Never Say Never Again: The Changing Landscape for Gas

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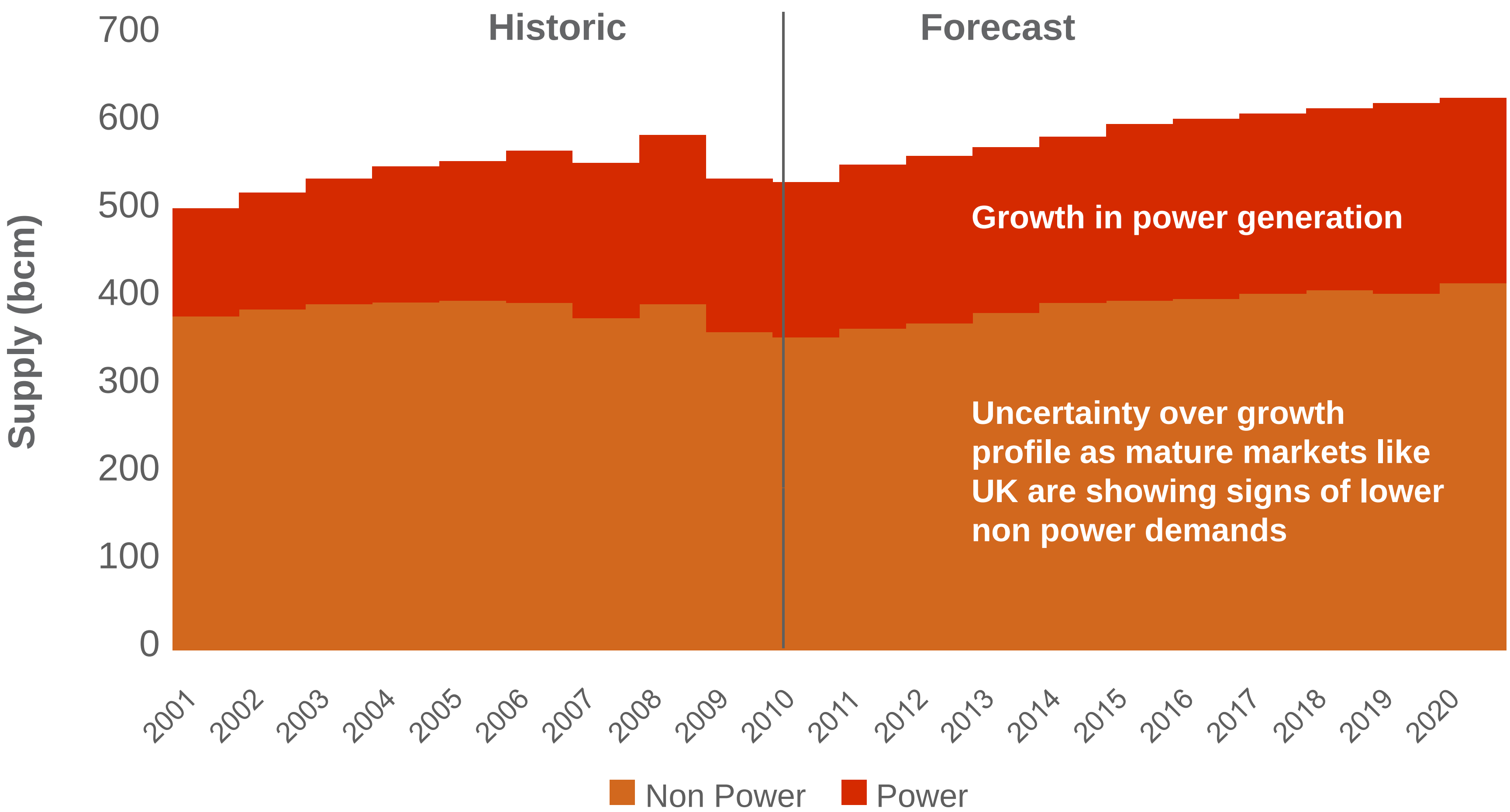
Agenda

