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International energy markets: challenges and prospects

Christopher Allsopp
New College Oxford
Director, Oxford Institute for Energy Studies
February 2013

Outline

- The world economy at the start of 2013
  - Renewed optimism underpinning oil prices
  - Surprisingly stable picture – but could it change?
- Longer term and structural aspects of energy markets
  - Disconnect between industry consensus and scientific concerns over global warming
  - Impact of North American developments/policy
  - Gas markets changing rapidly
  - Breakdown in ‘oil linked’ pricing in Europe
  - Will Asia follow?
  - Impact of LNG exports: East African potential
- Russia/Asia
  - A swing producer? Or – missed the boat?
- What kind of a picture looking forward?

The world economy

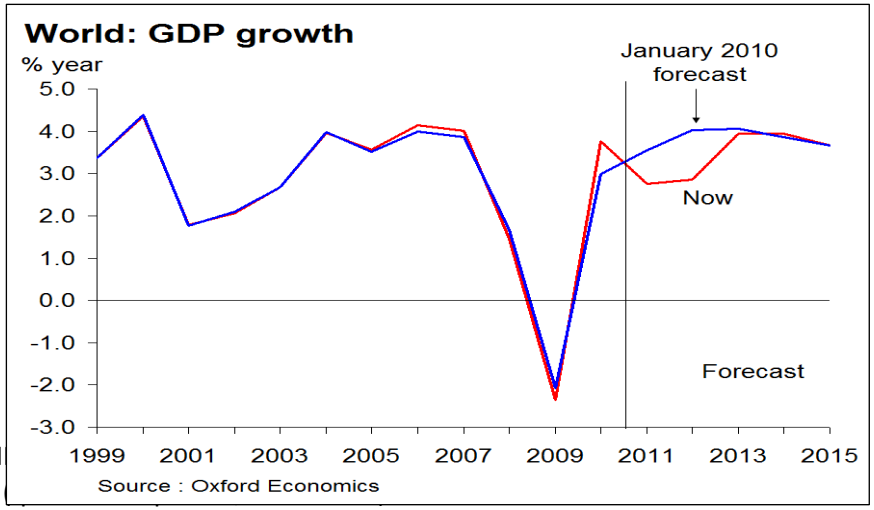
- Recap on the great recession, recovery, and fears of a double dip
  - Pessimism driven by global slowdown and mounting risks
  - Collapse in world trade and slowdown in 2011 and 2012: US, China and elsewhere: two speed recovery faltering
  - Mounting risks: Geopolitical, Euro crisis, US fiscal cliff and debt ceiling
  - Renewed optimism for 2013 reflects diminished risks in US and China and continuing problems (and low growth) in Euro area
  - Surprisingly stable picture – but could it change?
  - Roughly – back to the consensus growth of before the slowdown – but with a further level effect of about -2% on global GDP. Continuing downside risks but with some upside (esp. in US)
- Effects on global energy demand and on oil and other energy prices.
  - Relatively minor

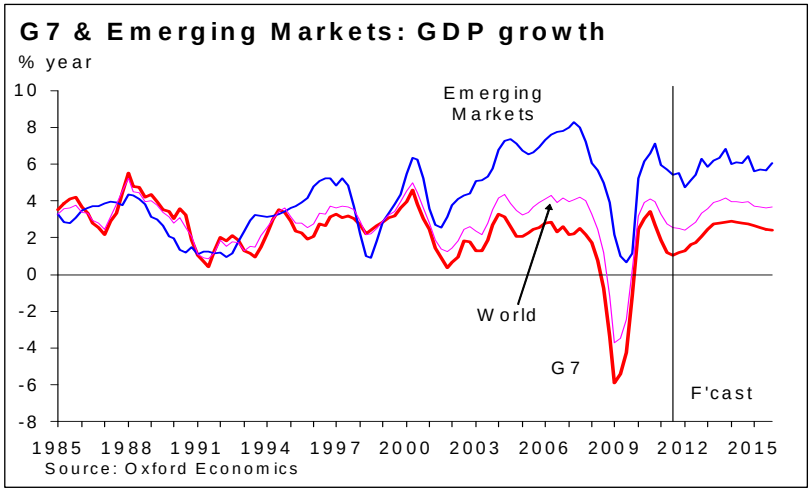
The shape of the 'great recession' (V-shaped: another dip?)

Consensus was for recovery at
4 ½ % per annum. Sharp revisions down – especially for second half of 2011 and 2012

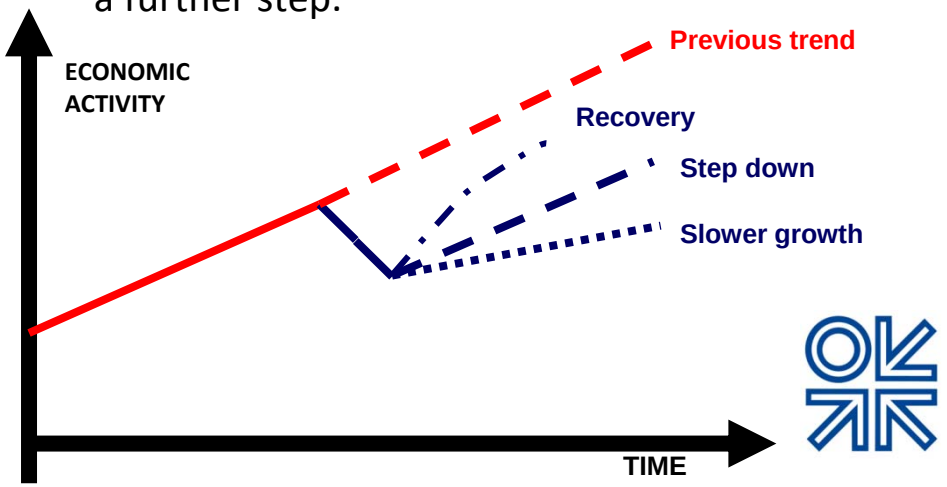
World growth still dominated by Emerging countries. India, China. Forecasts for OECD sluggish at best.
Euro zone – about – ½% for 2012

The 'level' effect; step down in demand for oil, gas, energy. (-2% ~ -10bcm gas in Europe)

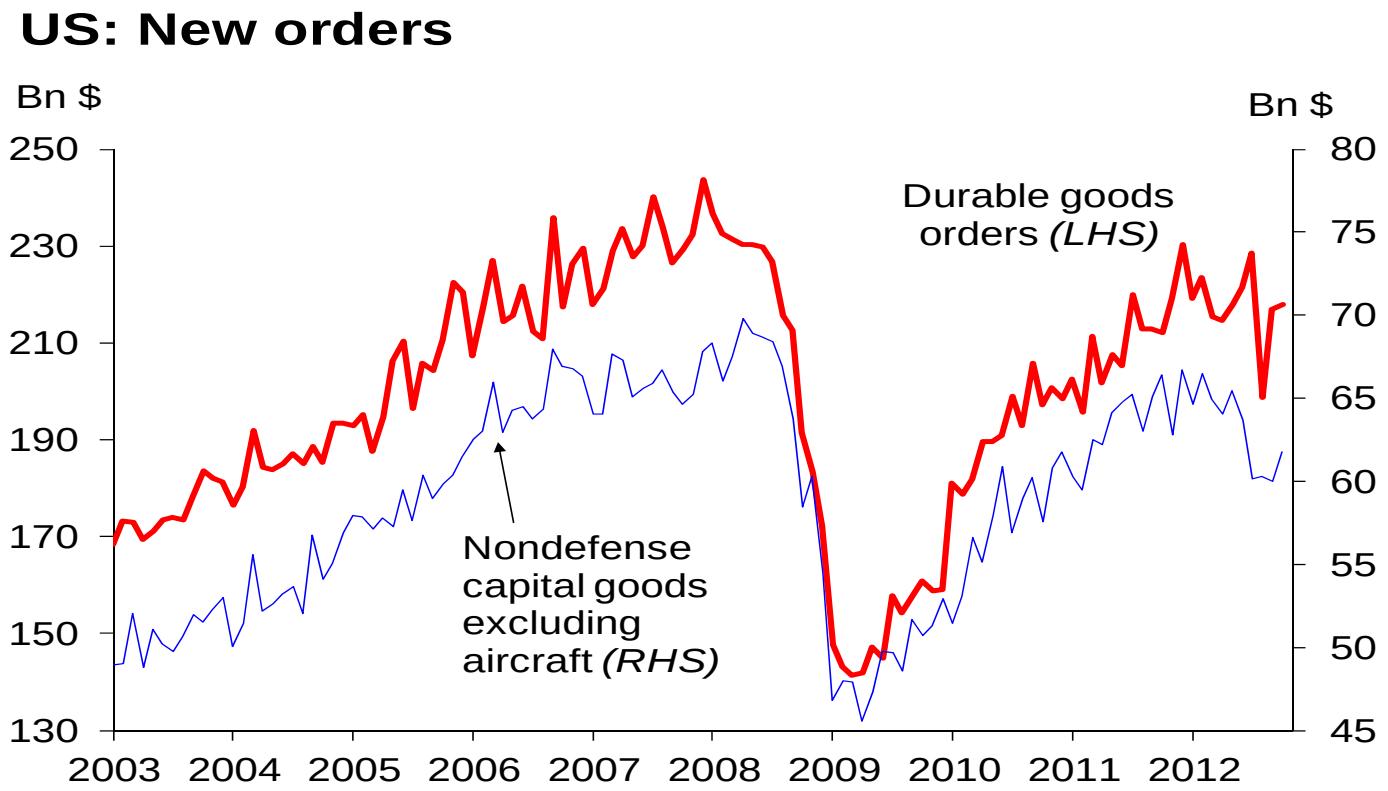




Consensus is for path marked 'step down'. Now a further step.

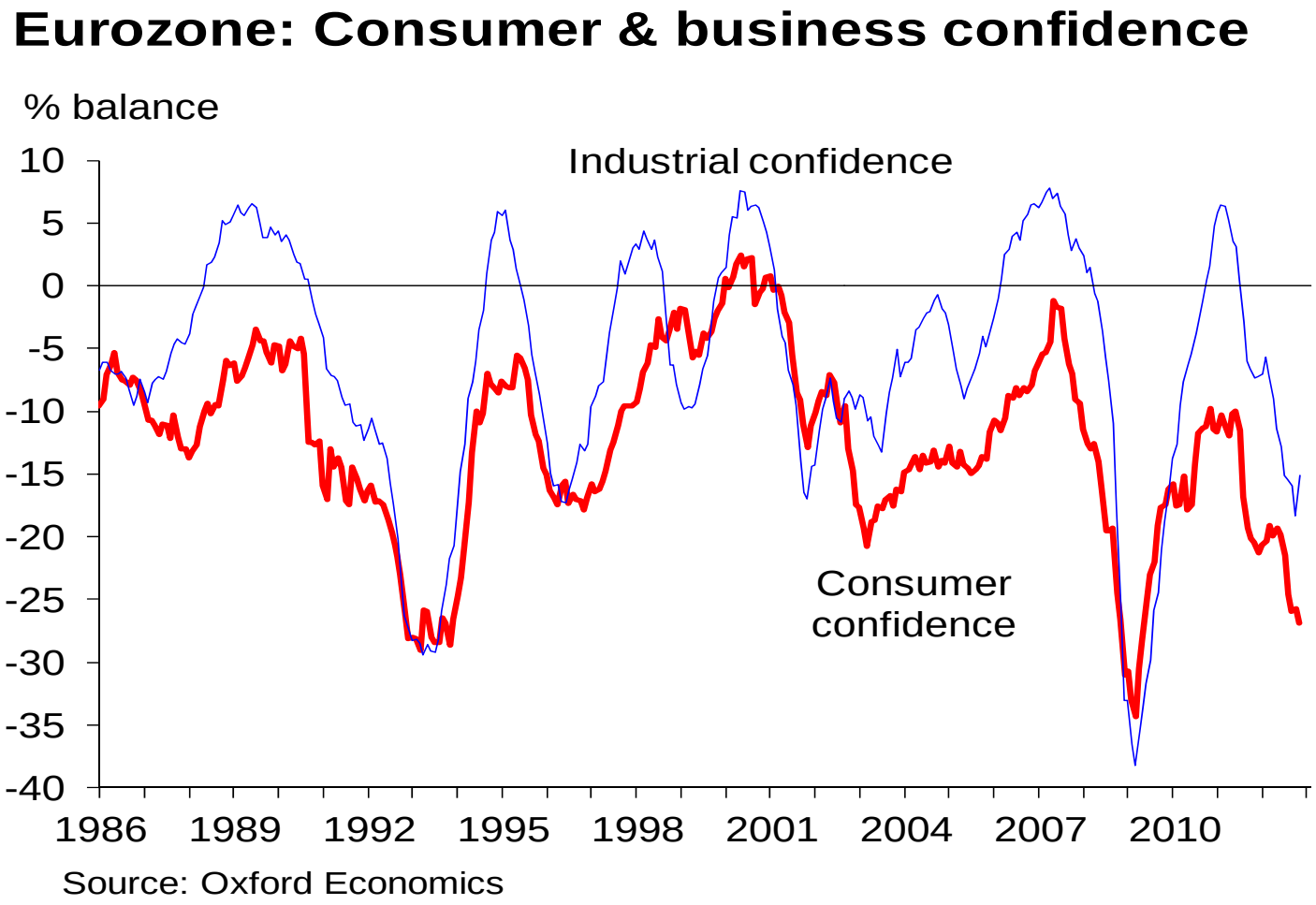


The US Fiscal cliff (an automatic tightening of fiscal policy by 4 - 5 % GDP) has been avoided. The debt ceiling is unlikely to bind. But fiscal policy is still constrained.

