

Institute for Energy and Finance



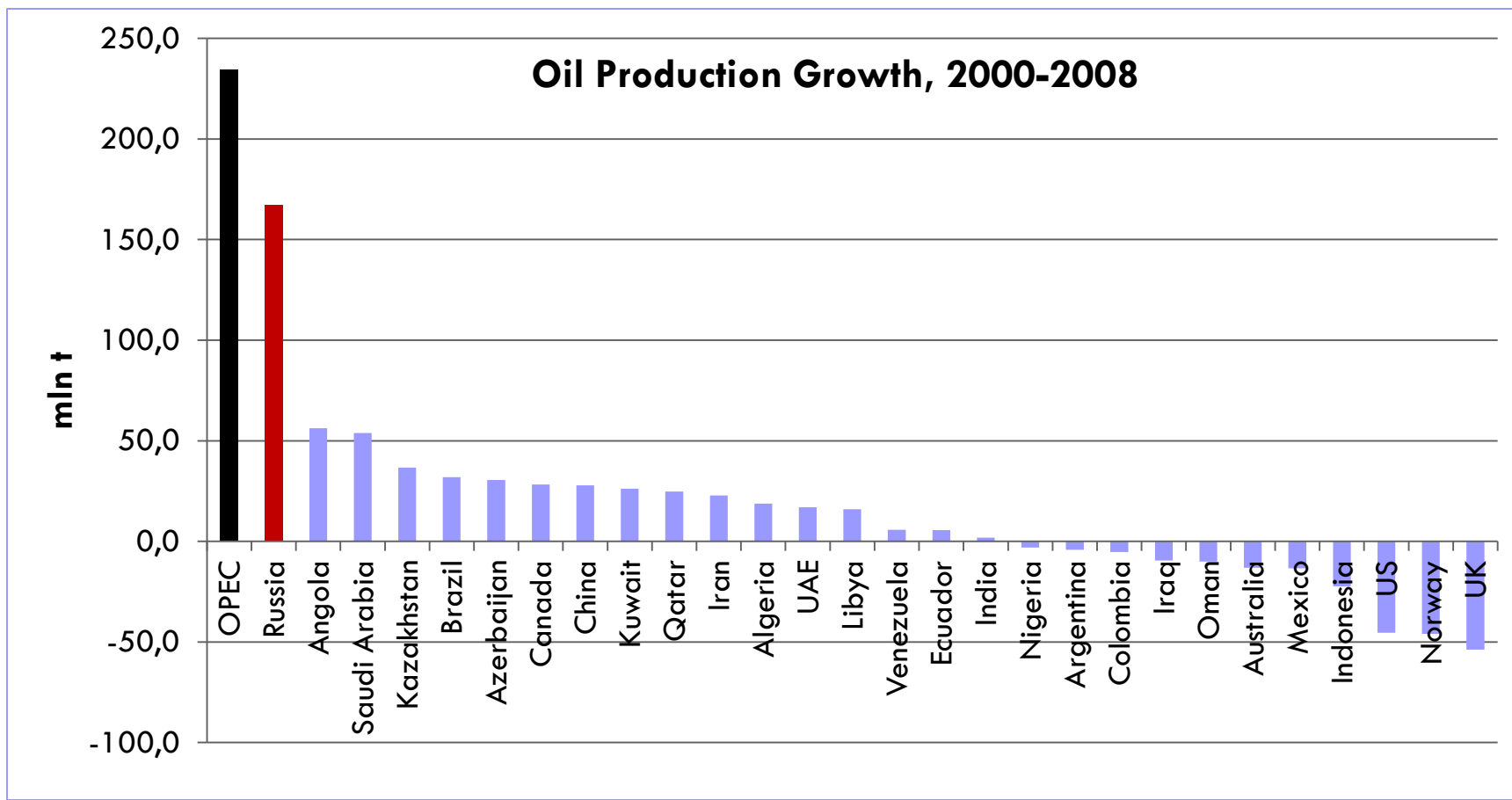
Long-term Scenarios and Key Challenges on World Energy Market

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Institute for Energy and Finance**