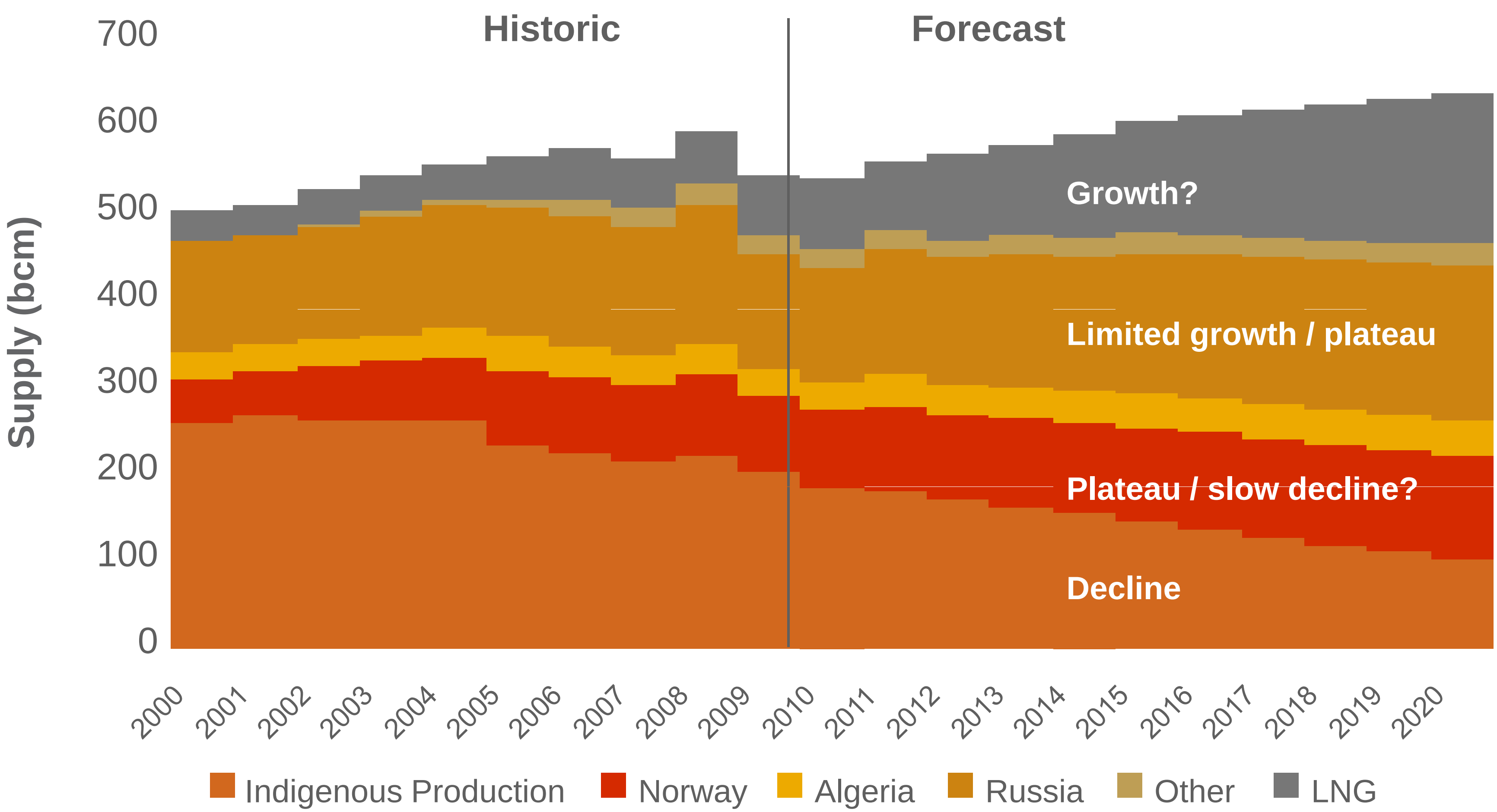
- European supply and demand
- European supply infrastructure
- LNG – Global and US
- Shale – US and Europe?
- UK
  - LNG imports
  - Future supply mix
  - Further changes ahead?