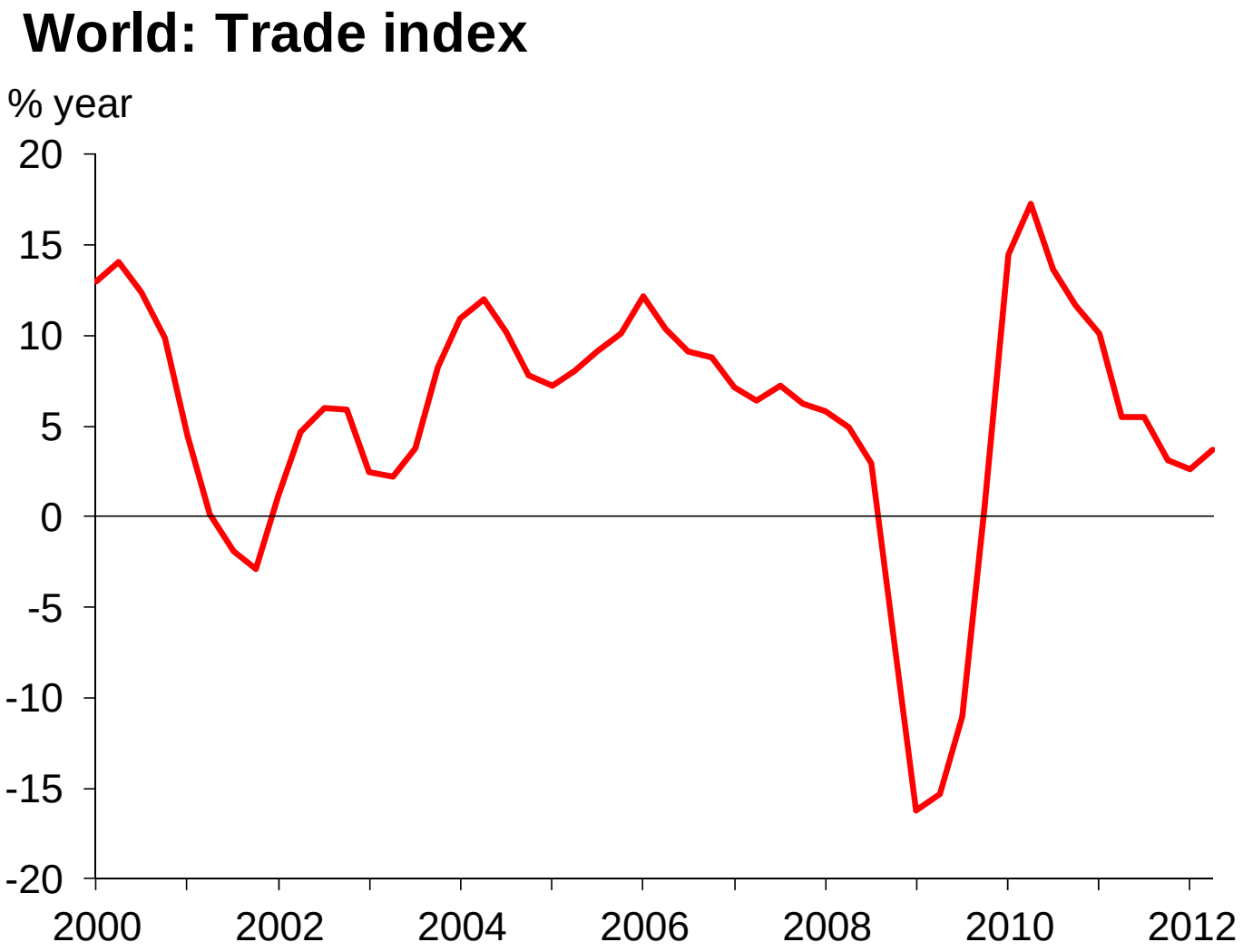


Source: Census Bureau/Haver Analytics

Eurozone recession deepening…

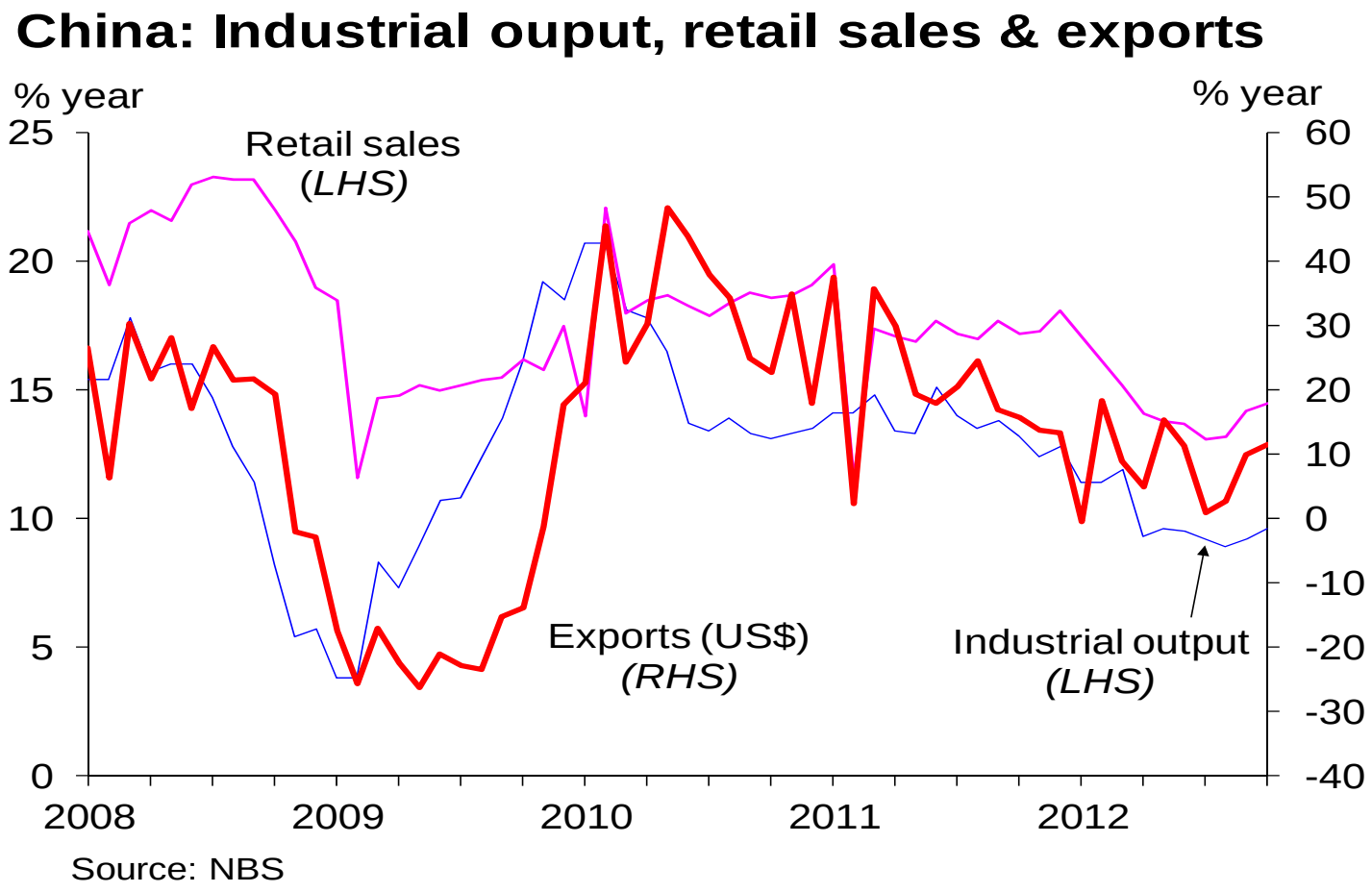


World trade growth slumped in 2012…

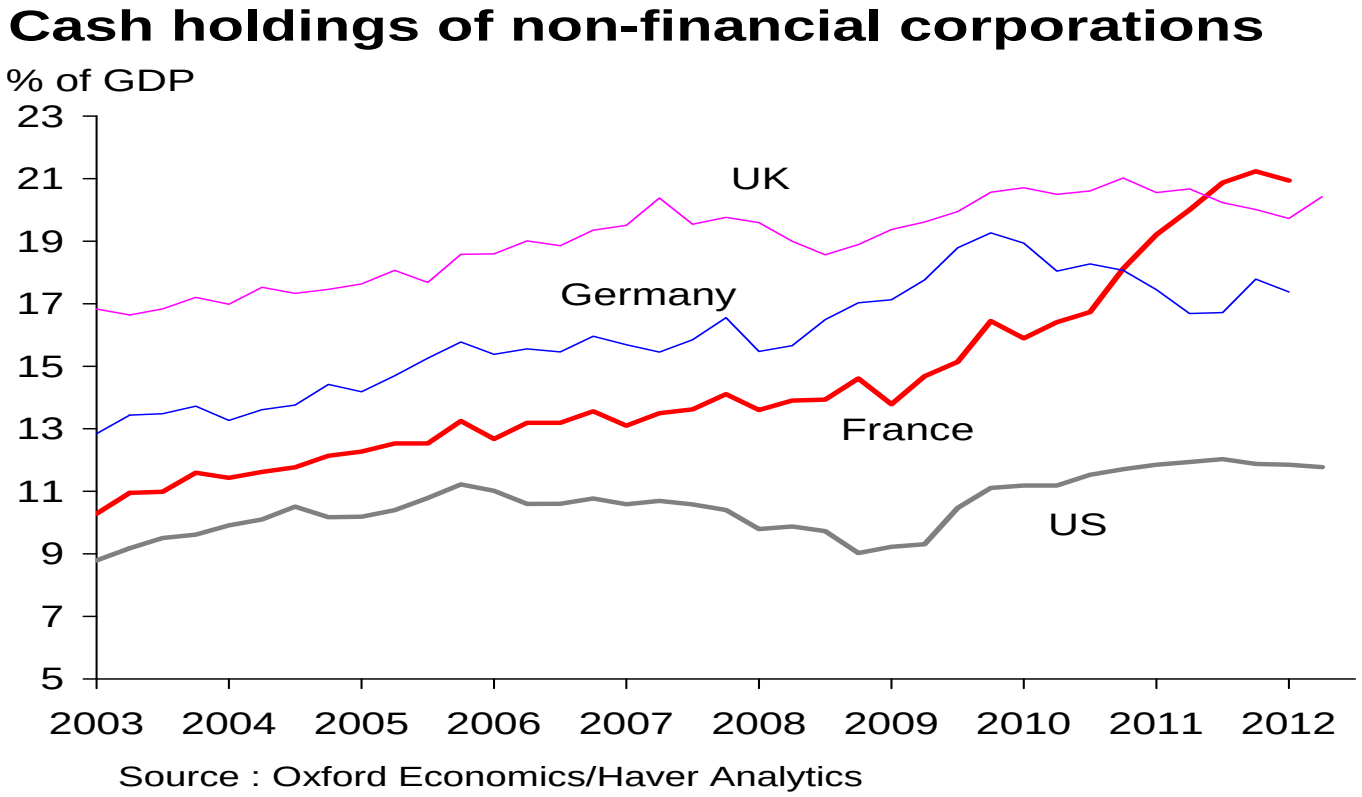


Source: Oxford Economics

Signs that Chinese downturn is coming to an end…



Corporate cash piles still growing – scope for investment revival and cumulative confidence effects



Oxford Economics baseline forecast

World GDP Growth % Change on Previous Year	2011	2012	2013	2014	Av 2015-17
US	1.8	2.2	2.3	3.1	3.0
Japan	-0.5	2.0	0.5	1.5	1.7
Eurozone	1.5	-0.4	-0.2	1.0	1.5
of which:					
Germany	3.1	1.0	0.8	1.7	1.6
France	1.7	0.0	0.2	1.1	1.3
Italy	0.6	-2.1	-1.2	0.3	1.2
UK	0.9	0.1	1.0	2.1	2.5
China	9.3	7.7	8.3	9.0	8.0
India	7.5	5.3	6.0	7.6	7.8
Other Asia	3.8	2.7	3.9	4.9	5.0
Mexico	3.9	3.9	3.7	4.9	4.2
Brazil	2.7	1.0	3.9	4.9	4.5
Other Latin America	7.0	4.4	2.6	4.1	4.1
Eastern Europe	3.7	2.8	2.1	3.6	4.1
MENA	5.1	3.2	4.6	5.1	5.0
World	**2.9**	**2.3**	**2.4**	**3.5**	**3.8**
World (PPP)	**3.6**	**3.0**	**3.5**	**4.2**	**4.4**

Risks are shifting to the upside

- **Middle East tensions (5%)**
  - Political tensions escalate in Egypt, Syria and Iran
  - Concerns about stability in the region push oil prices to over $200/barrel
  - Business and consumer confidence hit by energy shock
  - Political situation stabilises gradually. Oil prices return to baseline by 2015.

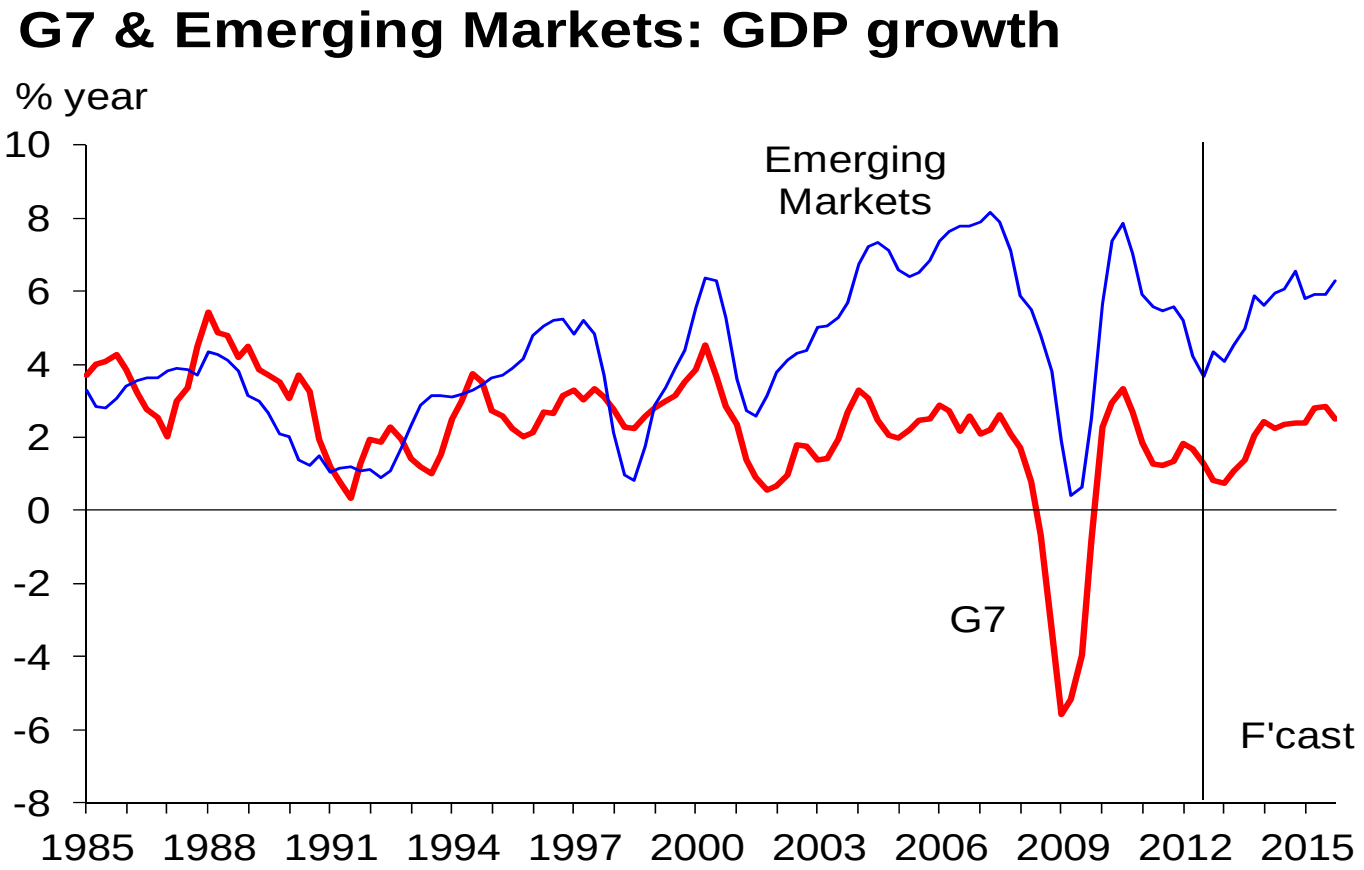
- **Eurozone exits in 2014 (15%)**
  - Fiscal austerity in peripheral countries becomes unbearable
  - No growth pushes unemployment yet higher. Pro-exit parties gain popularity.
  - No real progress on banking and fiscal union,
  - 6 countries exit Eurozone in 2014 Q1.

- **Oxford Forecast (60%)**
  - Steps to ensure Eurozone survival are taken, although they are not enough to kick start significant growth.
  - Risk premia fall, and consumer and business confidence gradually recover.
  - Recovery limited by public and private deleveraging and weak job growth
  - EMs robust as policy eases and growing middle class support consumer spending and trade

- **Faster upturns in US & EMs (15%)**
  - Resolution of outstanding fiscal issues encourages investment and hiring in the US.
  - Momentum in EMs builds as trade picks up and accommodating policy feeds through
  - Business and consumer confidence rise as conditions improve.

Summary: Emerging markets rebounding after soft patch: pick-up in US. Serious downside risks remain.

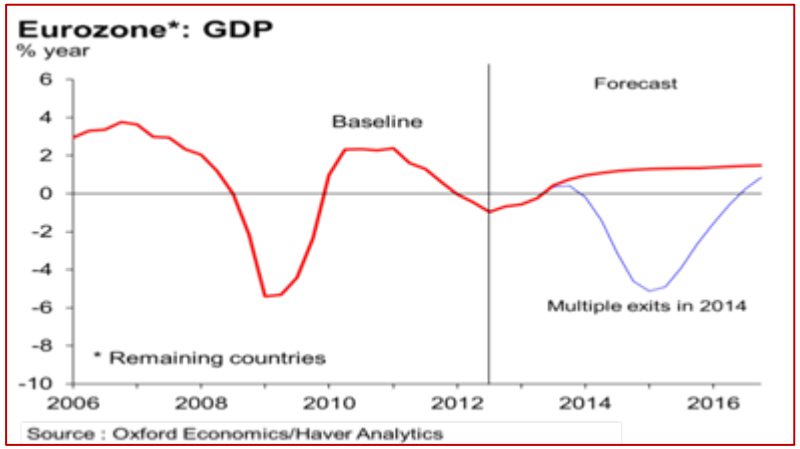
Forecasts have not changed much. What has changed is the assessment of risks – assumed to be overcome or avoided in the baseline assessment.