**Moscow
28th October 2013**

World Energy Landscape is changing dramatically

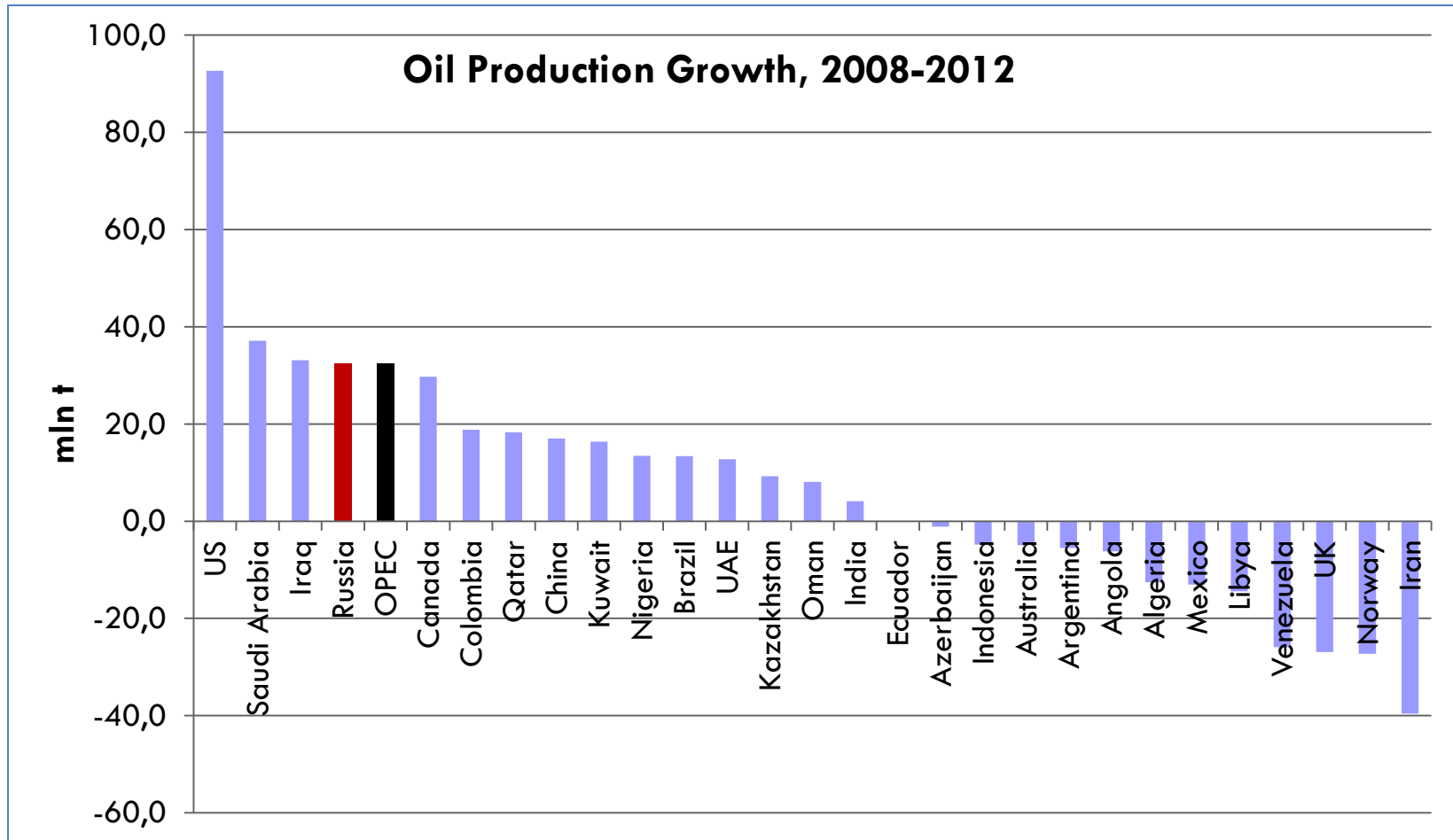
Before 2008...



Source: BP Statistical Overview

World Energy Landscape is changing dramatically

After 2008...