European gas demand



Source: National Grid. Wood Mackenzie / CERA

European supplies



Source National Grid / CERA

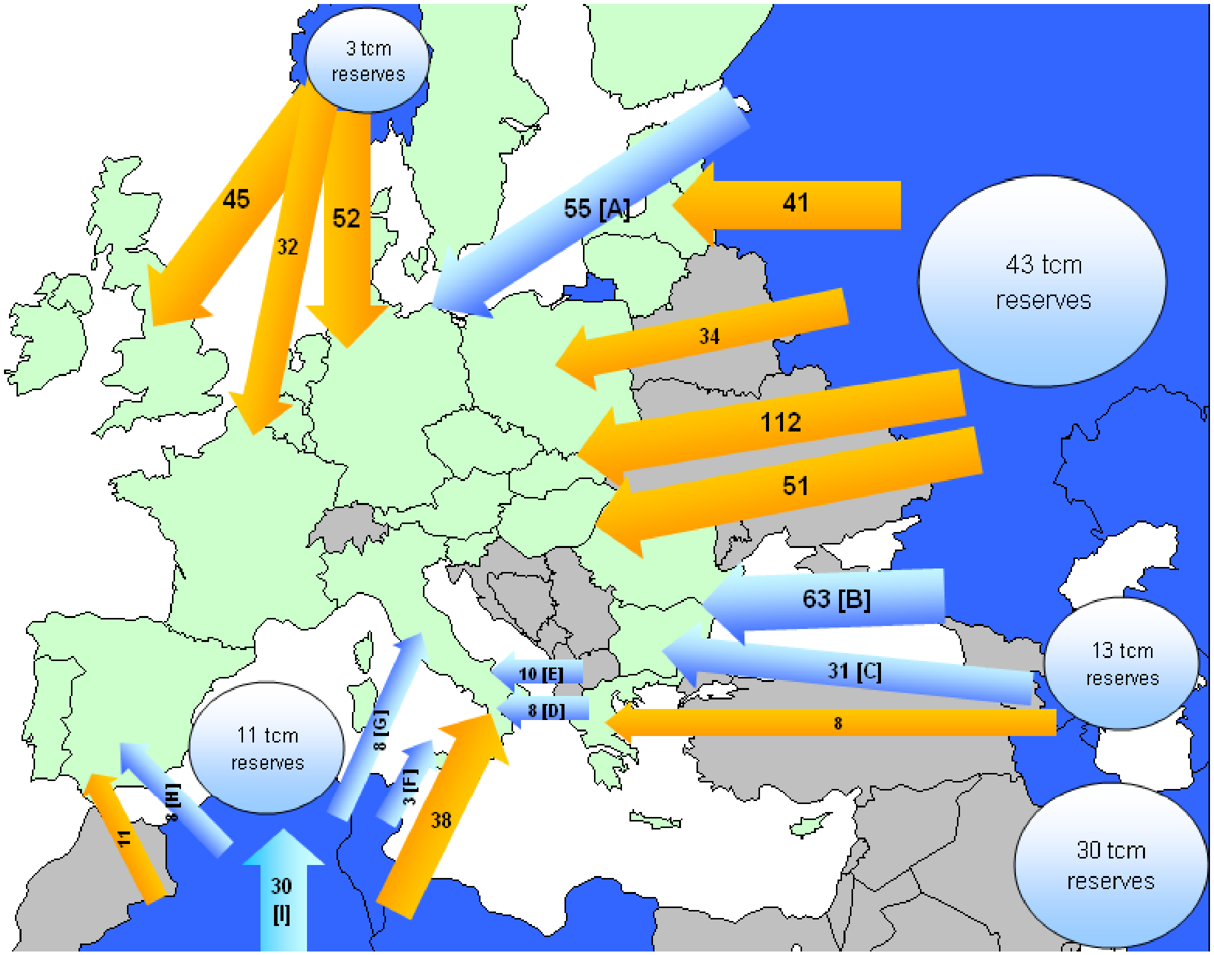
European pipeline map

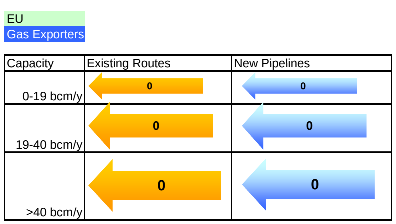
A **Nord Stream**

B **South Stream**

C **Nabucco**

Completion of Nord Stream and South Stream could fully mitigate exports through Ukraine