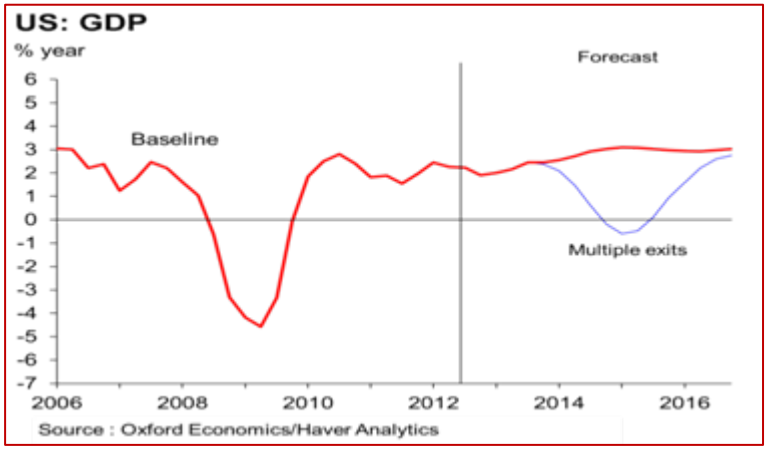


Eurozone breakup is still the greatest risk

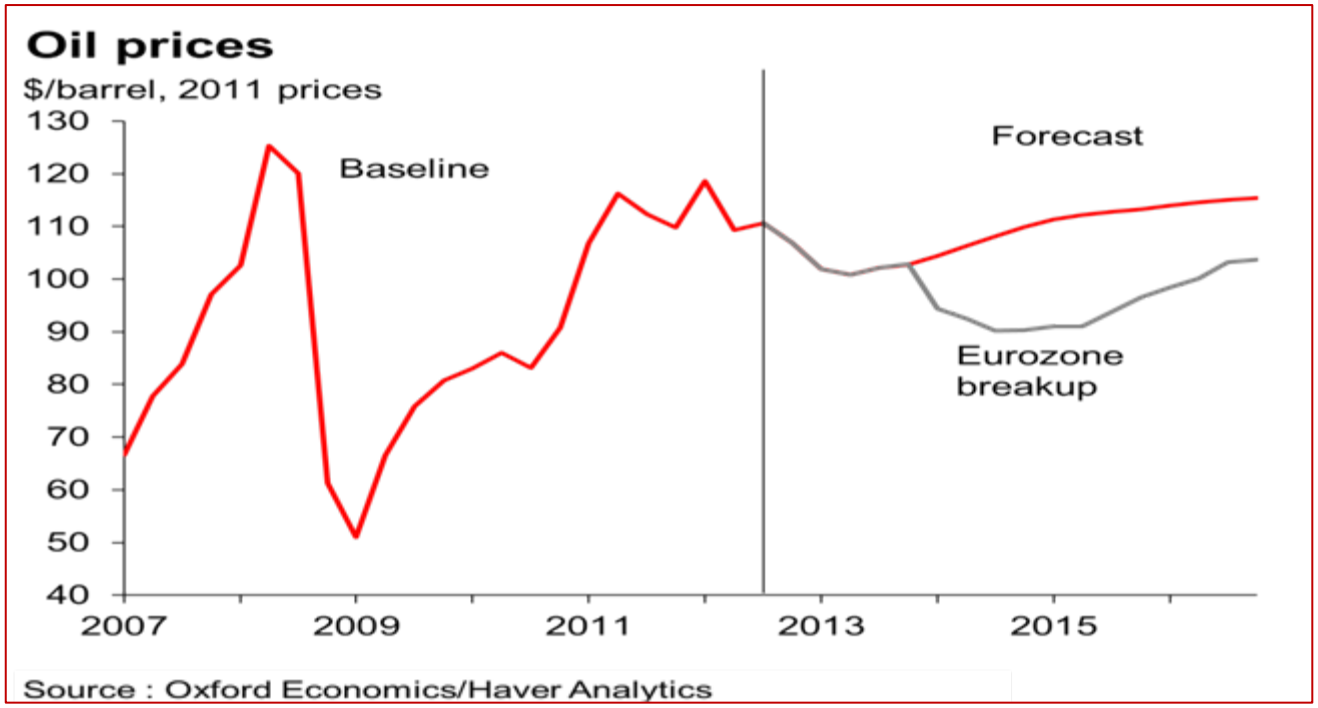
- A monetary union but no political union. So markets fear breakup - which leads to unsustainable bond yields - the short term crisis. ECB appeared to be unable to act like a true central bank.
- Germany is imposing incredibly tight fiscal policy as part of the 'solution' which is leading to severe recessions and political instability.
- Many countries are uncompetitive with large current account deficits which exacerbates the problem of weak growth and increases nervousness in the markets.
- The two big changes that have made a difference are
  - Some moderation of Germany's position
  - Draghi's move in the summer to take off currency risk applying to sovereigns

But what if the crisis returns?

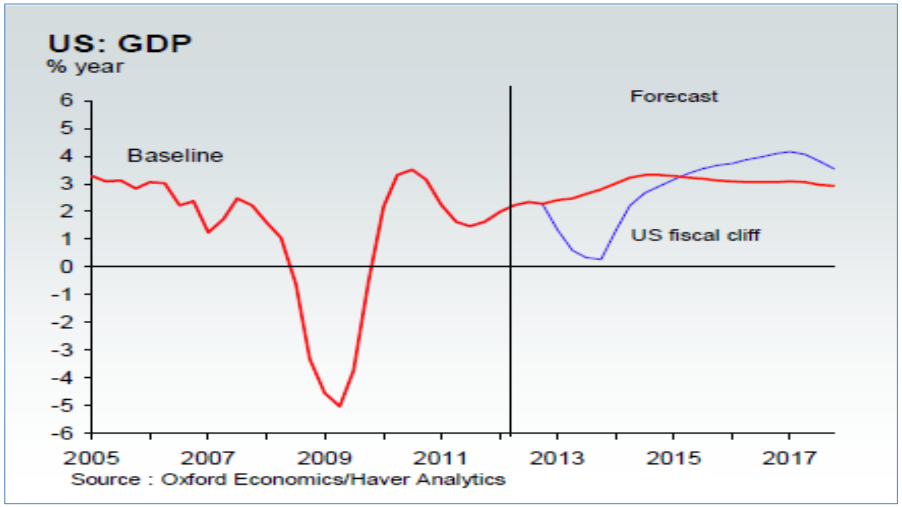


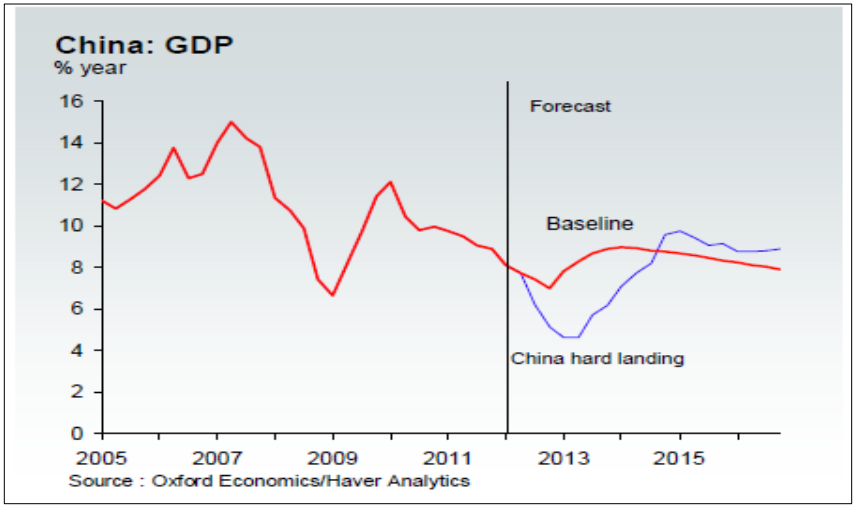


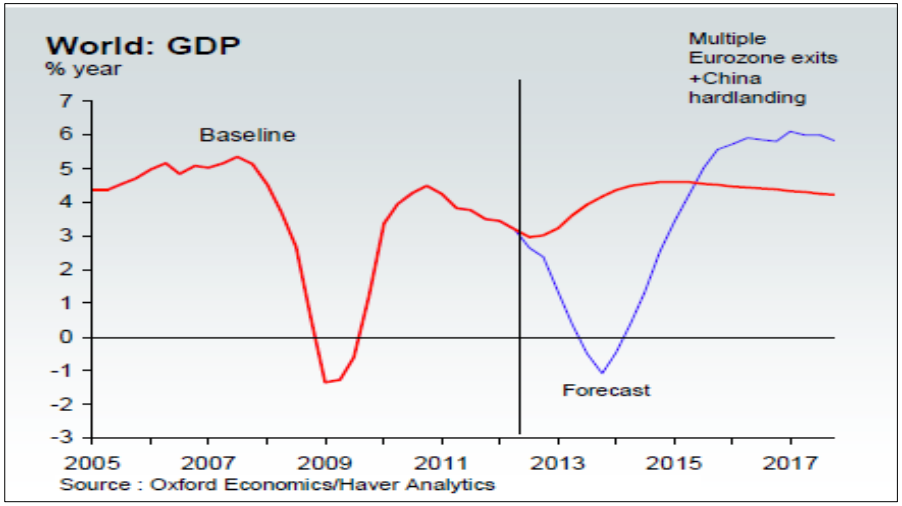
The effect on oil prices, though hard to estimate, could be dramatic. (As in the last recession, the OPEC response would be crucial).

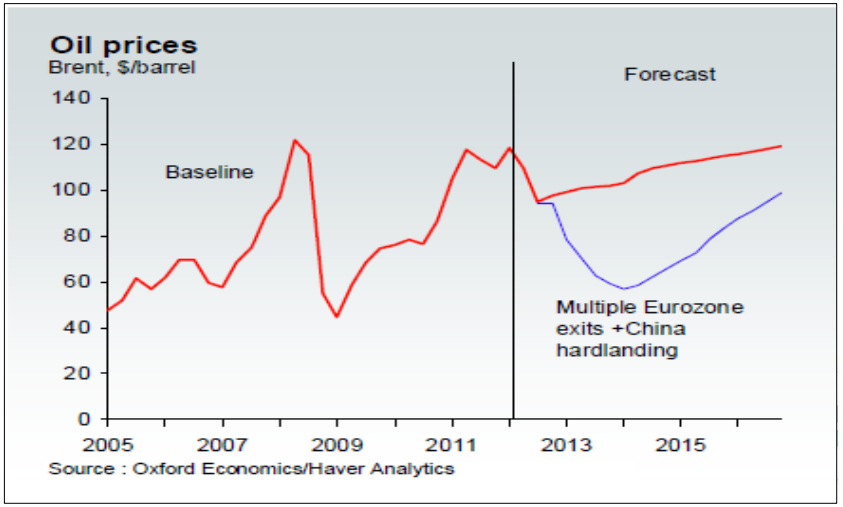


Other risks: fiscal cliff, China hard landing, Euro exits plus China hard landing





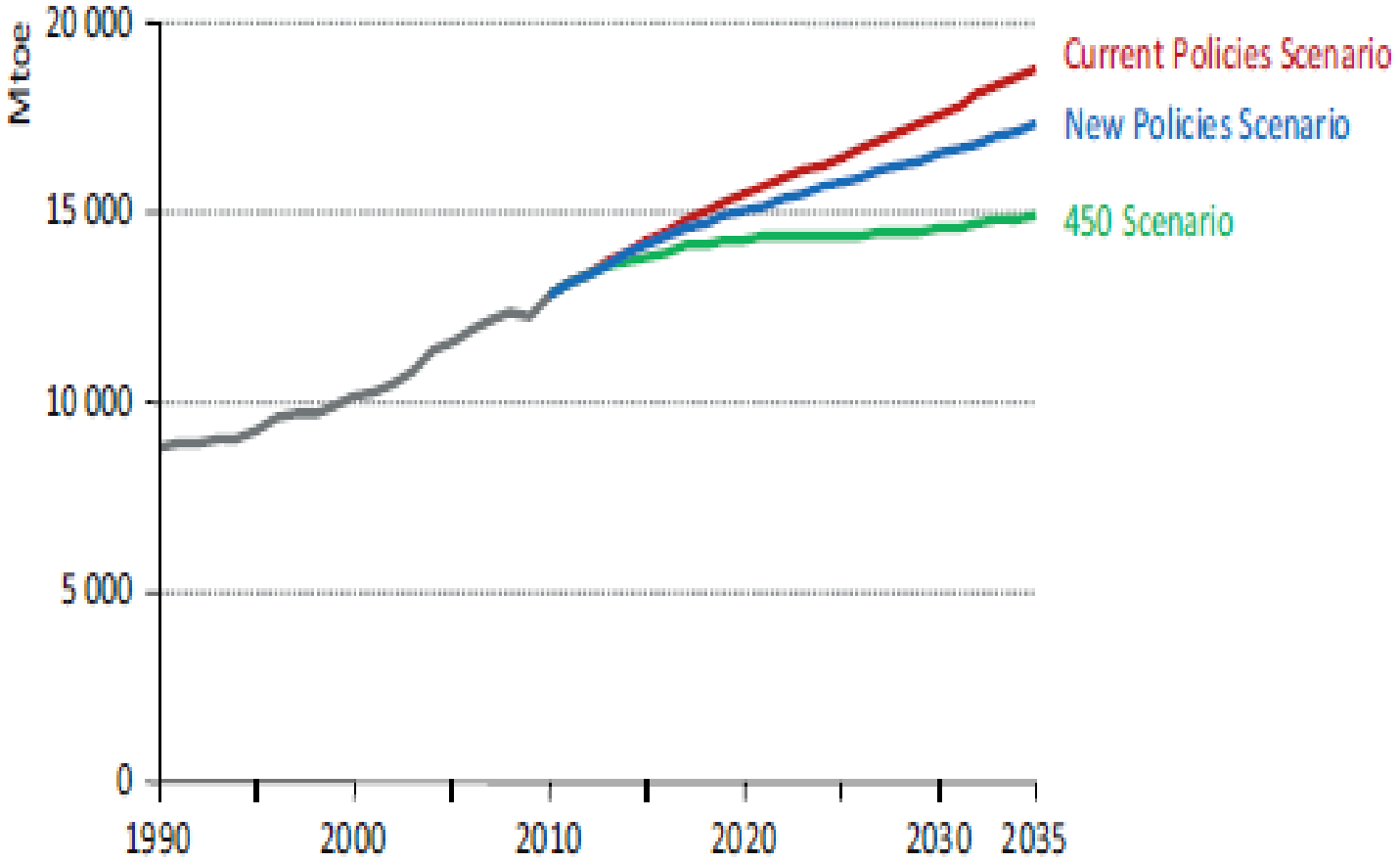




Longer term trends, forecasts and scenarios

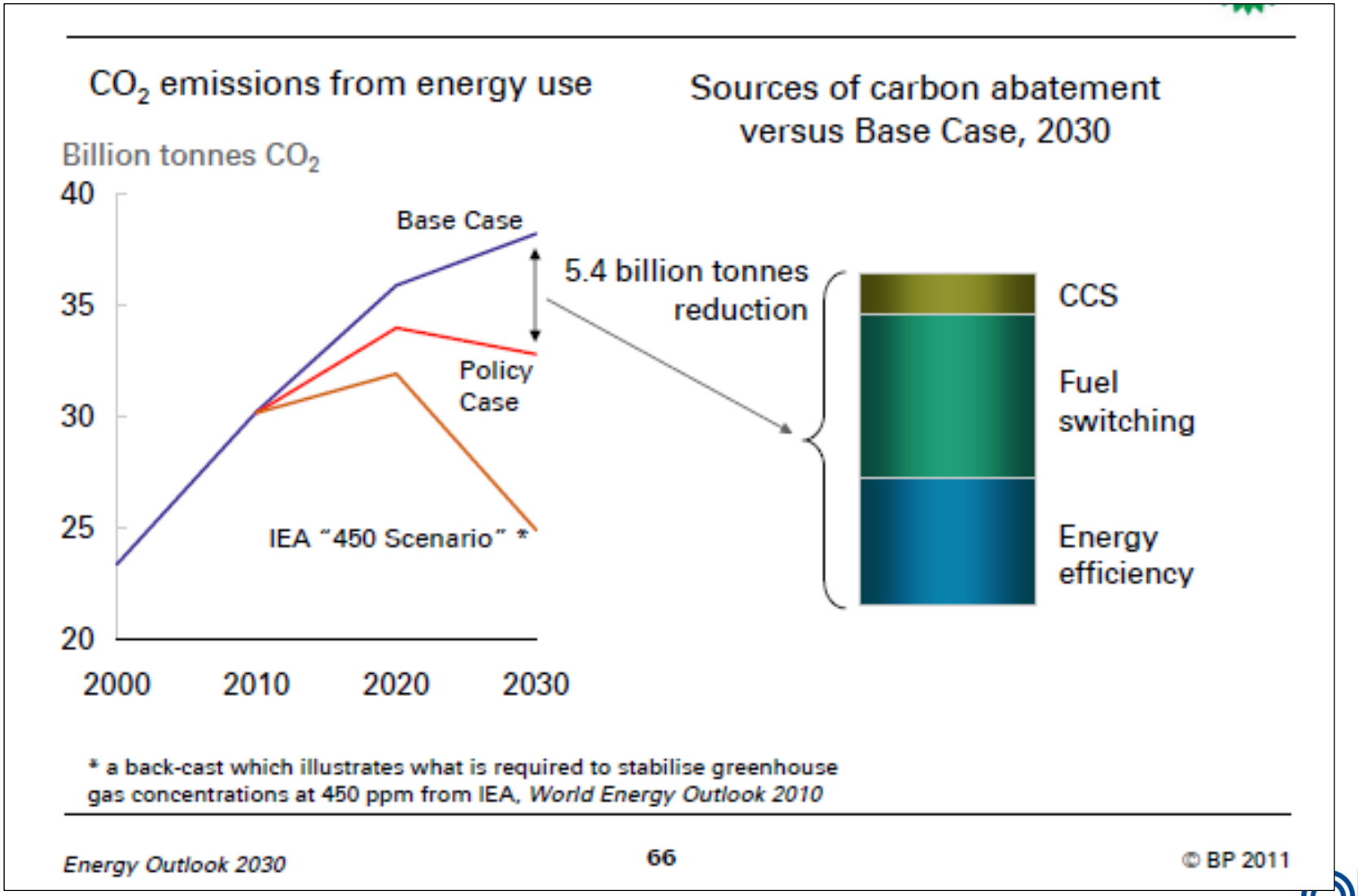
- The issues raised by longer term assessments are rather different. They are crucially dependent on assumptions about growth and about policy.
- Different scenarios (e.g. IEA, EIA, BP, Shell) use different methods
  - Current policies, new policies, 450 scenario (2 degrees global warming)
  - 450 scenario very difficult to achieve. Climate change mitigation policies are not working. Essentially a 'backcast'.
  - BP uses 'most likely policies' for its base case
- Nevertheless, scenarios can be useful
  - Eg Business as usual (BAU) does not work!
  - Even 'most likely policies' may throw up inconsistencies (usefully)
- Illustrated by the disconnect between the industry consensus and the climate change imperative. (They cannot both be right)