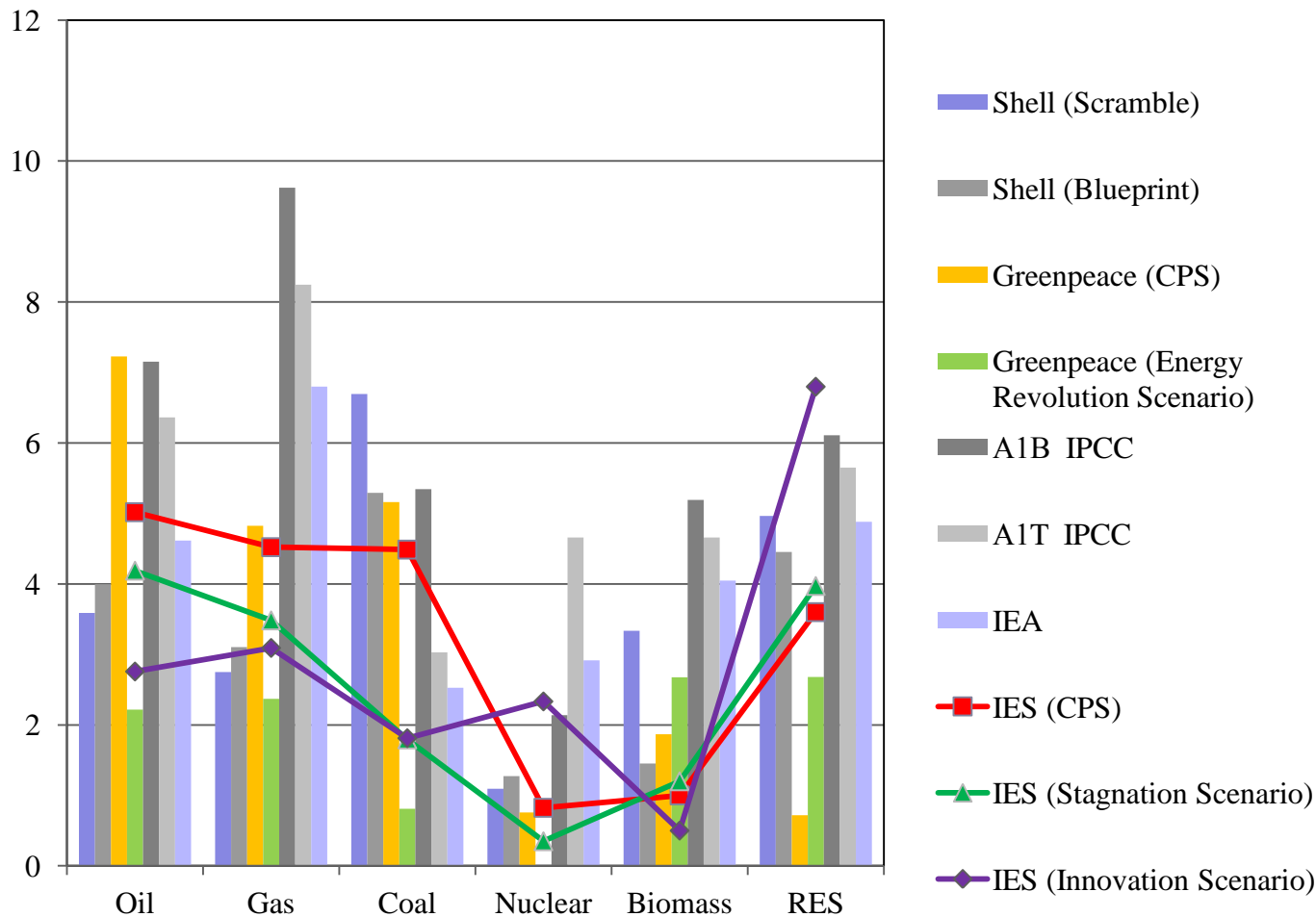


Source: BP Statistical Overview

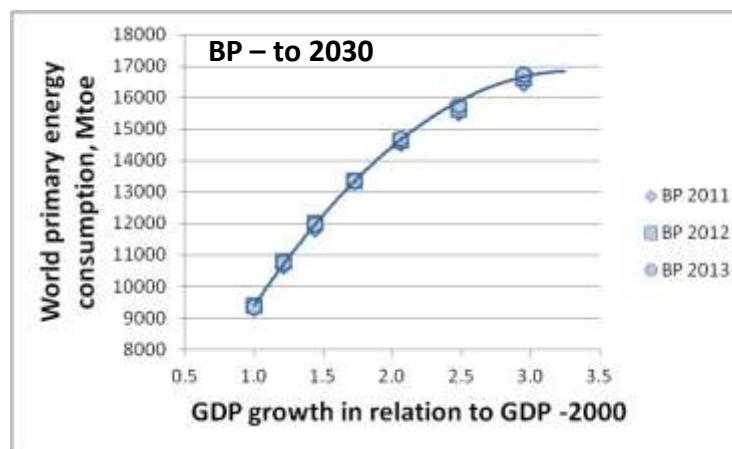
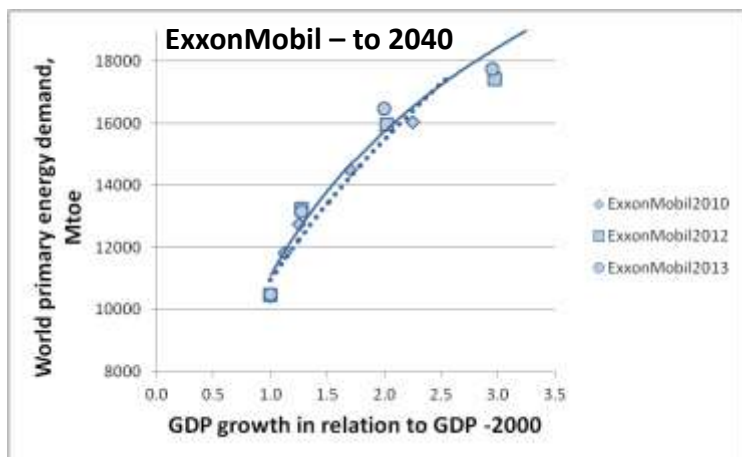