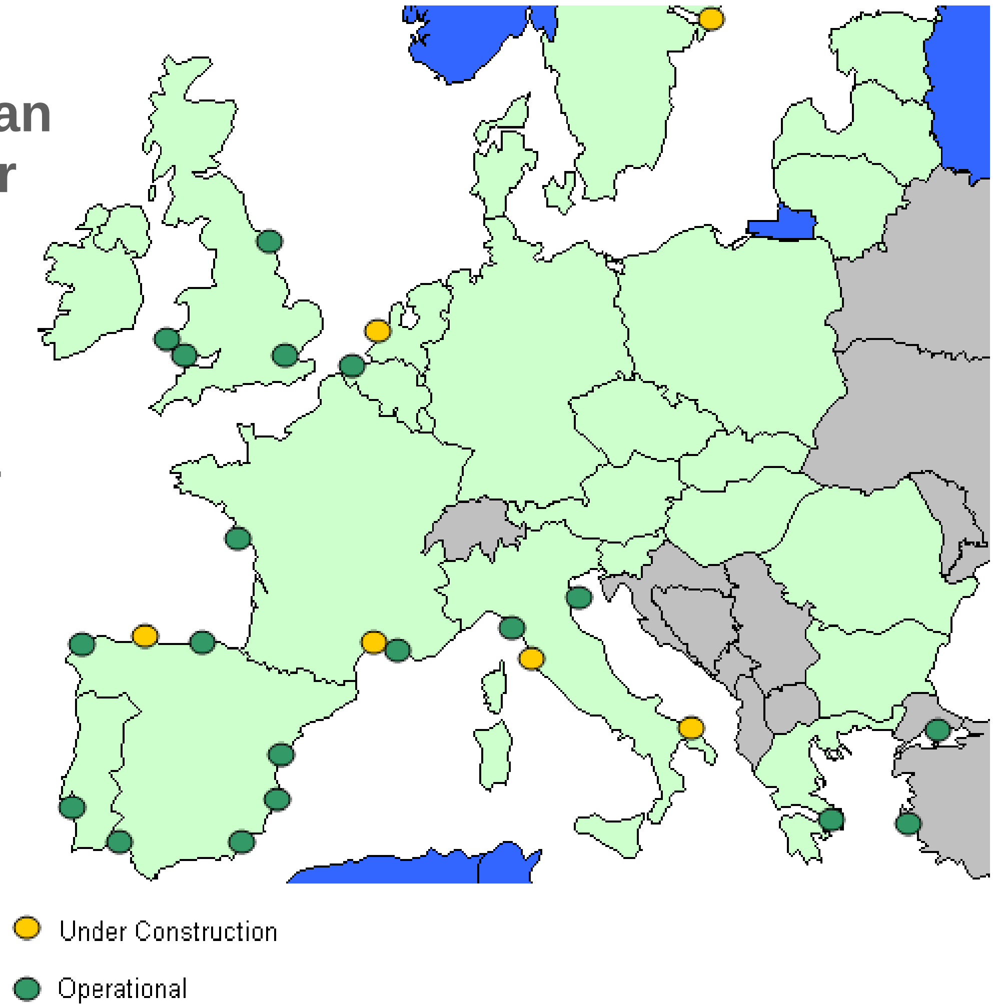




Source National Grid, BP, ENI, GTE, IEA

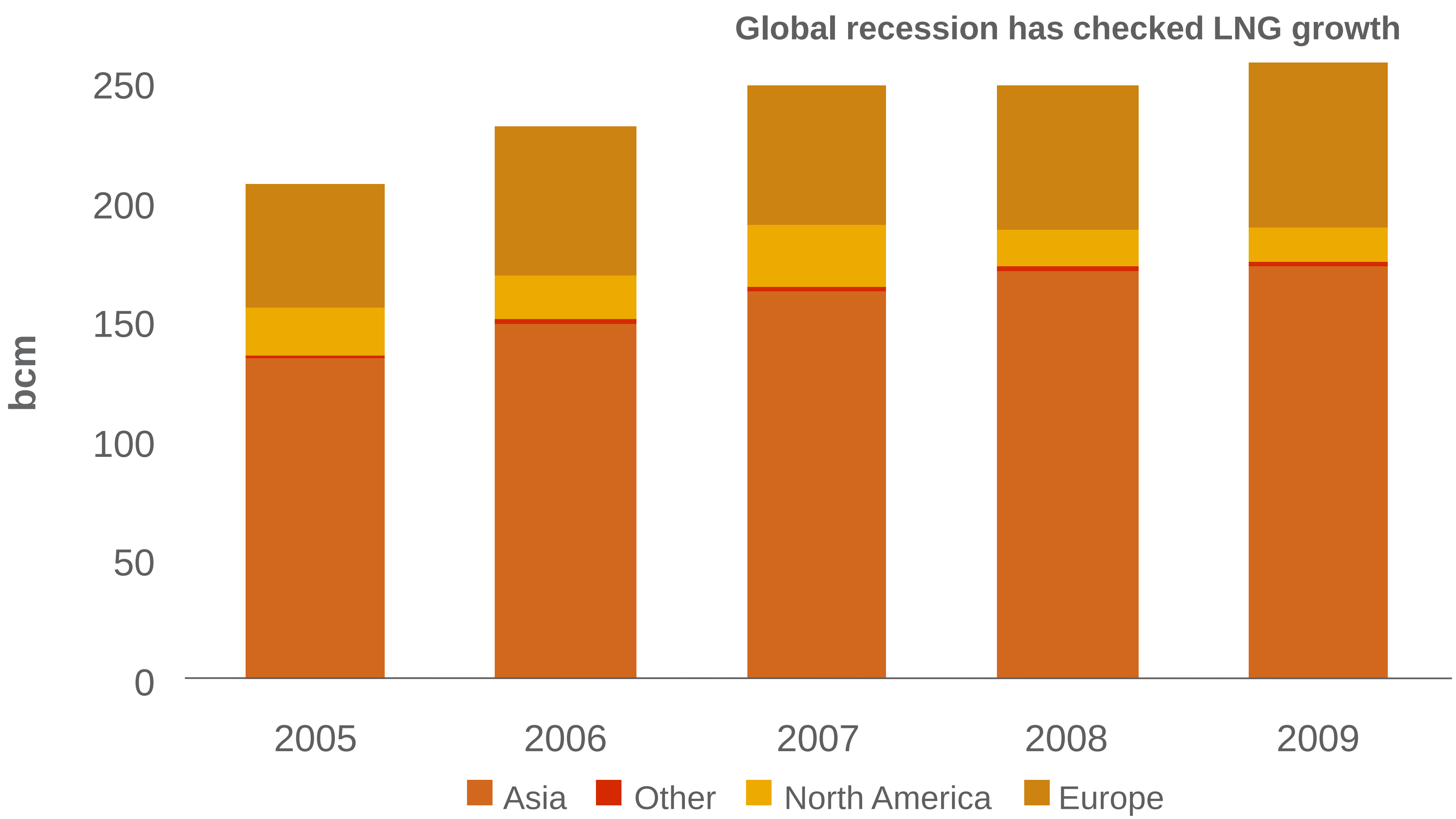
European LNG map

- Global, US and European LNG import capacity far exceeds utilisation
- Typical ratio of LNG regasification to production is about 3:1