Illustration: World Primary Energy Demand by Scenario: IEA



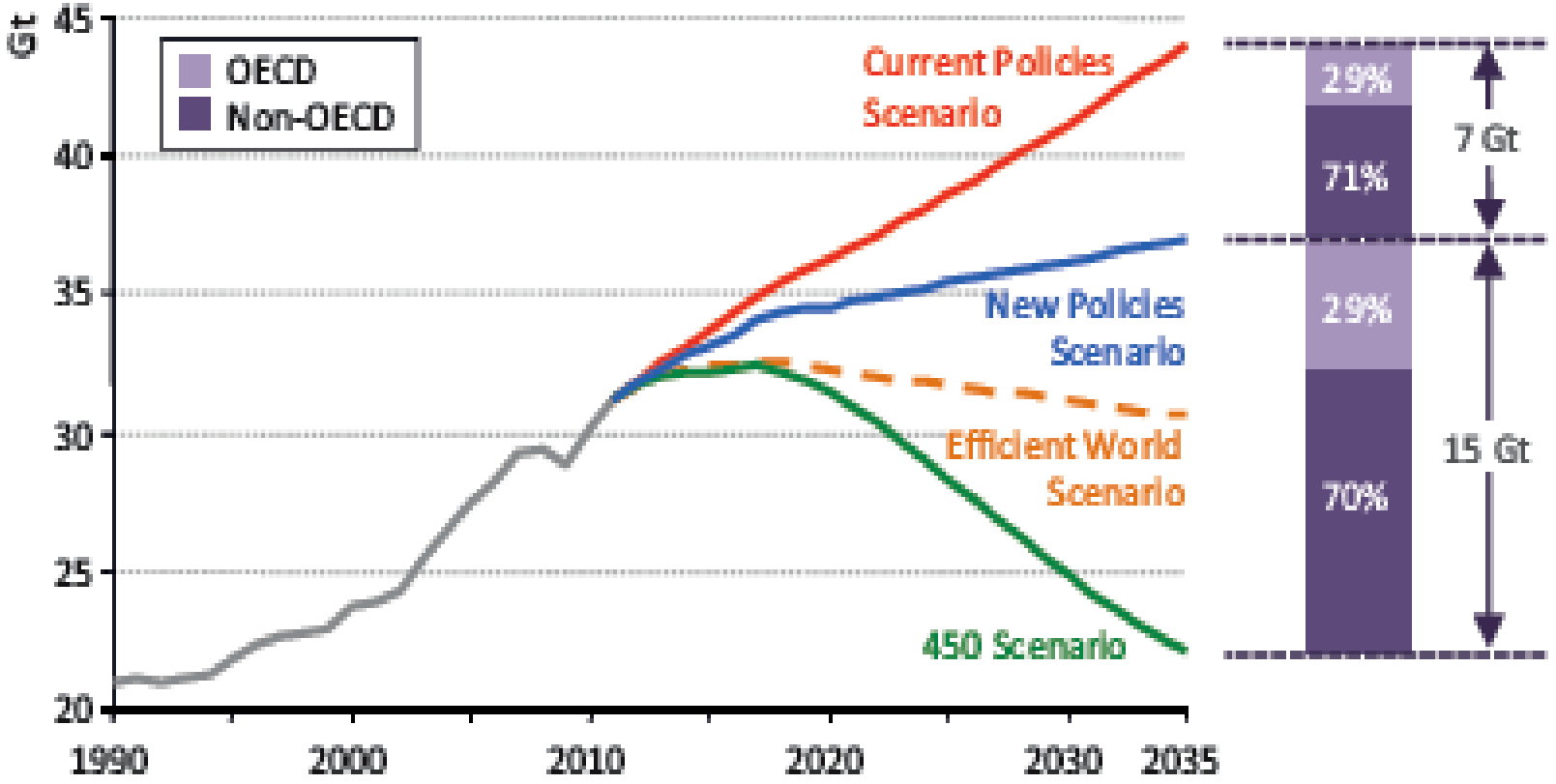
Source: International Energy Agency

BP Energy Scenarios to 2030



Source: BP, 2011

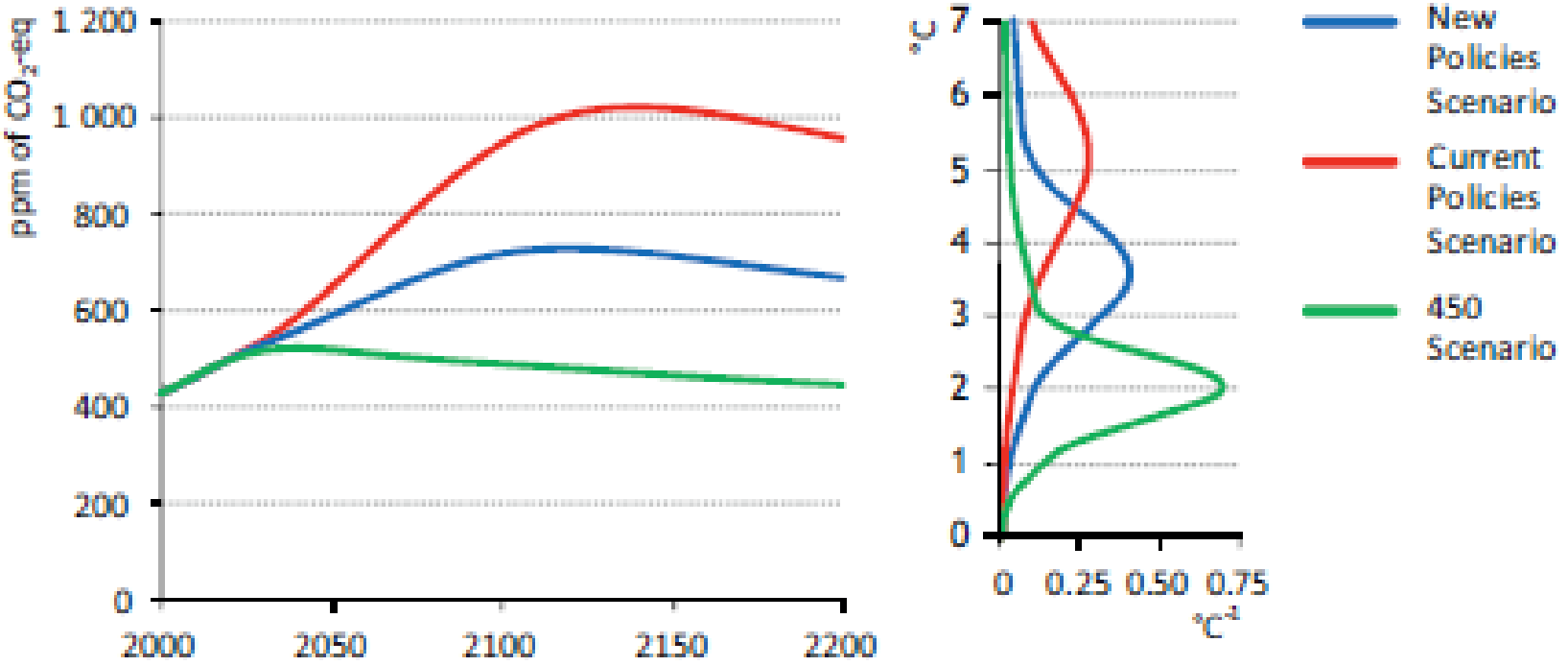
Global Energy-Related Carbon Dioxide Emissions by Scenario



Note: There is also some abatement of inter-regional (bunker) emissions which, at less than 2% of the difference between scenarios, is not visible in the 2035 shares.

Source: International Energy Agency

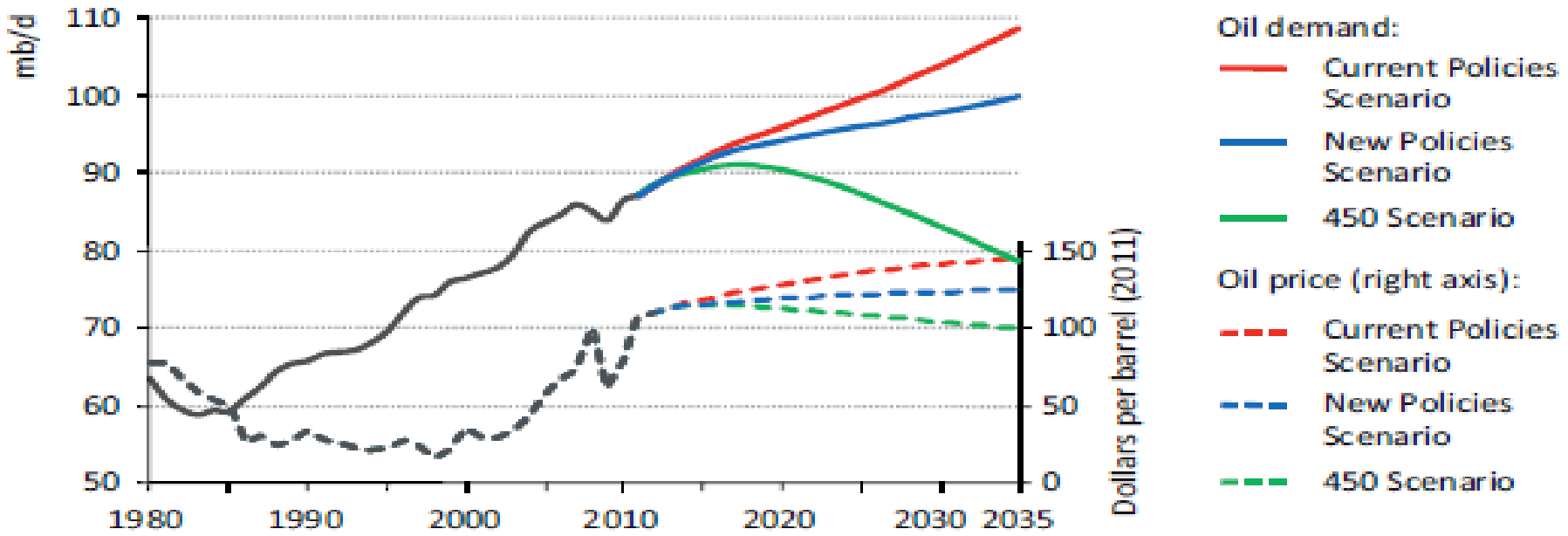
Greenhouse Gas Concentration Pathways (left) and Probability Distribution of Equilibrium Temperature Increase Above Pre-Industrial Levels (right)



Notes: The median of the temperature distribution in the three scenarios is aligned with the respective greenhouse-gas concentration levels in 2200, where levels are almost stabilised. The probability distribution function for the temperature range was derived based on the equilibrium climate sensitivity distribution given in Rogelj, Meinshausen and Knutti (2012). PPM = parts per million.

Sources: IEA analysis using the MAGICC (version 5.3v2) and OECD ENV-Linkages models.

World Oil Demand and Oil Price by Scenario*(IEA 2012)



* Average IEA crude oil import price.

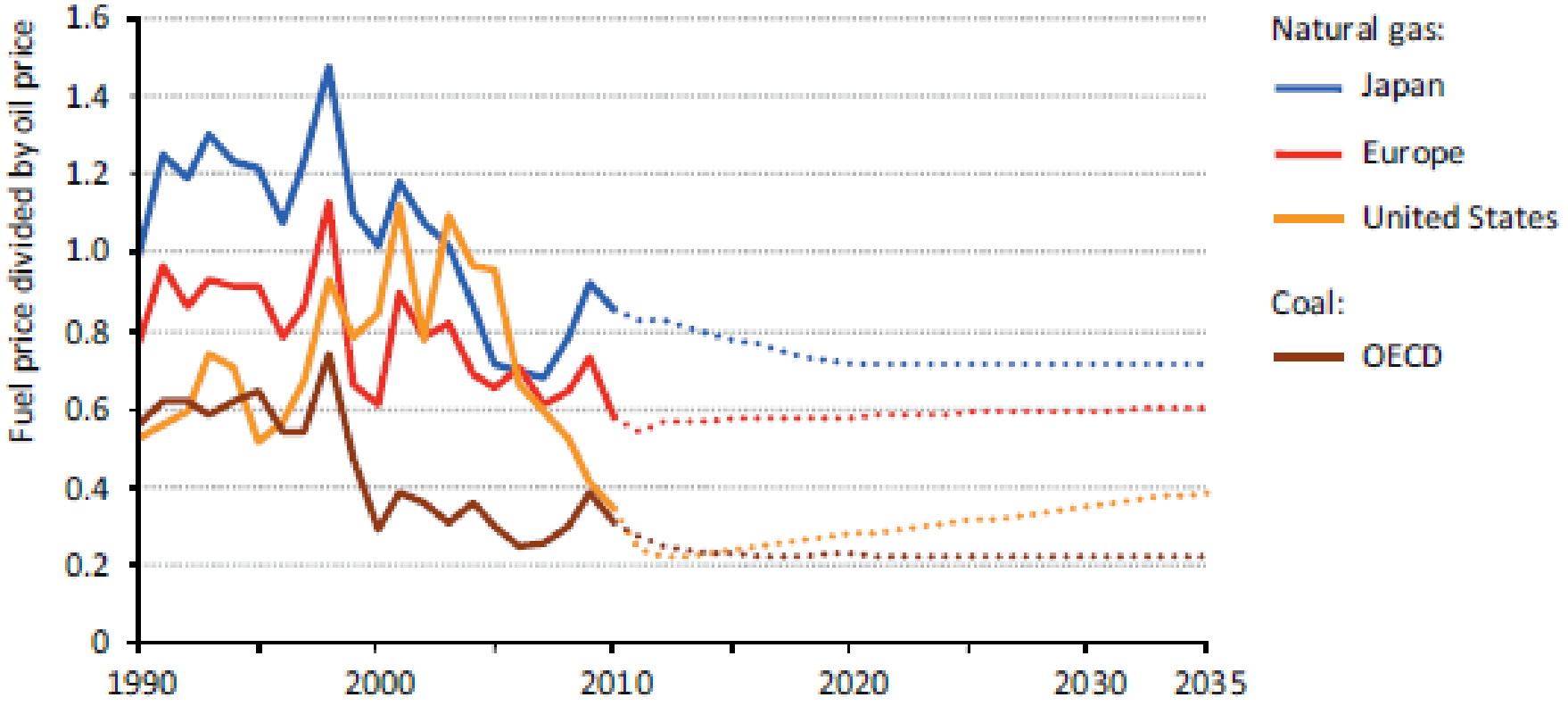
Remark: does anyone believe that in 2035 the 450 scenario is consistent with $100 oil?

Source: International Energy Agency

The problem of price: especially relative prices ...

- Oil prices relatively high – under current conditions
- Natural gas prices vary from around $3 per Mmbtu in the US, to about $8-9 in Europe, and up to double that in Japan/Asia. Coal prices, on an energy equivalent basis are much lower than that.
- Low US gas prices are pushing out coal from power generation in the US, stimulating low price coal exports to Northern Europe, increasing the coal burn in countries such as Germany (which is dropping nuclear)

Ratio of Average Natural Gas and Coal Prices to Crude Oil Prices in the New Policies Scenario



Note: Calculated on an energy-equivalent basis.