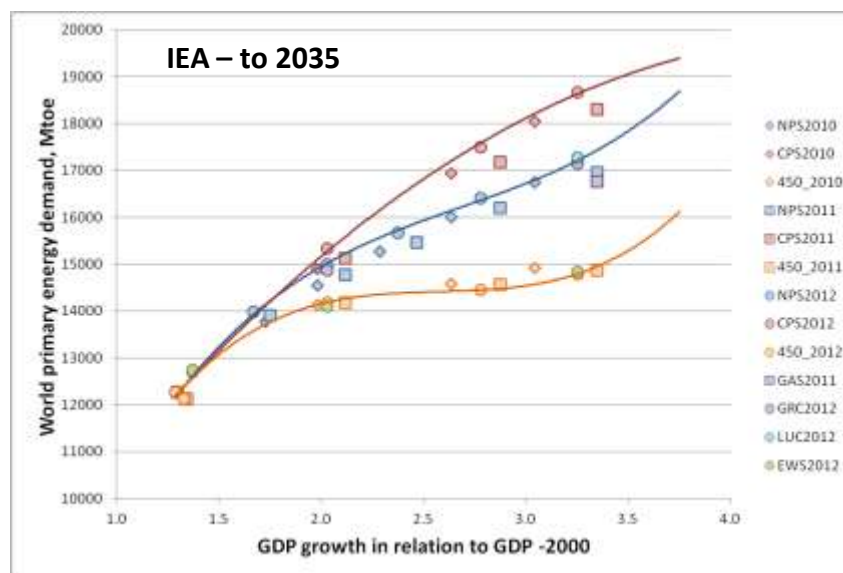
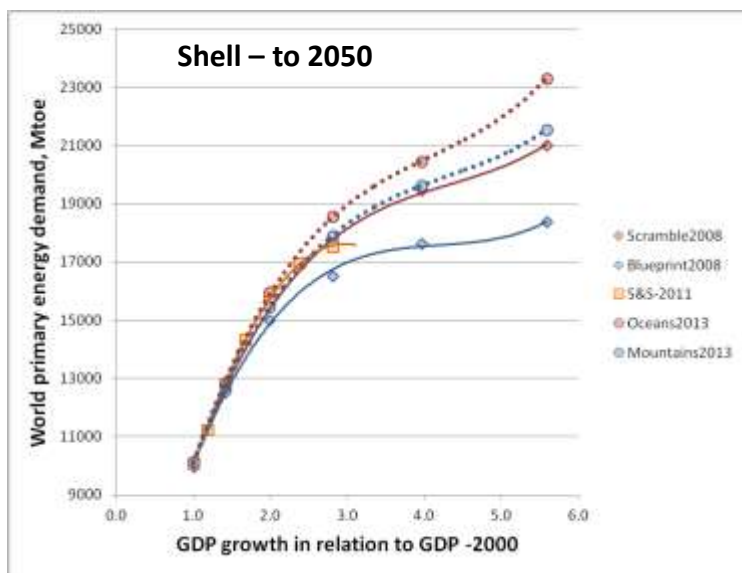
From the Forecasts to Scenario's Fields