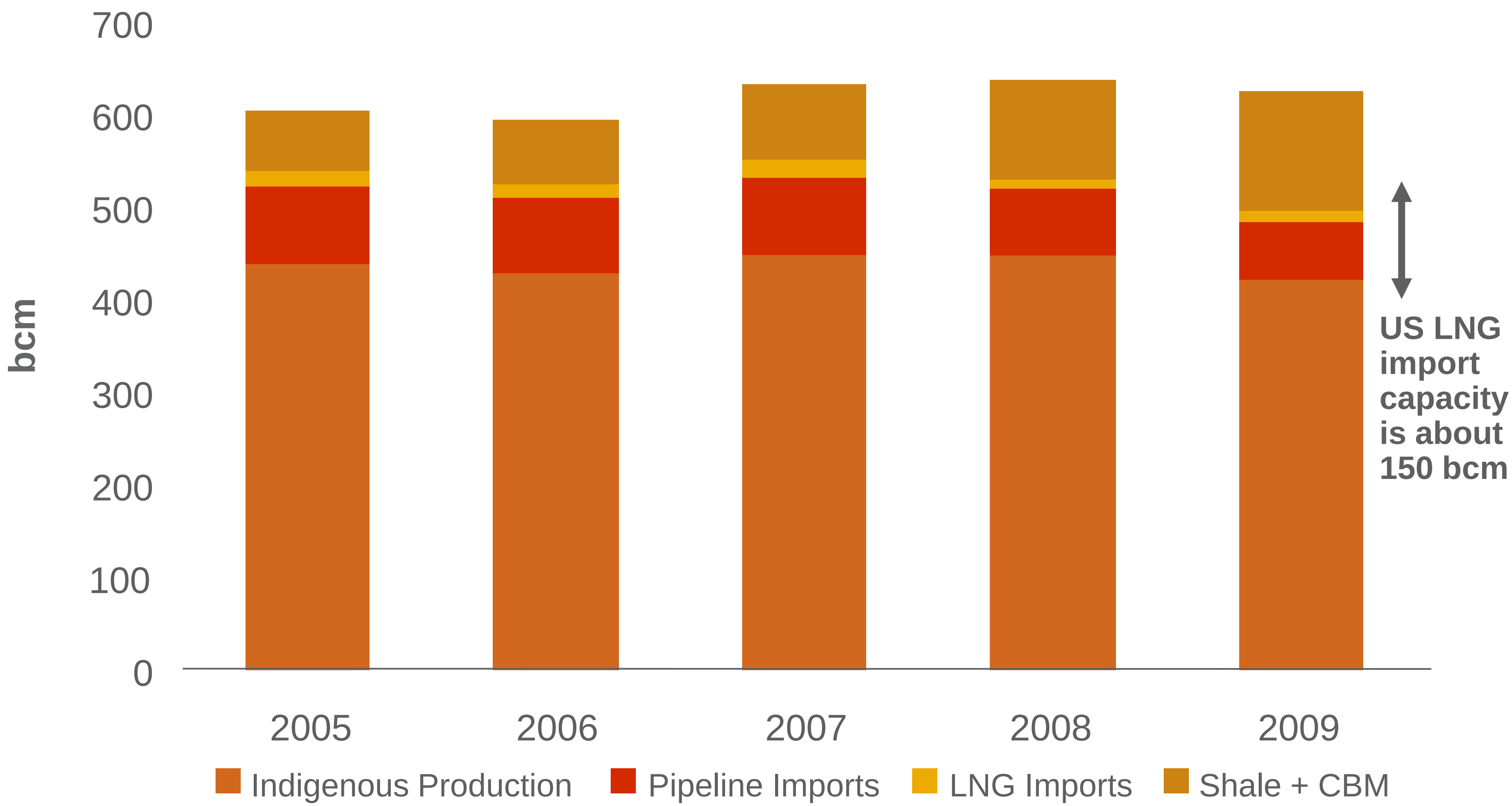
Source: National Grid

LNG markets



Source: BP / others

US market



Source: EIA

LNG and Shale – the game changer?