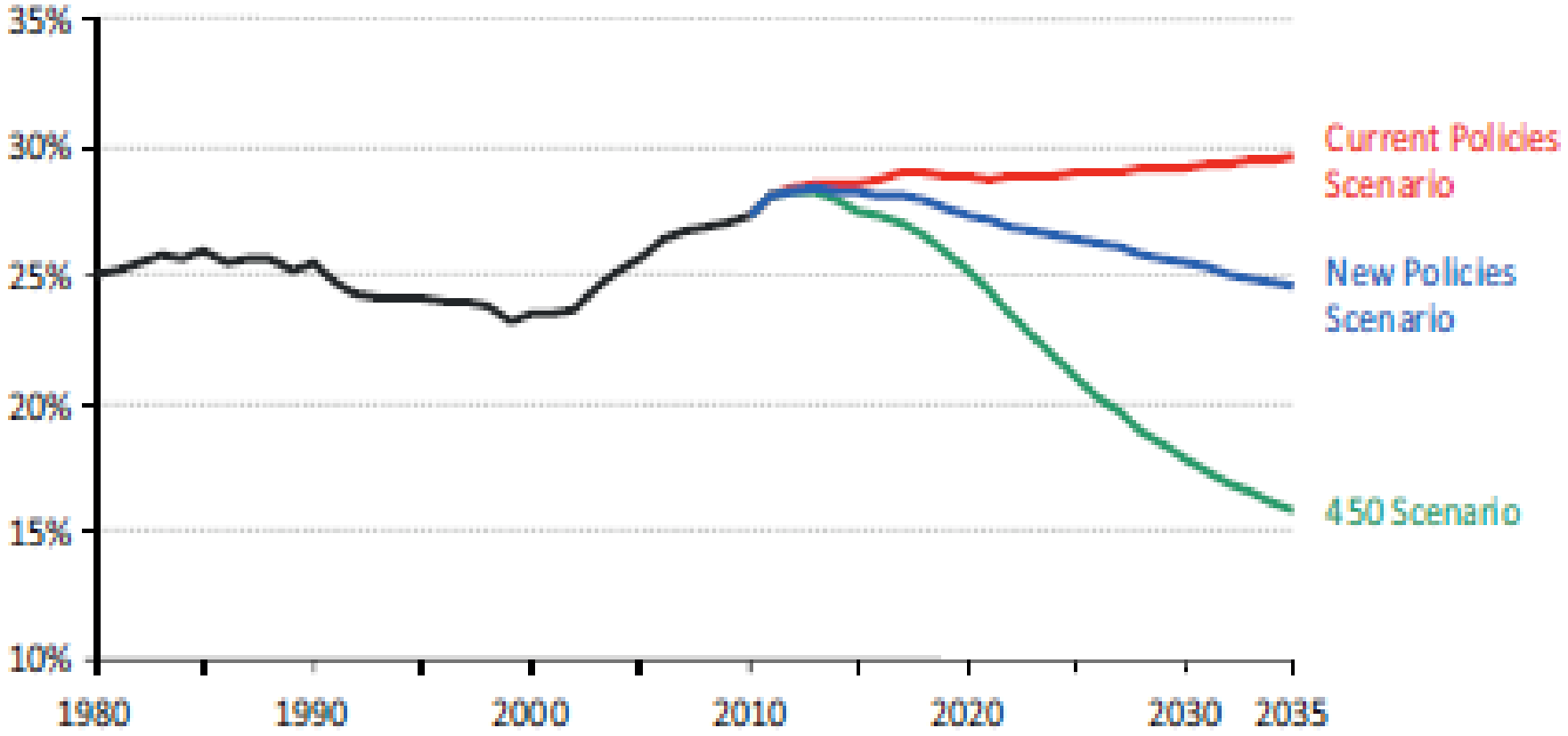
Source: International Energy Agency

Globally, coal prices are much too low relative to natural gas, nuclear and renewables

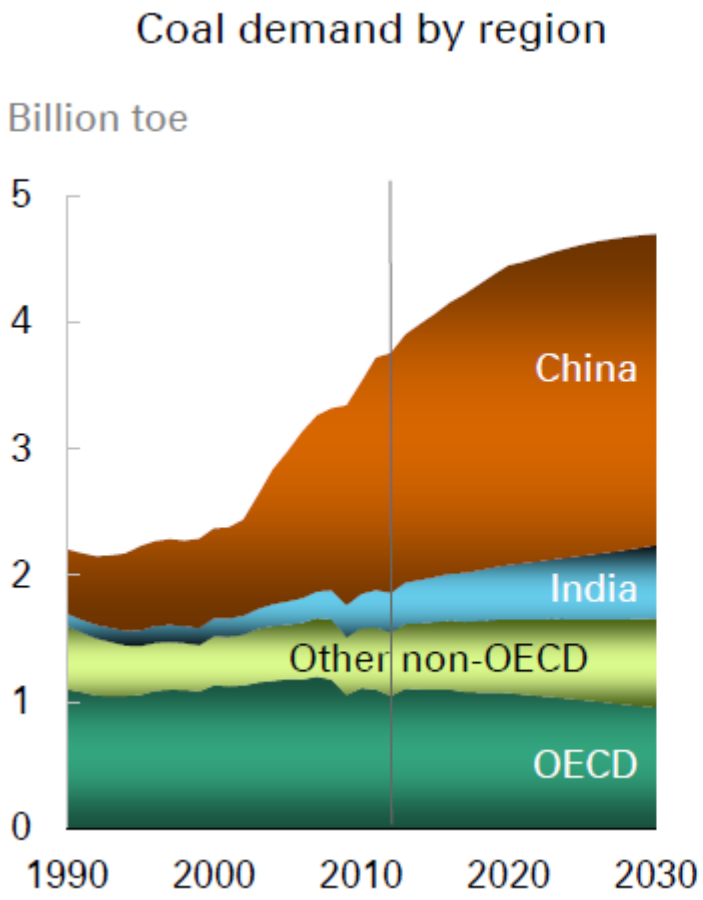
Potential solutions include: taxes on coal, a carbon tax (favouring, for example, natural gas). Or cap and trade systems, such as EU ETS; command and control or regulatory interventions.

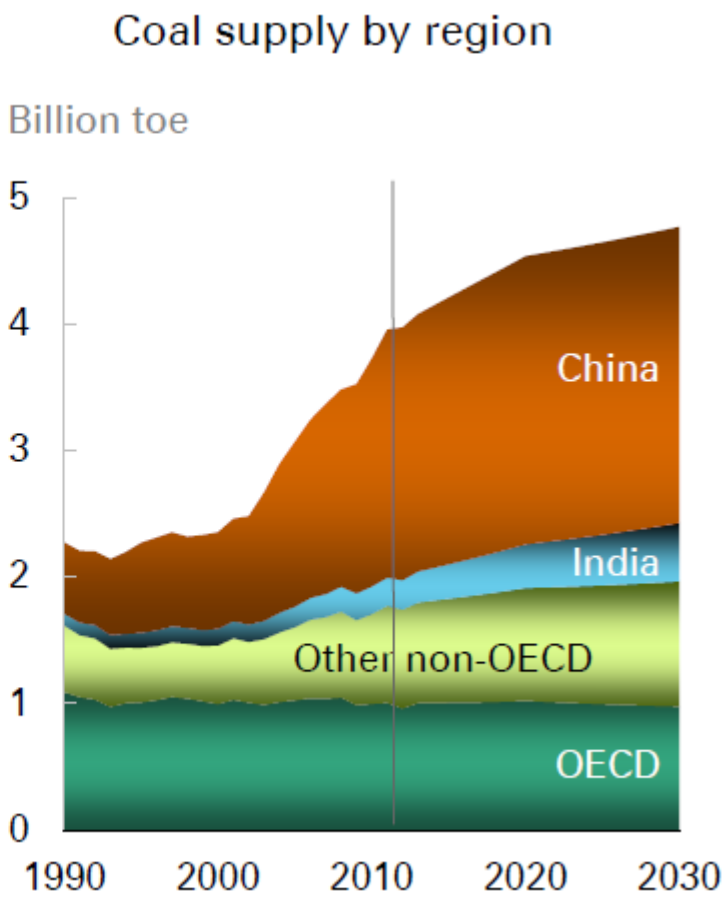
A carbon tax would have to be large to give (imported) gas an advantage over coal in most countries outside N America.

Share of Coal in World Primary Energy Demand by Scenario



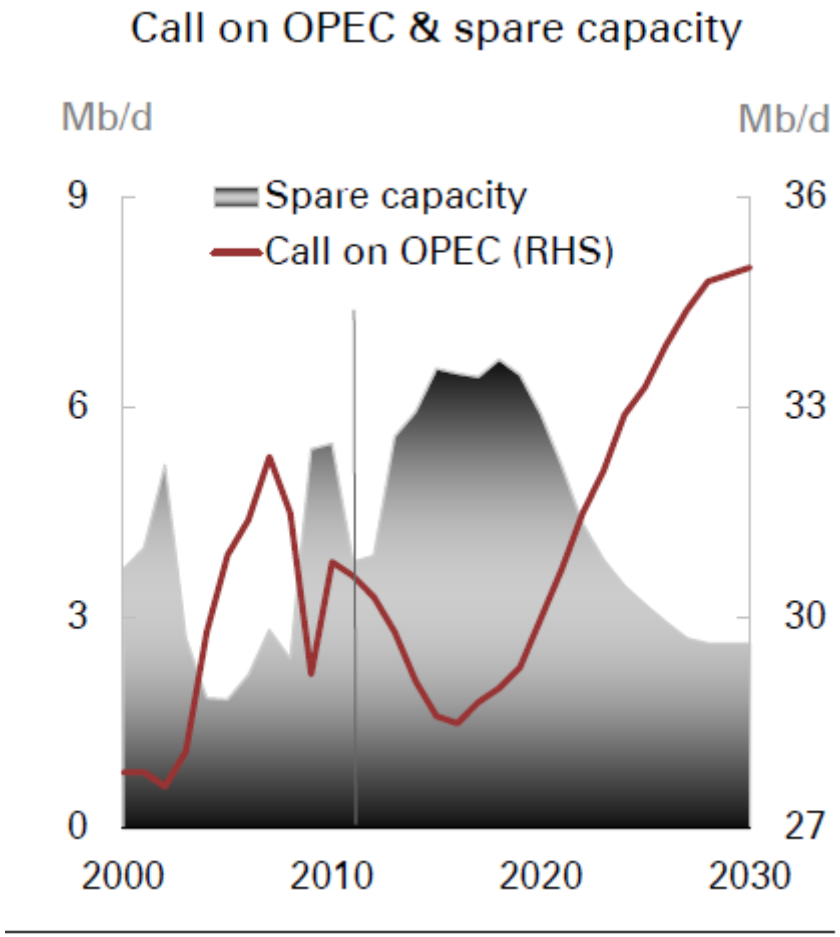
Source: International Energy Agency





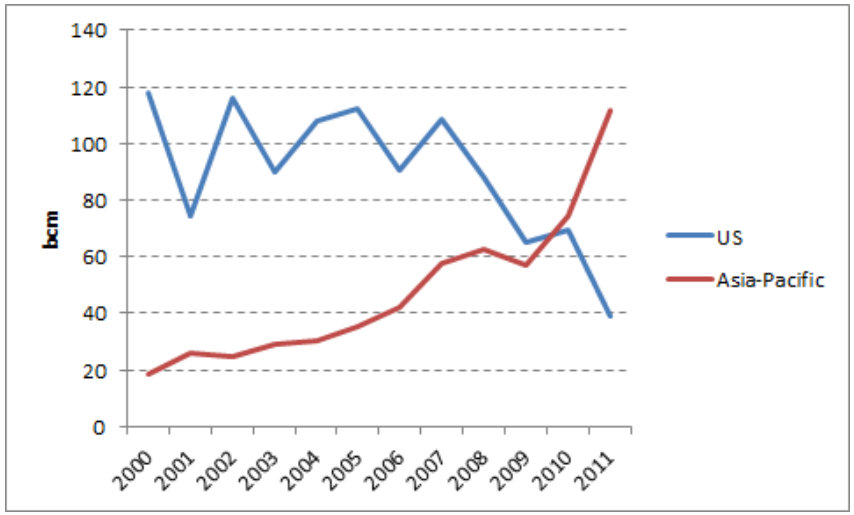
North American developments and policy

- US expansion of tight oil – near self sufficiency by 2030
- Implications for the call on OPEC
- More price uncertainty

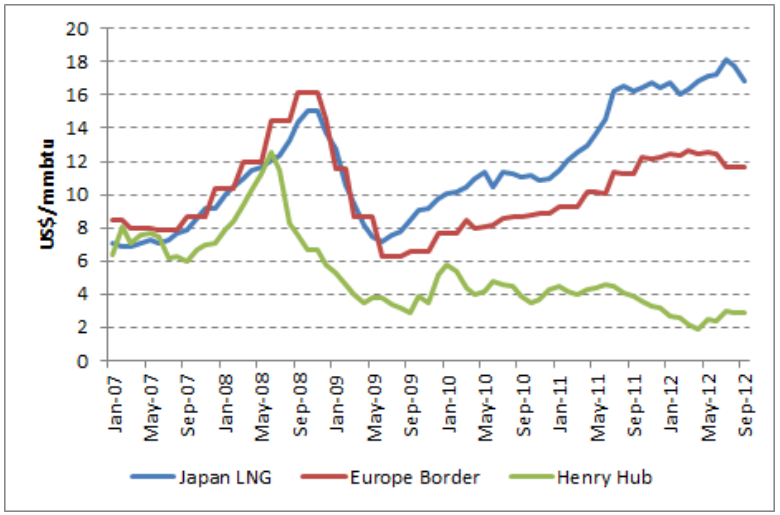


Shale: The rationale for North American LNG exports: large price differentials leading to arbitrage opportunity

Gas imports to the US and Asia



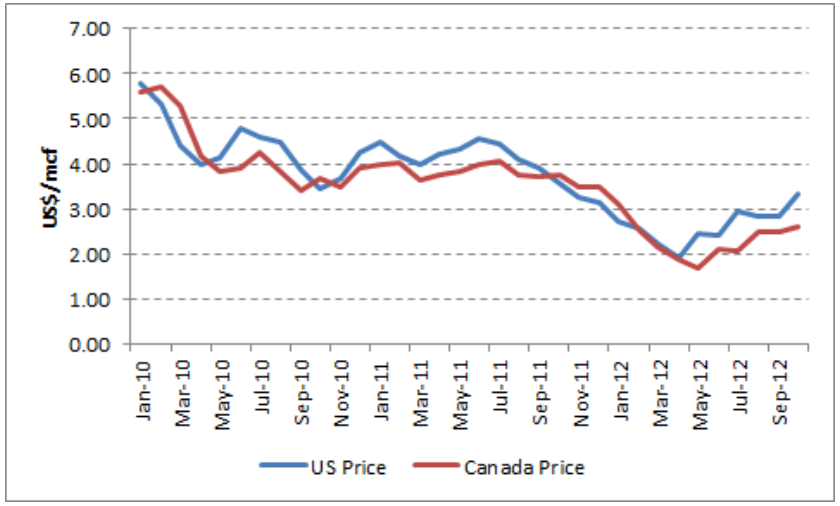
Gas prices in US, Europe and Japan



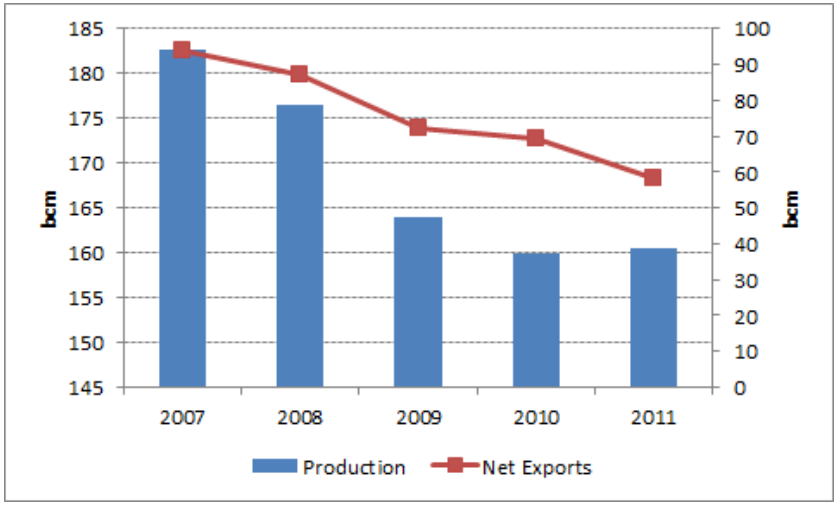
- The shale gas revolution in the US has seen gas imports drop sharply and LNG import facilities lie idle
- In contrast gas imports to Asia have risen sharply thanks to Chinese demand growth and the impact of Fukushima
- A significant price gap has opened up, driven by the supply-demand imbalance and also by the continuance of oil-linked pricing – an arbitrage opportunity that is begging to be exploited