- **Forecasts are not the possible future but our visions of the future from today's assumptions**
- **We need to analyze these assumptions** to reveal possible challenges, restrictions, opportunities and risks
- **Scenario's fields analysis** is the way to assess the variety and uncertainties
- **Permanent monitoring** is the way to deal with the variety of scenarios paths caused by scenarios fields

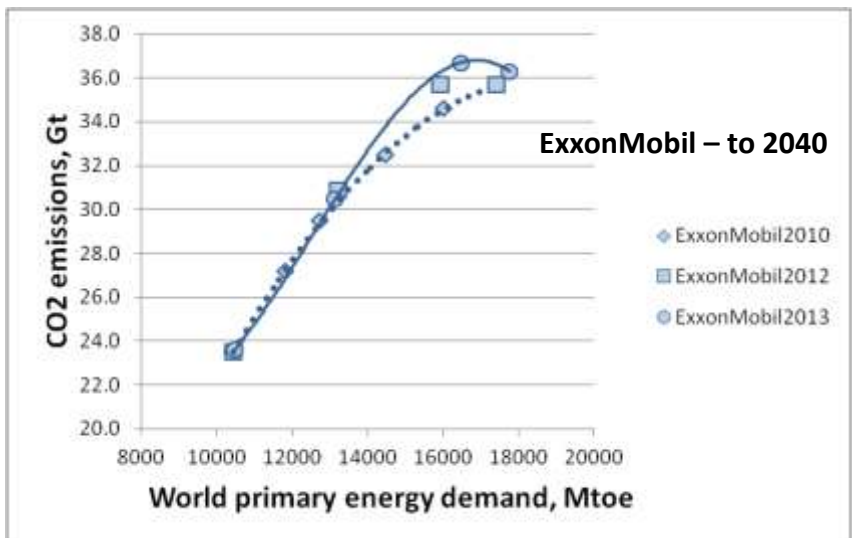
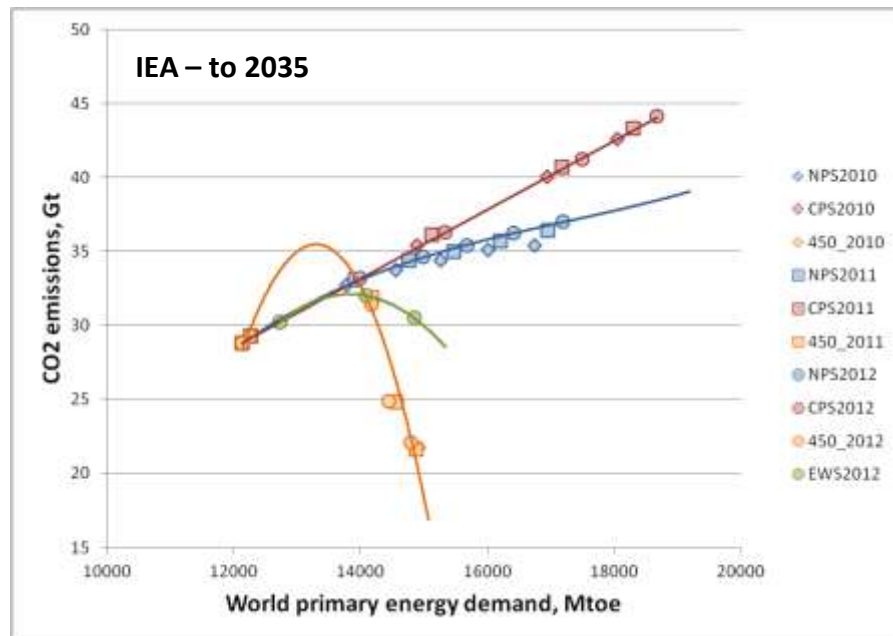
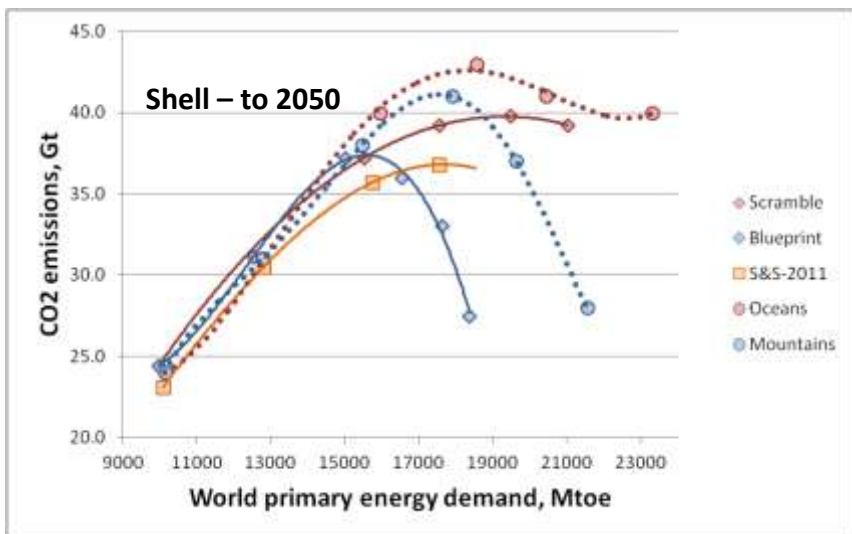
Global Energy Scenario's field: high level of uncertainty



