 Early Release and Short-Term Energy Outlook, April 2013

Gas flares from Bakken fracking are visible from space

Image: NASA Earth Observatory image/Suomi NPP



Efficiency Driven Operations – *Technology development focused on reducing impact*

Still require

- High number of wells
- Surface disturbance
- Service intensity / well
- Heavy truck traffic
- Extensive Resources
- Produced water mgmt
- Air emission reporting
- Noise control

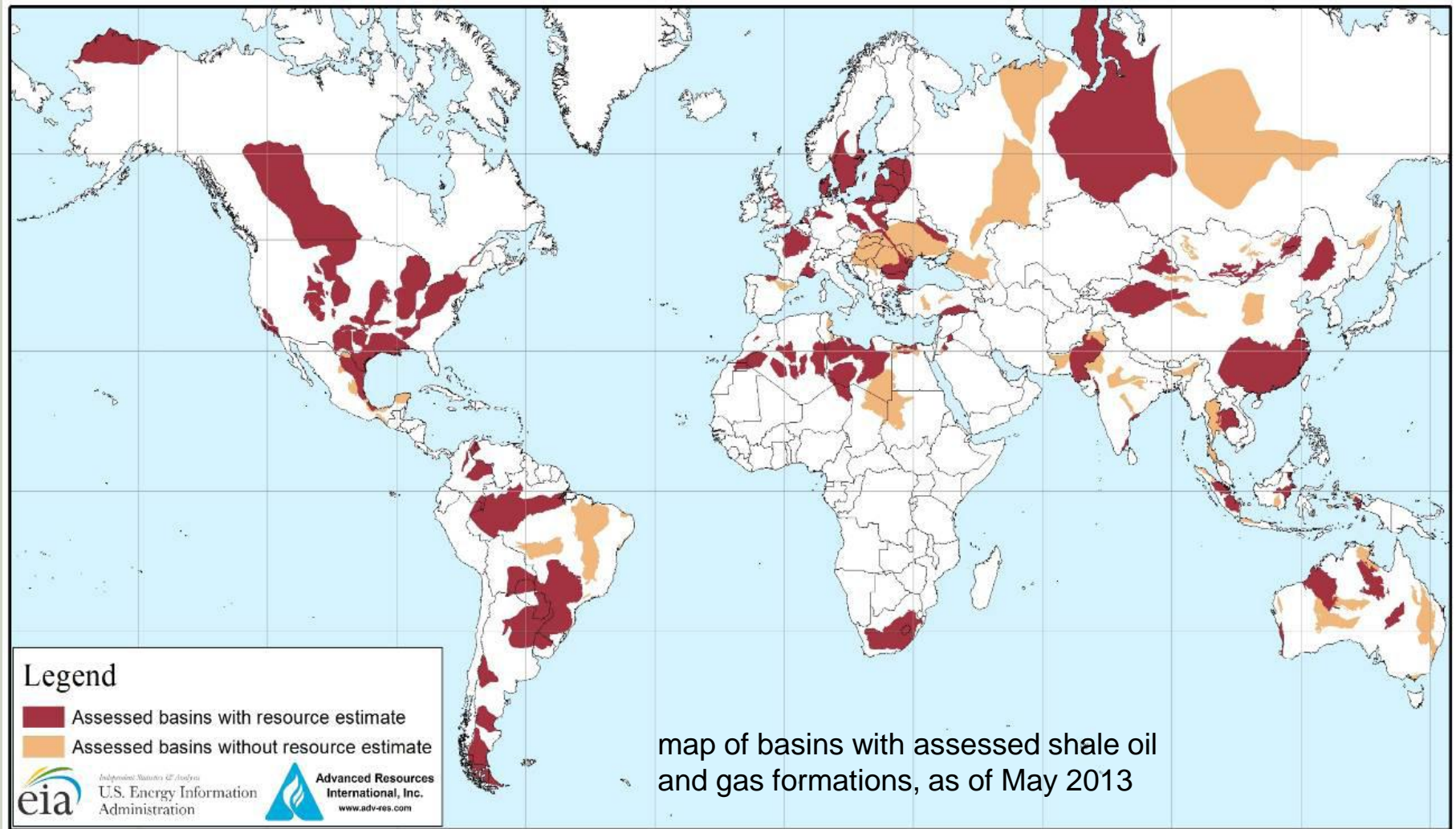
Need improvement for

- Complex reservoirs
- Production economics



Source: Schlumberger, 2013

Shale oil and gas have the potential to dramatically alter world energy markets



Source: United States: EIA and USGS; Other basins: ARI

Top ten countries with technically recoverable shale resources

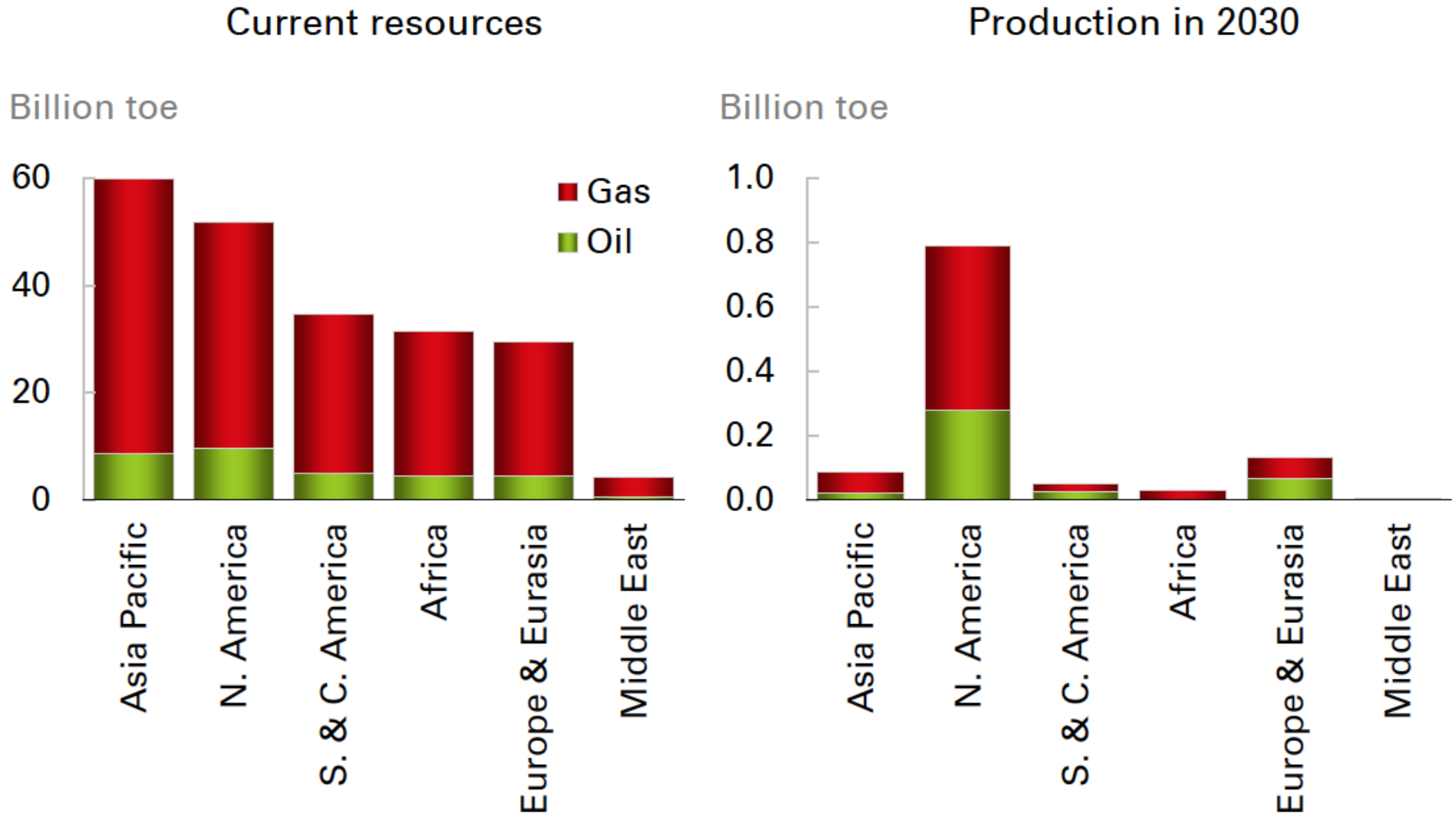
Shale oil			Shale gas		
Rank	Country	Billion barrels	Rank	Country	Trillion cubic feet
1	Russia	75	1	China	1,115
2	United States	58	2	Argentina	802
3	China	32	3	Algeria	707
4	Argentina	27	4	United States	665
5	Libya	26	5	Canada	573
6	Venezuela	13	6	Mexico	545
7	Mexico	13	7	Australia	437
8	Pakistan	9	8	South Africa	390
9	Canada	9	9	Russia	285
10	Indonesia	8	10	Brazil	245
	World total	345		World total	7,299

Source: United States: EIA and USGS; Other basins: ARI.

Note: ARI estimates U.S. shale oil resources at 48 billion barrels and U.S. shale gas resources at 1,161 trillion cubic feet.

Shale gas and tight oil resources and production

Source: BP energy Outlook 2030, 2012



Resources data © OECD/IEA 2012

US shale gas and tight oil production success

US dominance in 2030 because of the importance of 'above ground' factors:

- competitive environment
- rig availability
- robust service sector
- land access facilitated by private ownership
- deep financial markets
- favourable fiscal and regulatory terms

A competitive industry spurs continued technological innovation

Source: BP energy Outlook 2030, 2012

The energy context - *summary*

- In the next decades, *fossil fuels* will continue to dominate world's energy demand
- *Advances in technology* will be key to expanding fuel supplies
- Demand growth will be met by newer sources with the biggest gains coming from *Middle East and unconventional*

An Energy Coup for Japan: 'Flammable Ice'

Japan has invested hundreds of millions of dollars since the early 2000s to explore offshore methane hydrate reserves in both the Pacific and the Sea of Japan.



Source: NY Times , March 12, 2013

Energy Realities

*“If we are to deliver sustainable energy systems, the focus must shift from **the supply mix to demand efficiency**. We need more demand-side investments, innovation, incentives, and stronger technical standards to reduce energy intensity.”* Christoph Frei , WEC, 2013

The need for urgent focus in technology development and demonstration in electricity storage and CCS, and the need to manage our carbon budget and minimise our water footprint.

Thank you

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