The opportunity is perhaps even more relevant for Canada than it is for the US

Gas price in US and Canada



Canada's gas production and exports

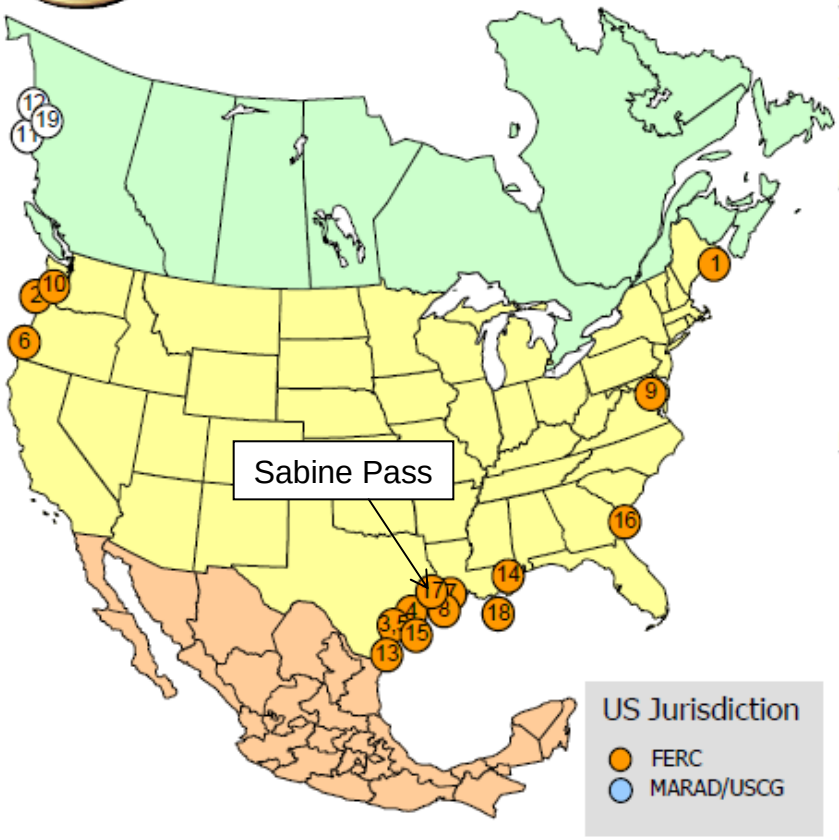


- Canada's gas exports to the US have been falling thanks to increased shale gas production
- Production has declined in line with this fall, but Canada has significant conventional and unconventional reserves to exploit
- Exports to Asia are a commercial and a political goal, with a particular focus on assets on the West Coast
  - Gas prices in Canada would not support development of the country's unconventional resources

16 new LNG export schemes are identified by the FERC, excluding Sabine Pass which has been approved

North American LNG Import/Export Terminals

Proposed/Potential



Import Terminal

PROPOSED TO FERC

1. **Robbinston, ME:** 0.5 Bcfd (Kestrel Energy - Downeast LNG)
2. **Astoria, OR:** 1.5 Bcfd (Oregon LNG)
3. **Corpus Christi, TX:** 0.4 Bcfd (Cheniere – Corpus Christi LNG)

Export Terminal

PROPOSED TO FERC

4. **Freeport, TX:** 1.8 Bcfd (Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction)
5. **Corpus Christi, TX:** 2.1 Bcfd (Cheniere – Corpus Christi LNG)
6. **Coos Bay, OR:** 0.9 Bcfd (Jordan Cove Energy Project)
7. **Lake Charles, LA:** 2.4 Bcfd (Southern Union - Trunkline LNG)
8. **Hackberry, LA:** 1.7 Bcfd (Sempra – Cameron LNG)
9. **Cove Point, MD:** 0.75 Bcfd (Dominion – Cove Point LNG)
10. **Astoria, OR:** 1.30 Bcfd (Oregon LNG)

PROPOSED CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS

11. **Kitimat, BC:** 0.7 Bcfd (Apache Canada Ltd.)
12. **Douglas Island, BC:** 0.25 Bcfd (BC LNG Export Cooperative)

POTENTIAL U.S. SITES IDENTIFIED BY PROJECT SPONSORS

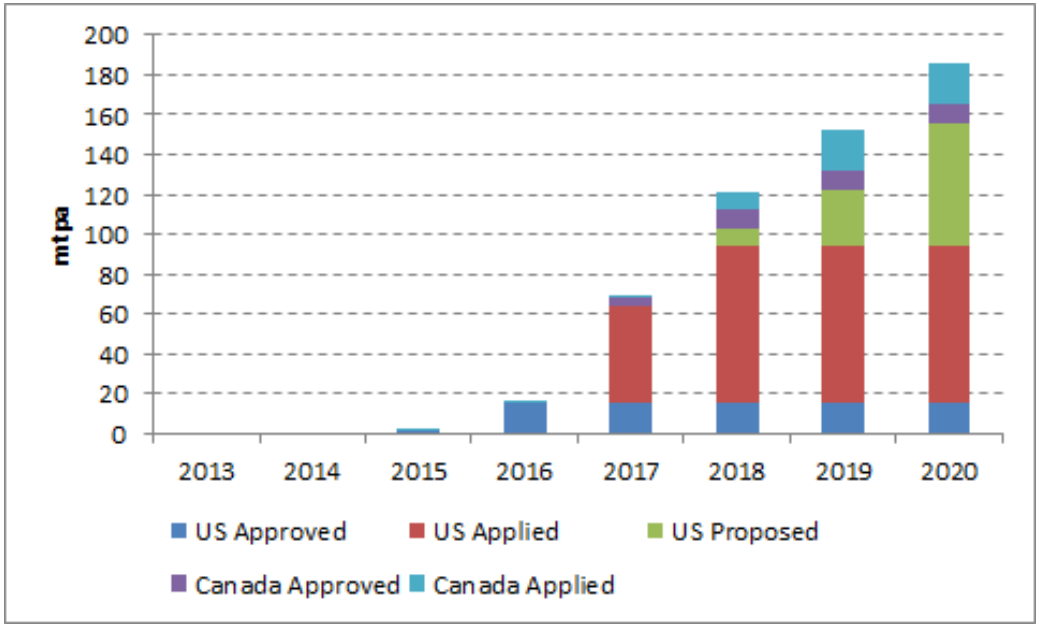
13. **Brownsville, TX:** 2.8 Bcfd (Gulf Coast LNG Export)
14. **Pascagoula, MS:** 1.5 Bcfd (Gulf LNG Liquefaction)
15. **Lavaca Bay, TX:** 1.38 Bcfd (Excelerate Liquefaction)
16. **Elba Island, GA:** 0.5 Bcfd (Southern LNG Company)
17. **Sabine Pass, TX:** 2.6 Bcfd (ExxonMobil – Golden Pass)
18. **Plaquemines Parish, LA:** 1.07 Bcfd (CE FLNG)

POTENTIAL CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS

19. **Prince Rupert Island, BC:** 1.0 Bcfd (Shell Canada)

North America could swamp the LNG market if all its projects came online (which is why that won't happen)

Possible North American LNG exports



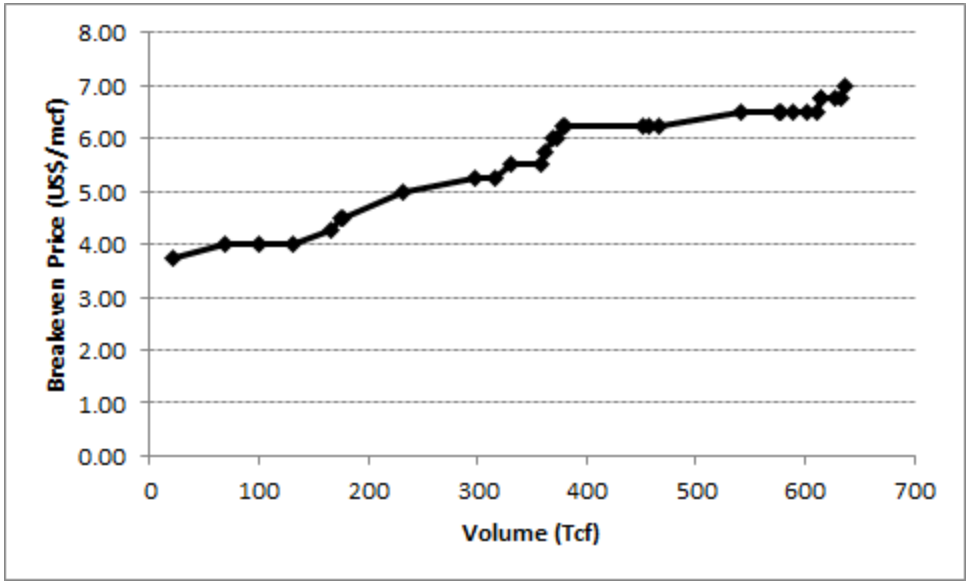
- If all the US and Canadian projects came online 185mt of LNG could be exported by 2020 (compared to a global LNG market of 330mt in 2011)
- The key criteria for a new liquefaction plant are FERC approval for construction and DoE approval for non-FTA exports – only Sabine Pass (Cheniere) has these to date
- Political decision on US exports expected in 2013, with the impact on domestic prices and industry being the key uncertainty

Key question is about domestic gas price impacts.

- EIA survey looked at three key issues – the volume of exports, how fast they might be introduced and how shale gas production might respond
- Base case with no exports sees HH price rising to an average of $5.80 over period to 2035
- Exports cause early peak in prices but levelling out as production responds
- Key issue is the supply response of shale gas output – in worst case scenario HH price could average almost $10/mmbtu
- US policy very uncertain. Range of outcomes from ban on exports (crude oil exports are banned) to free for all
- Auction of permits? Export tax ? (As in Russia). Fiscal terms
- Effects on competitiveness (hype) and on consumer incomes.
- Major uncertainties

Breakeven cost of shale gas production set to force an increase in Henry Hub price irrespective of exports

Cost curve for US shale output



- Consensus view is that current US shale gas production is not sustainable in the longer term at current price levels
- Liquids output and forward sales have mitigated low prices to date, but ultimately dry gas likely to be the marginal cost price setter
- Breakeven price likely to be in a $4-7/mmbtu range, with $5.50/mmbtu the mid point

Cost of US gas exports into Europe and Asia

Gas imports to the US and Asia

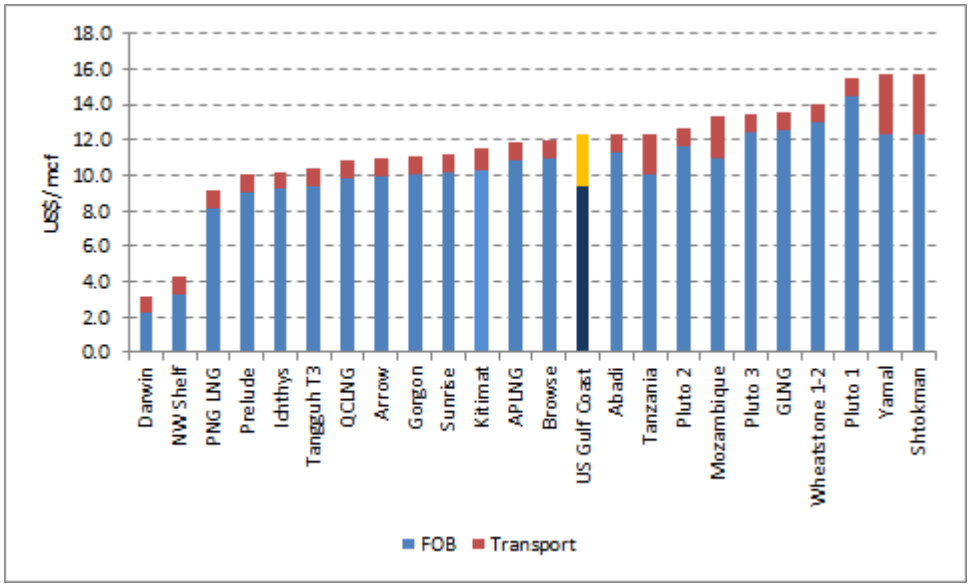
Henry Hub Price	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**10.0**
Liquefaction	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Transport to Europe	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Transport to Asia	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Regasification	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Full Cost Europe	**6.6**	**7.6**	**8.6**	**9.6**	**10.6**	**11.6**	**12.6**	**13.6**	**14.6**
Full Cost Asia	**8.4**	**9.4**	**10.4**	**11.4**	**12.4**	**13.4**	**14.4**	**15.4**	**16.4**

NB: does not assume 15% mark-up in Cheniere contracts

- Delivered cost to Europe or Asia includes upstream cost (or market cost), liquefaction, transport and regasification
  - Cheniere contracts include a 15% mark-up on Henry Hub price
- Delivered price to Asia assumes transport through a widened Panama Canal, where the tariff has yet to be confirmed
- At current (low) HH price delivered cost to Europe would be .c$8/mmbtu and to Asia would be $10.mmbtu
- Add about $2 for a more realistic assesment

Gas from US Gulf Coast would be competitive in Asia but would not cause a huge price shift

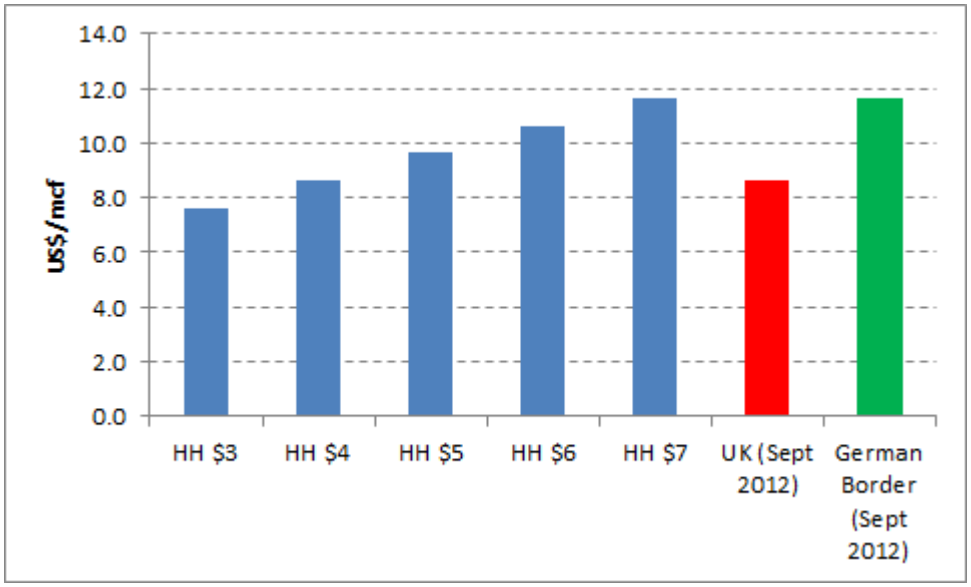
Breakeven delivered gas prices to Asia



- At a HH price of $5.50/mmbtu Sabine Pass LNG would sit in the middle of the cost curve to Asia
- Canadian LNG has a significant transport cost advantage but the initial capex for greenfield sites would be higher
- North American LNG would be unlikely to cause a large effect on prices, but is already changing the way in which price formation is being negotiated

In Europe US gas can again be competitive but is unlikely to cause a price crash

US gas export costs vs European prices



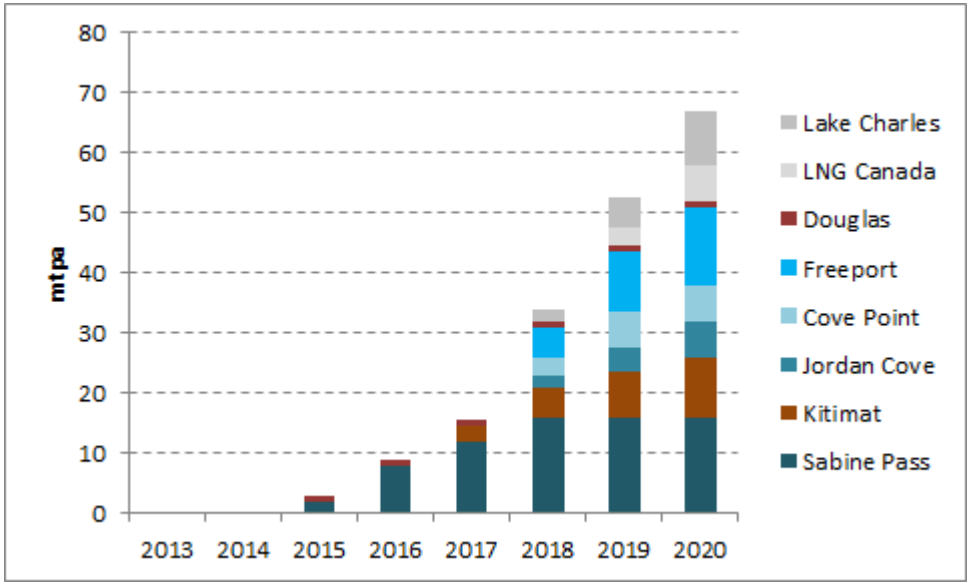
- US gas exports are likely to have a marginal impact in Europe
- A most likely delivered cost would be c.$10/mmbtu
- This would undercut current oil-linked contract prices, and would continue to do so unless the oil price falls back to c.$90-95 per barrel
- Price of US LNG imports to Europe can provide a benchmark for Gazprom if it seeks to be price competitive

Numerous Asian consumers are already involved in North American gas

- Supply contracts have already been signed with Cheniere Energy and with Kitimat in Canada
- Tolling agreements have been reached with a number of other potential liquefaction facilities
- Asian players have acquired significant gas assets across the US and Canada from which gas could be sourced for liquefaction
- Japanese and Chinese companies are most prevalent, but Korean and Indian companies are also taking upstream interests
- All these companies are likely to push for exports from North America, and can use their assets as negotiating tools with competing suppliers
- Would it be better to pay the price and invest elsewhere?