Primary Energy Consumption

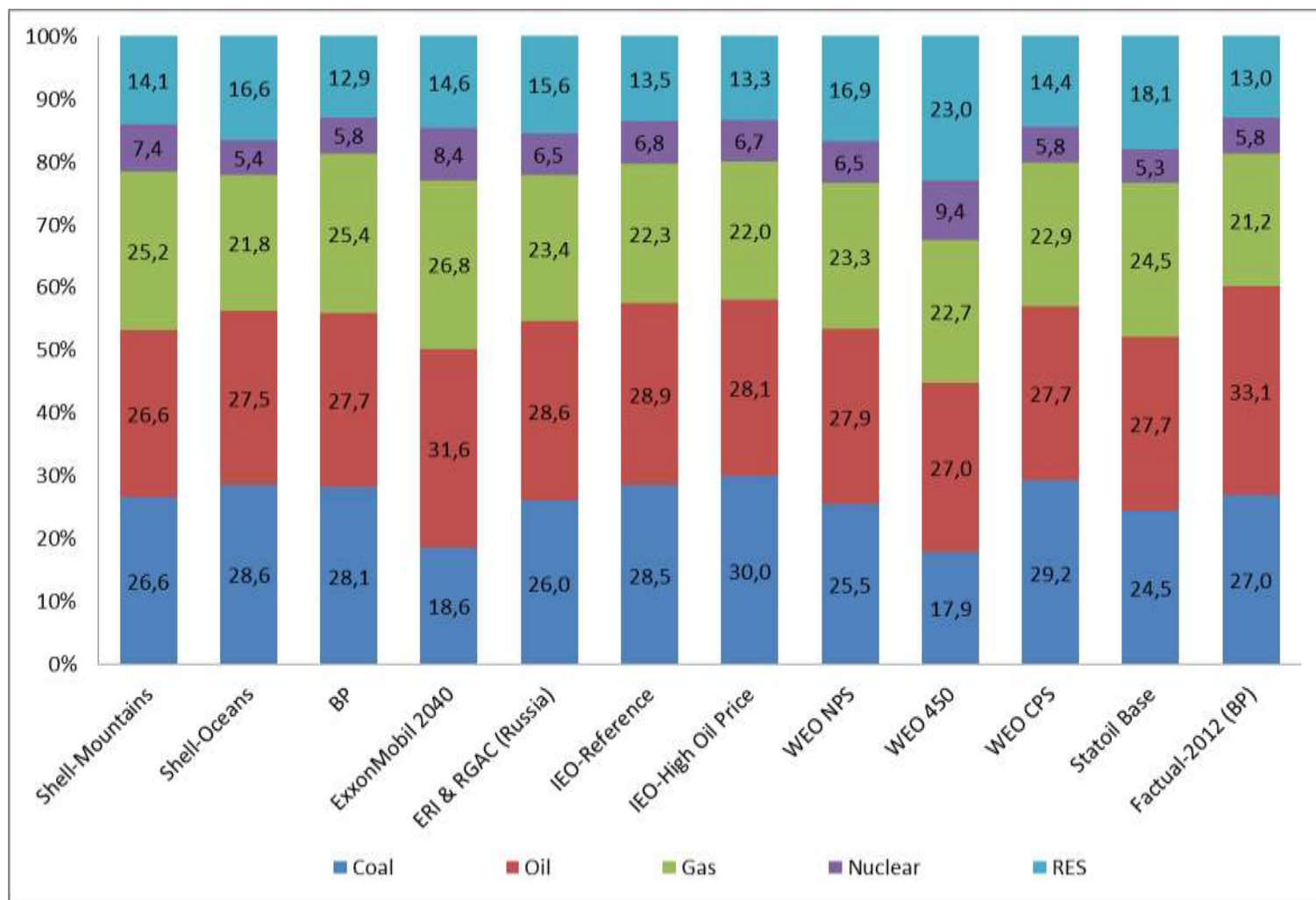


CO2 Emissions



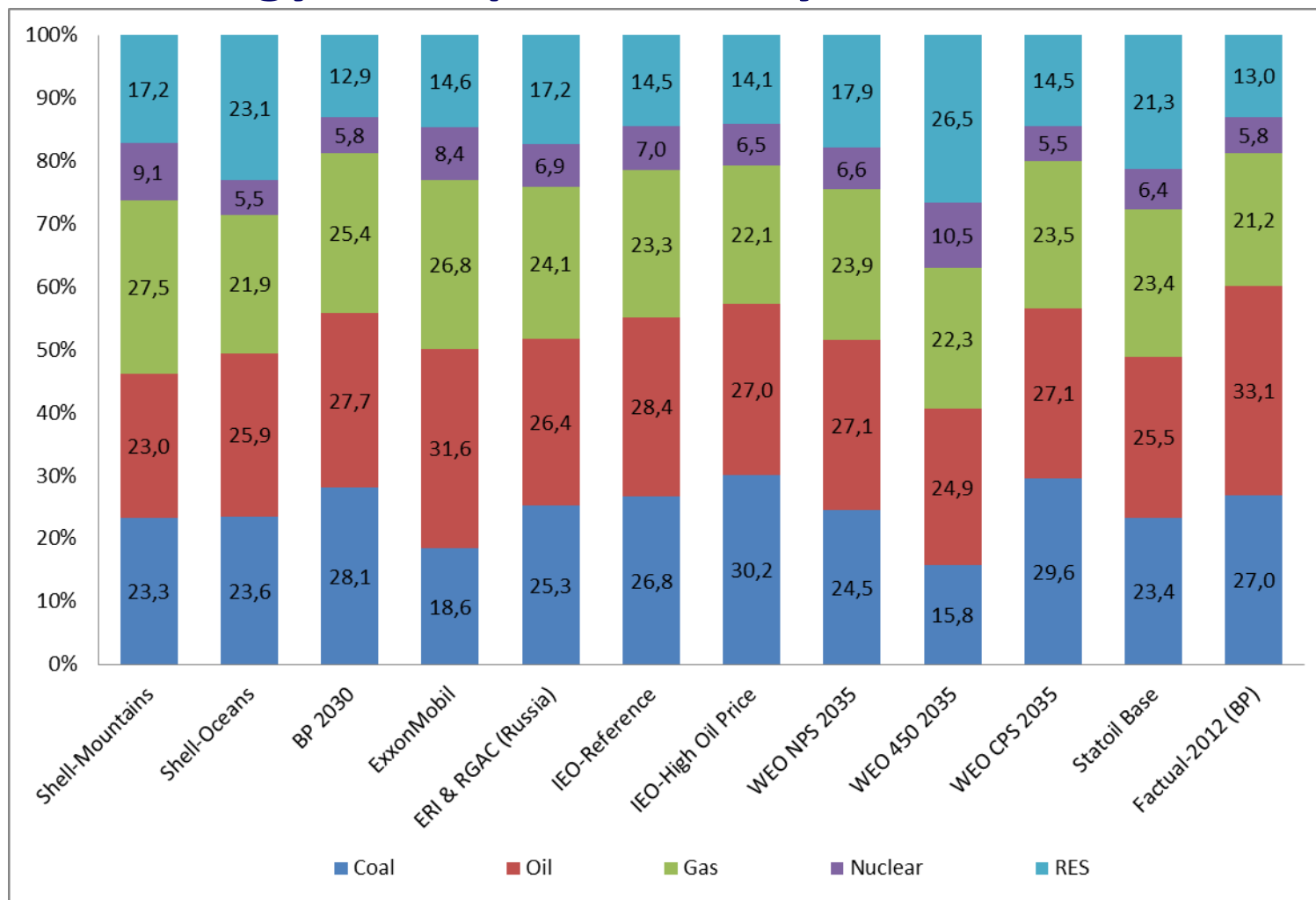
CO₂ emissions could be good indicator of bifurcation points