Likely outcome is total exports in the range 50-65mtpa by 2020

Estimate of North American LNG exports



- Application to FERC a key indicator of commitment to LNG exports
- Involvement of significant Asian partners may also catalyse developments
- 5 US projects and 3 Canadian projects seem most likely to move ahead by 2020
- Significant further development could push HH price to a level where exports become a less profitable option and could also cause political reaction

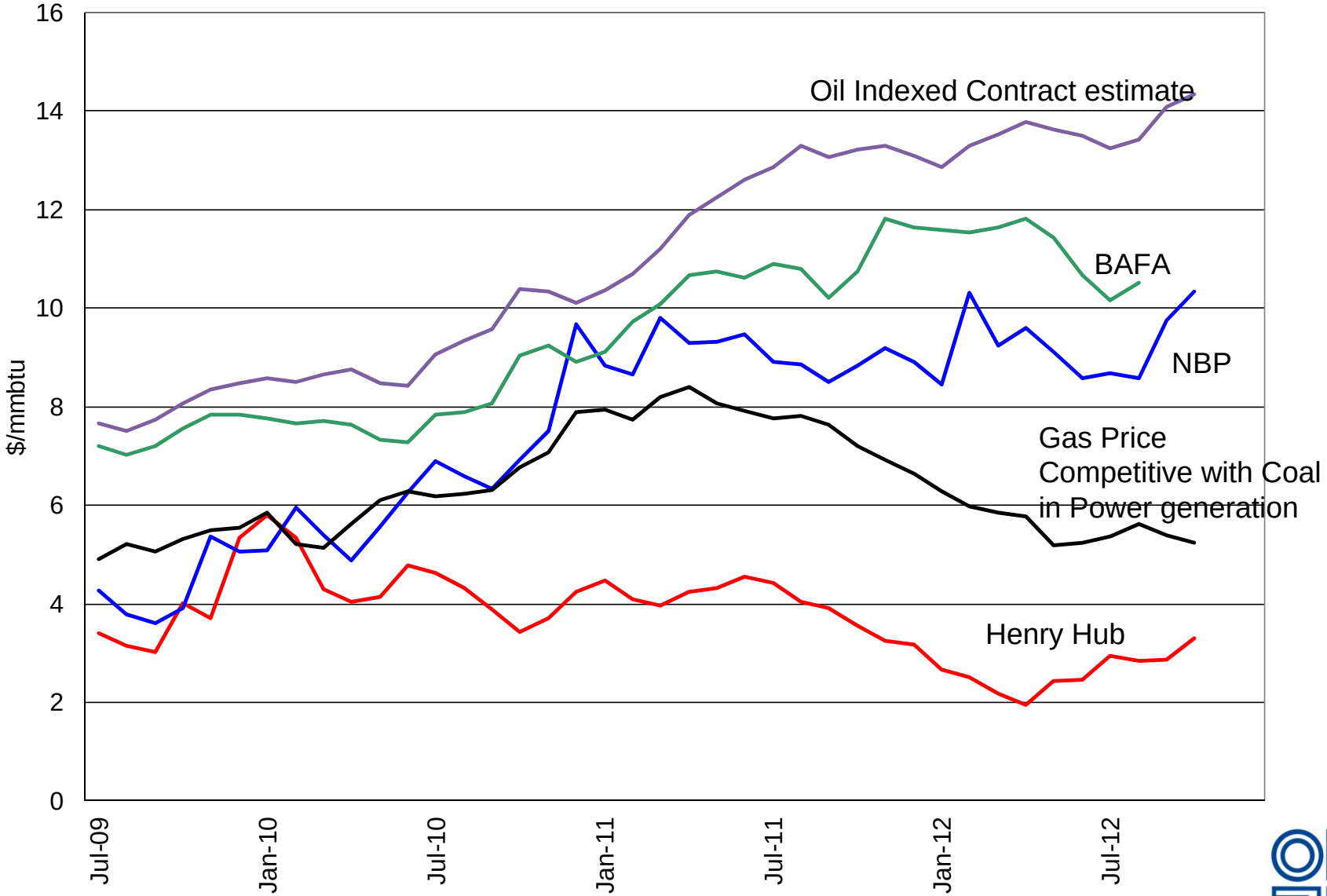
Prospect of North American gas exports already having an expectational impact on contracts and price formation

- The potential for North American LNG exports is undoubtedly large, and the current arbitrage opportunity is very tempting
- Political decisions will confirm or undermine the opportunity in 2013
- However, commercial considerations will play a greater role in limiting the overall size of export volumes
- North American exports are price competitive in Asia but sit in the middle of the cost curve
- In Europe US LNG exports are likely to act as a marginal price setter
- In both regions, though, the potential for HH-linked pricing has already caused a re-think of the price formation model

Price formation in Europe – and Asia

- Oil linked pricing breaking down
- The Groningen net back system
- Rise of European hubs – gas on gas competition
- Flexibility and renegotiation
- What accounts for the high prices in Asia?
- Competition policy and market structure
- Rusia and China

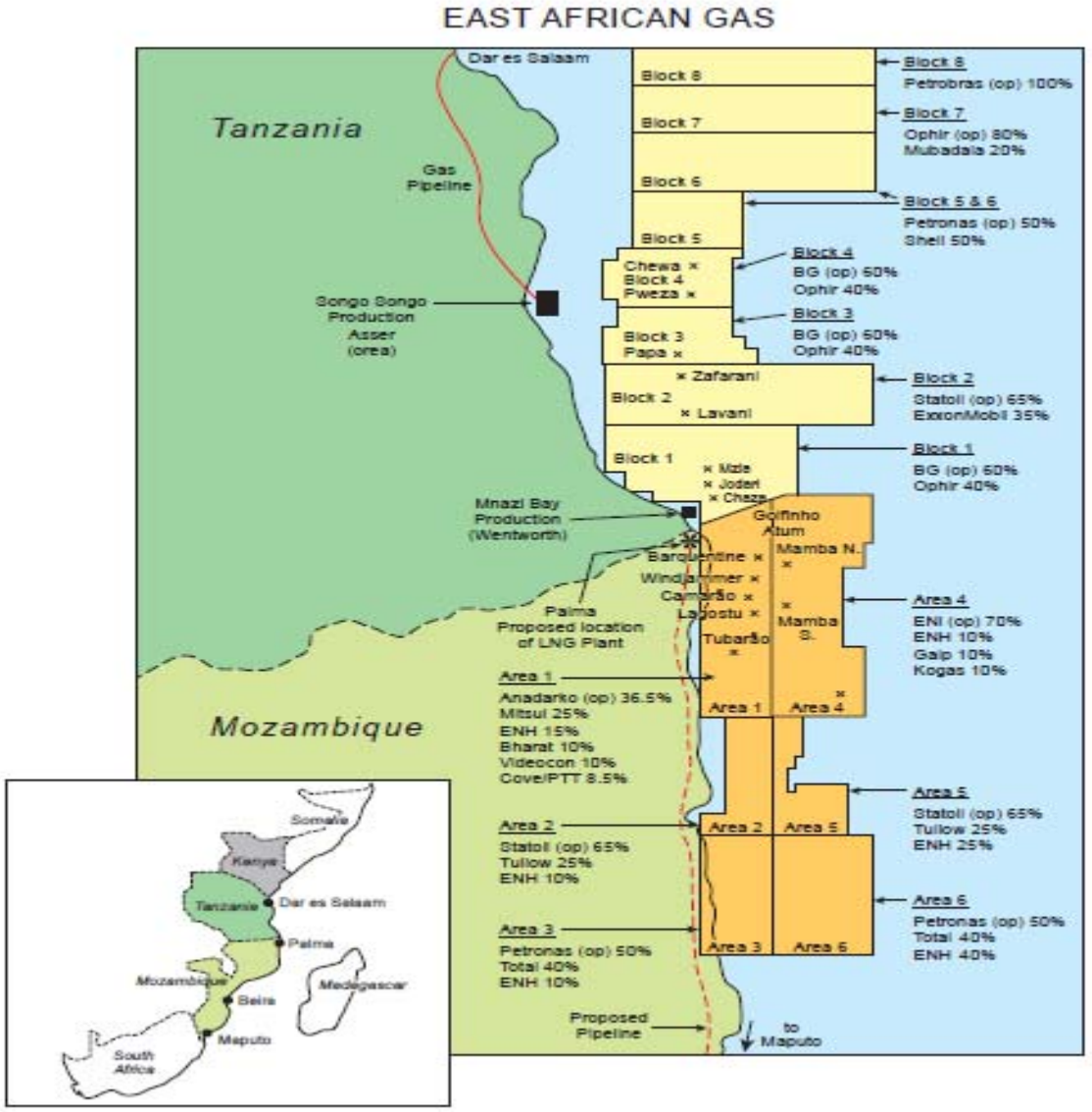
European Gas Prices vs Coal
June 2009 – October 2012

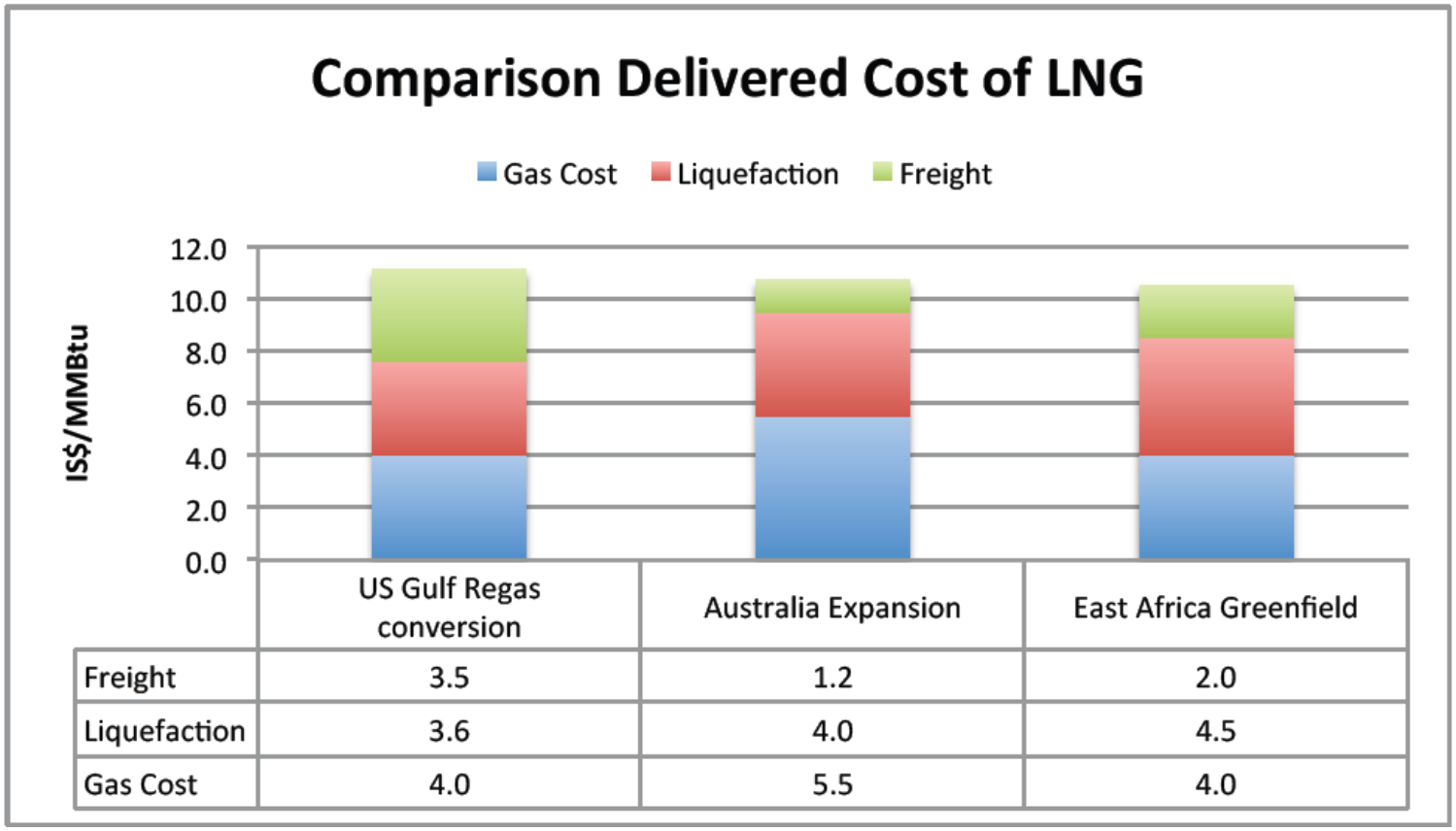


Source: Platts, BAFA, EIA, ICE, Argus, Own Analysis

What about East Africa?

- The potential
- Infrastructure and financing issues
- Costs and prices
- Managing the resource



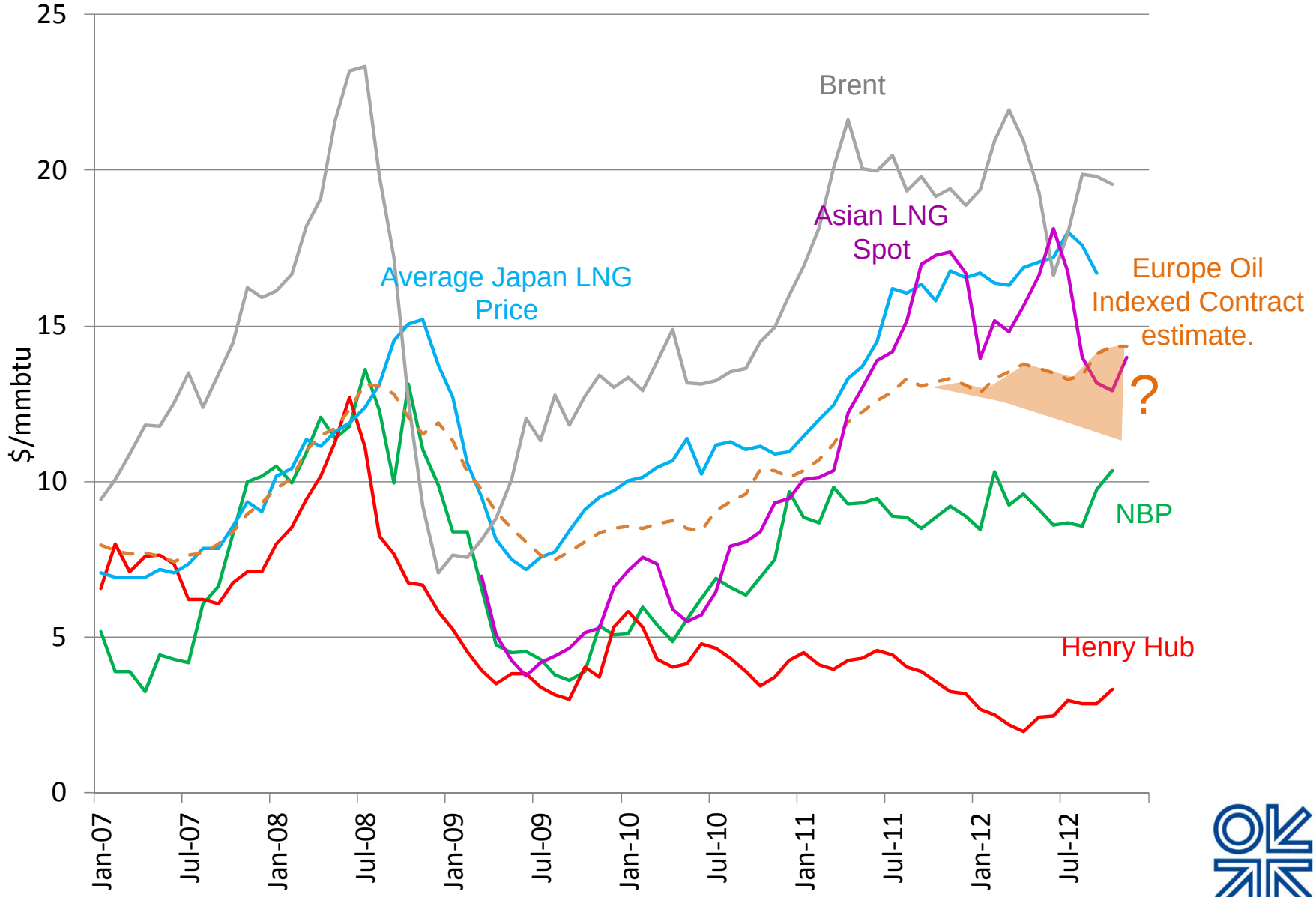


	US Gulf Regas conversion	Australia Expansion	East Africa Greenfield
Freight	3.5	1.2	2.0
Liquefaction	3.6	4.0	4.5
Gas Cost	4.0	5.5	4.0