World Energy Mix up to 2030 by Different Scenarios



NOTE: projections for 2030 from latest available scenarios,
in case projection year differs from 2030 it is reflected in the scenario name

World Energy Mix up to 2040 by Different Scenarios



NOTE: projections for 2040 from latest available scenarios, in case projection year differs from 2040 it is reflected in the scenario name

Primary Energy Consumption Growth Rates by Region (SHELL, 2030-2040)

MOUNTAINS			
	2010-2020	2020-2030	2030-2040
USA & Canada	0,19%	-0,03%	0,49%
EU	-0,33%	-0,08%	0,28%
OECD Asia & Oceania	0,31%	-0,34%	-0,11%
China	4,14%	2,44%	1,01%
India	5,43%	3,65%	0,74%

OCEANS			
	2010-2020	2020-2030	2030-2040
USA & Canada	-0,04%	-0,44%	-0,17%
EU	-0,61%	-0,14%	-0,10%
OECD Asia & Oceania	0,08%	-0,59%	-0,39%
China	4,64%	2,21%	-0,38%
India	5,96%	4,46%	3,30%

MOUNTAINS: Some revival of USA and EU towards 2040, China dominance

OCEANS: Stagnation of developed world and China towards 2040, India growth

Primary Energy Consumption Growth Rates by Region (IEA, 2030-2035)