Concluding remarks

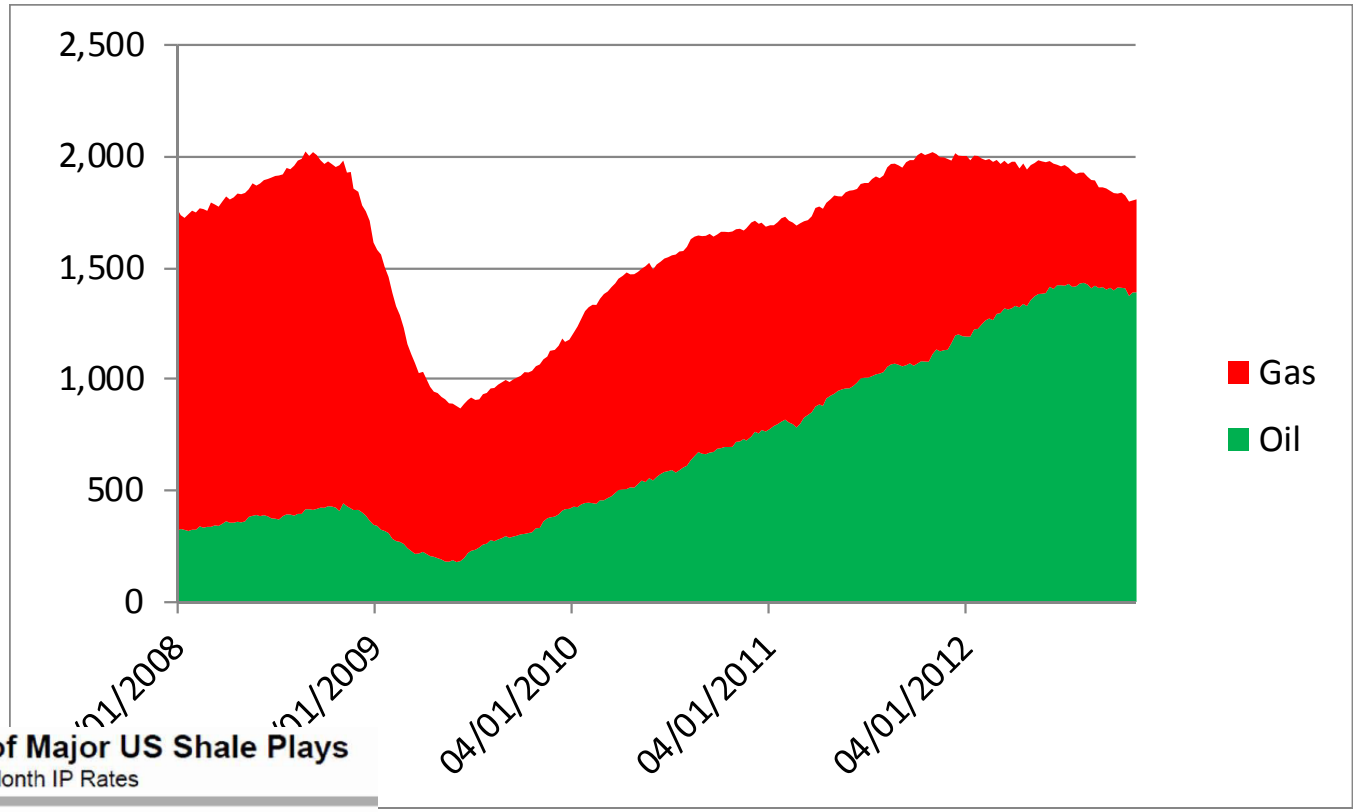
- There has been a marked turn in sentiment about the world economy – without much change in consensus-type medium term forecasts.
- Medium term scenarios help delineate possible futures – but, inevitably highlight uncertainty and the 'disconnect' between climate science and the industry.
- North American developments will have a large impact. Additional (tight) oil supplies could affect prices - unless there is an offsetting response from OPEC.
- Shale gas from N America is unlikely to be cheap.
- But do they mean that Russia has 'missed the boat' in supplying Asia? Dr Paik is the best person to answer this.

"Globalisation": how quickly can international "basis" develop?



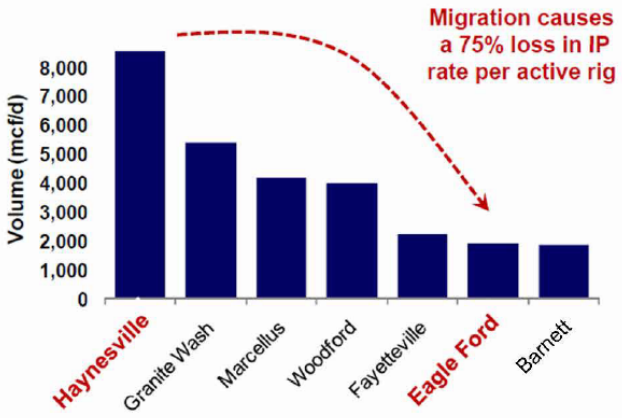
Sources: Argus, EIA, Platts, Own Analysis

US Oil and Gas Directed Drilling



Initial Gas Productivity of Major US Shale Plays

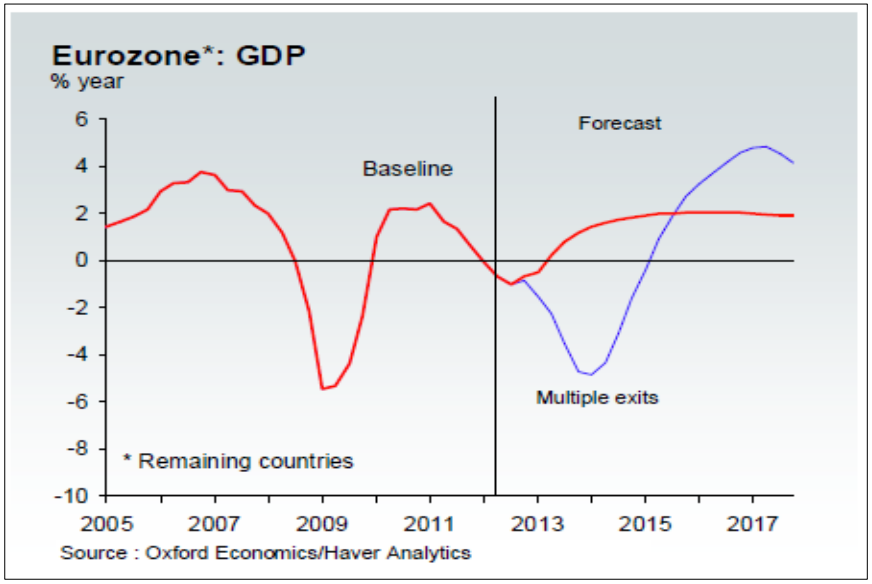
Average One Month IP Rates

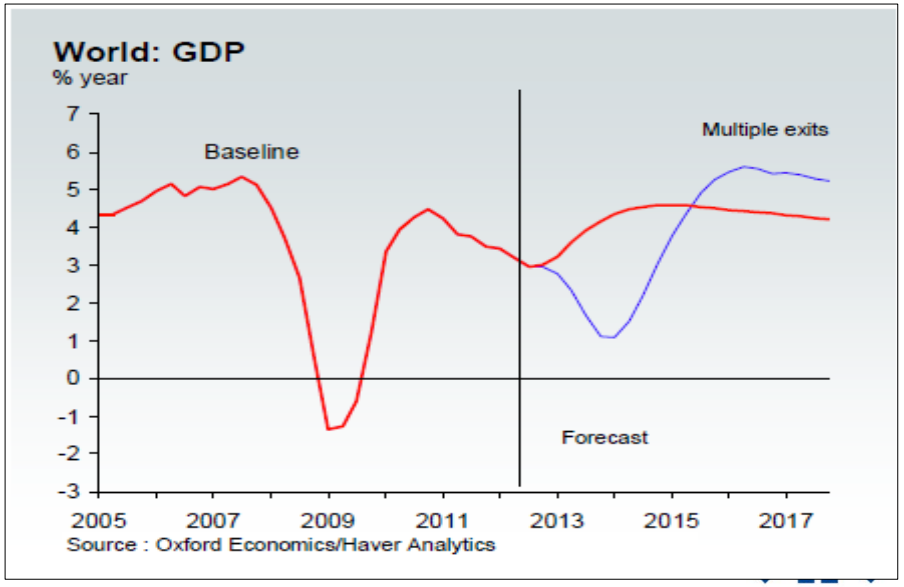


Source: Baker Hughes,
Arthur E Berman, Labyrinth Consulting Services

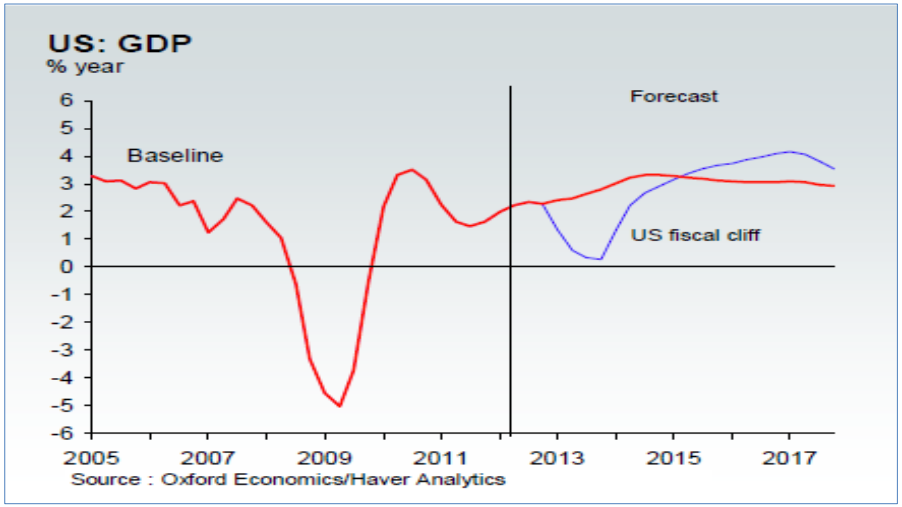
What if?

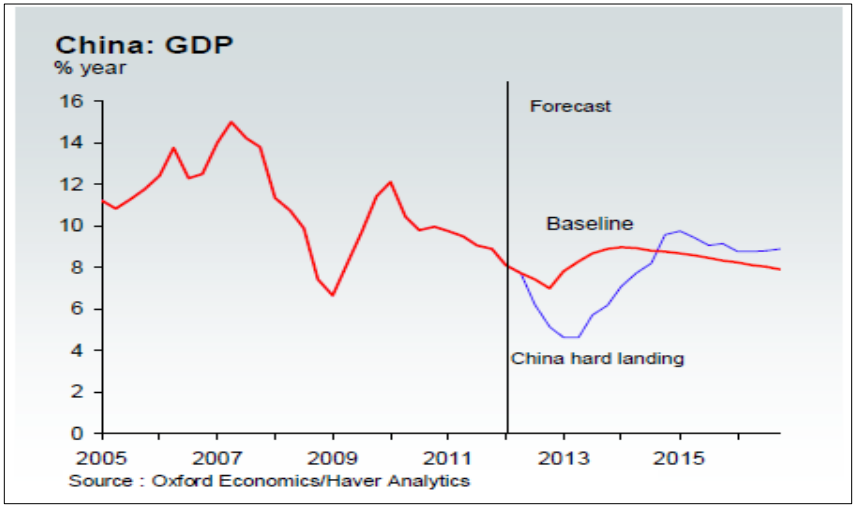
- Simulations are difficult – major uncertainties.
- Oxford Economics – about - 6 % growth in euro area after multiple exits. Major effect on world economy

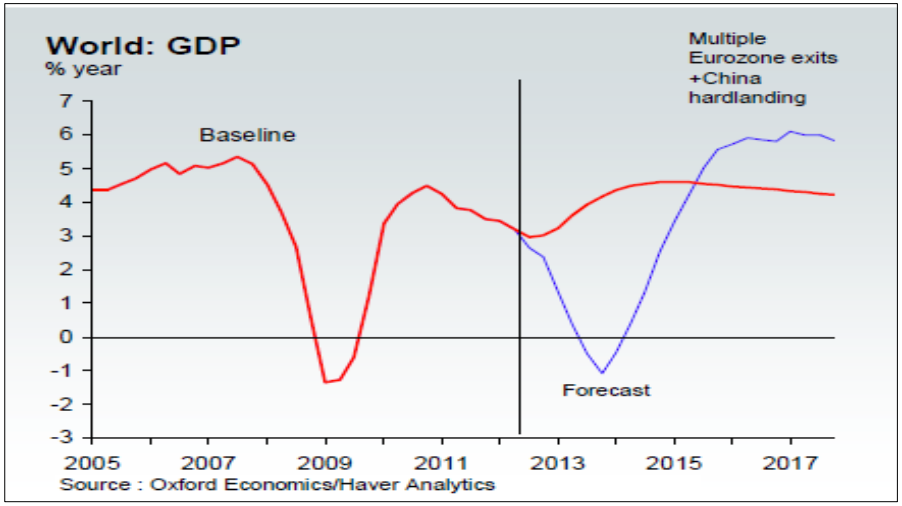


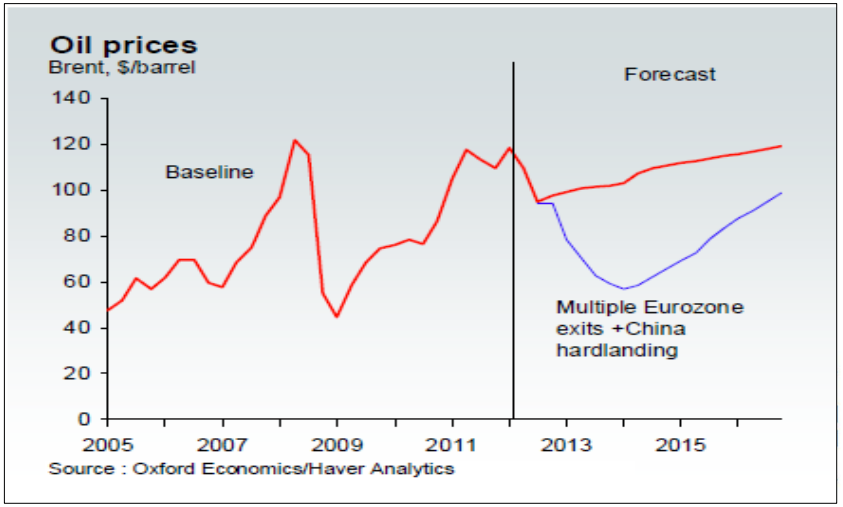


Other risks: fiscal cliff, China hard landing, Euro exits plus China hard landing









The political debate in Canada is still evolving and may limit future developments

- Canadian politicians have been very enthusiastic about increased economic inks with Asia, seeing energy as a key plank in this strategy
- However, this enthusiasm may be tempered by a number of concerns
- Nexen and Progress Energy deals highlight concerns over Asian influence in Canada
- Environmental lobbies against gas industry development are increasing their complaints
  - Development of shale gas
  - Pipeline routes
  - Shipping routes from Kitimat
- Some projects also remain fixated with oil-linked pricing (e.g. Kitimat) which would reduce competitiveness. (this is likely to change)

Contact: report@tky.ieej.or.jp