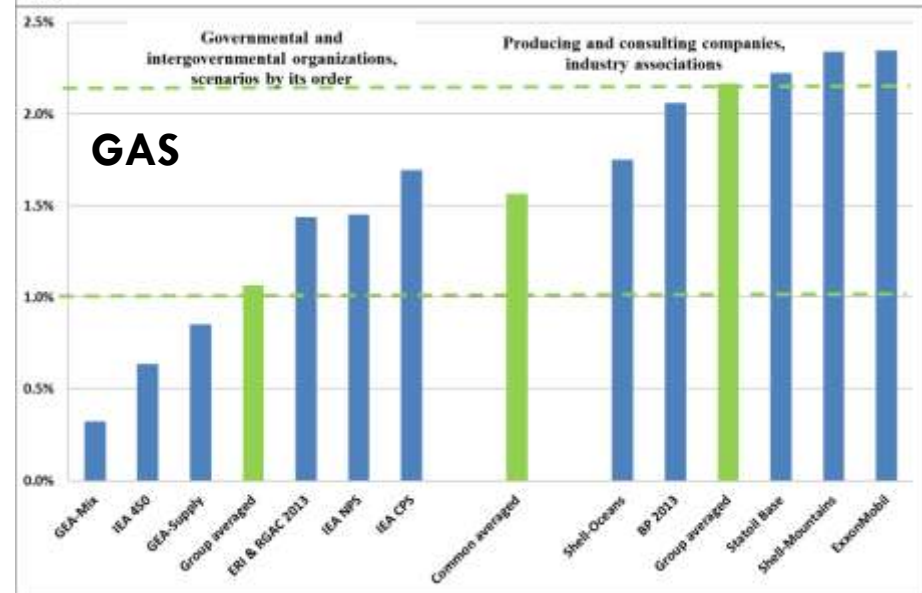
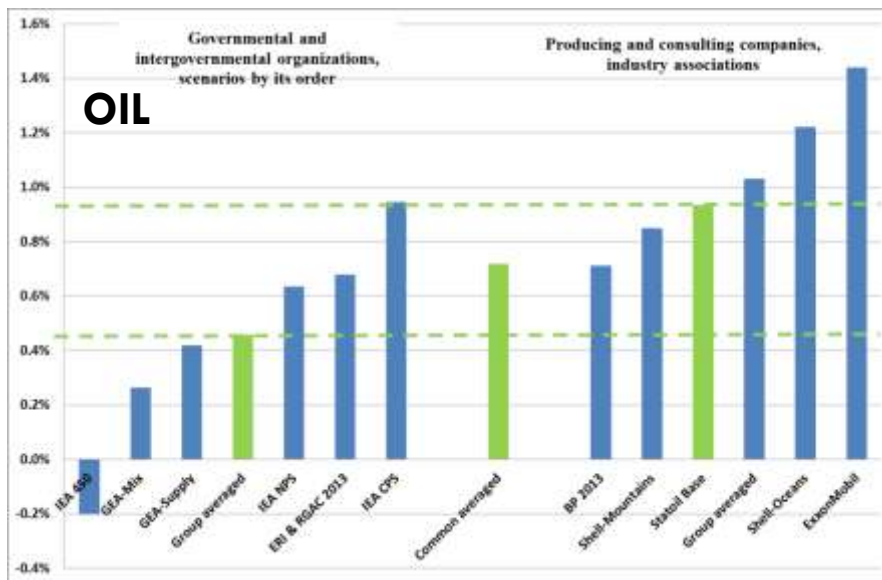
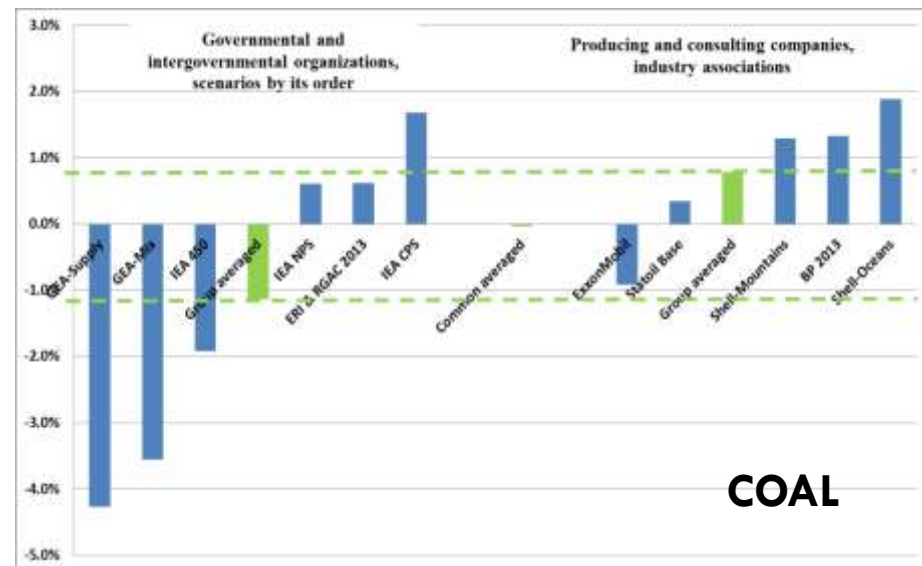
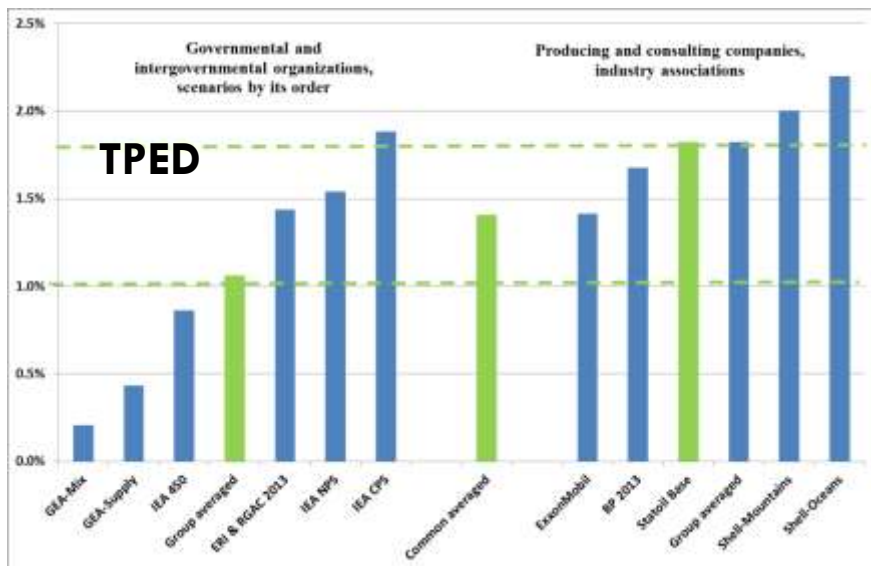
NPS			
	2010-2020	2020-2030	2030-2035
USA	0,21%	-0,24%	-0,17%
EU	-0,21%	-0,07%	0,04%
OECD Asia & Oceania	0,21%	0,15%	0,09%
China	3,35%	1,09%	0,69%
India	3,49%	2,93%	3,12%

CPS			
	2010-2020	2020-2030	2030-2035
USA	0,34%	0,16%	0,28%
EU	0,02%	0,23%	0,22%
OECD Asia & Oceania	0,43%	0,37%	0,29%
China	3,83%	1,65%	1,23%
India	3,90%	3,34%	3,61%

NPS: Stagnation of OECD markets, India dominance

CPS: Stabilization of OECD markets, China and India dominance

World Energy Rates of Growth (by energy sources), 2012-2030



Key Long-Term Challenges

- Long term forecast reveals mostly three possible ways of energy sector development: reasonably low primary energy consumption (~ 17 bln toe in 2035); high consumption (~ 18,5 bln toe in 2035 or ~ 19,5-20,5 bln toe in 2040)
- Ecological scenarios (IEA) seem not very probable because they require serious technological improvements in rather short periods
- Main issues in future energy mix are the ability of renewables to become commercially viable and the competition between gas and coal, in most scenarios oil reduces its share anyway

Key Long-Term Challenges (Continued)

- Most regional growth in energy markets is expected in non OECD Asia, primarily China and India; in developed countries the market will be stabilized but with possibility to certain growth in 2030-2040; India has more dynamic energy market than China
- From all fossil fuels gas seems to have most high prospects to grow, approximately equal to the projected primary energy consumption growth
- It should be noted that the scenarios projections demonstrate almost perfect linear correlation between world primary and final energy that implies no notable development in transformation technologies