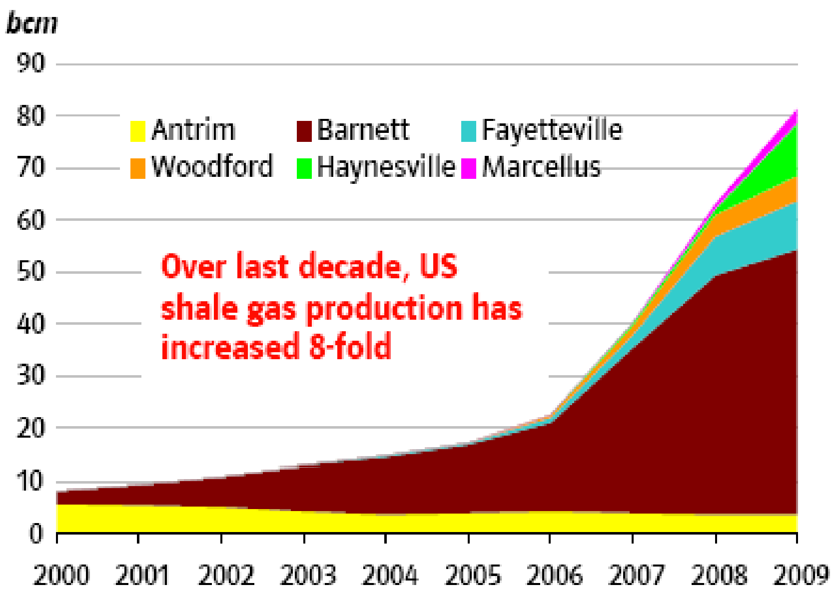
- US LNG import capacity developed to meet longer term US gas shortfall arising through lower indigenous production and lower pipeline imports
- **BUT** non conventional US gas developments (notably Shale) have limited US LNG import needs, despite low prices
- Global recession and low US LNG imports have provided excess LNG to alternative markets, notably UK
- UK and other spot market gas is now priced much lower than 'oil indexed' contracted gas leading to pressures to break indexation
- To change the current supply / low price position:
  - Increased global LNG demand – China and India
  - Lower US non conventional gas due to depressed US price
  - More 'managed' gas production from producers

Shale summary

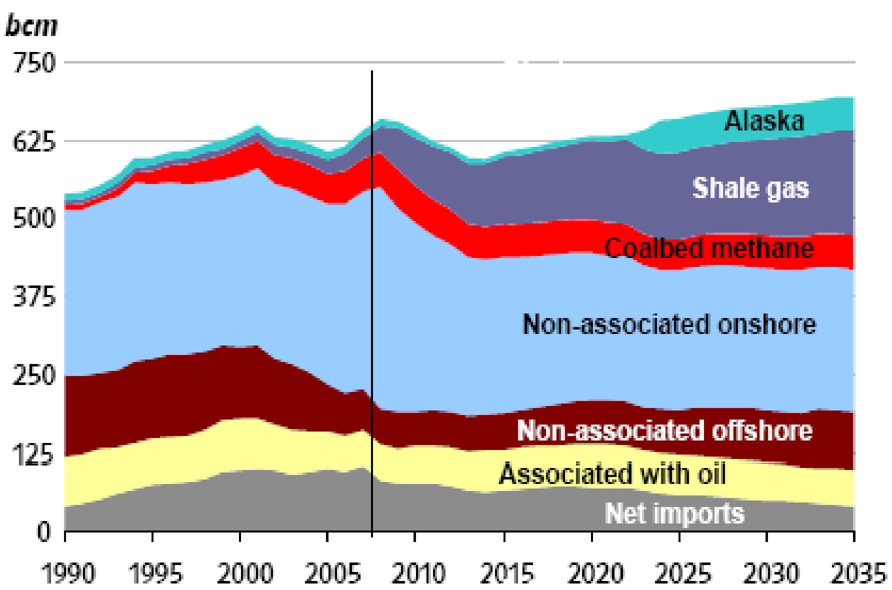
- Challenges: very complex technically and operationally
  – Horizontal wells
  – Multi-stage fracturing with large volumes of water and sand
  – Completions designed to maximise production while protecting environment
- High initial production costs
  – High well density requires significant surface footprint
  – Field development requires large number and efficient use of equipment and personnel
- Why Shale Gas Development?
  – US examples shows us success is possible
  – If managed properly – very high Inflow performance and long term steady production
  – Costs in Europe estimated to be 3 times USA

US shale and total production

Shale Gas production in the US



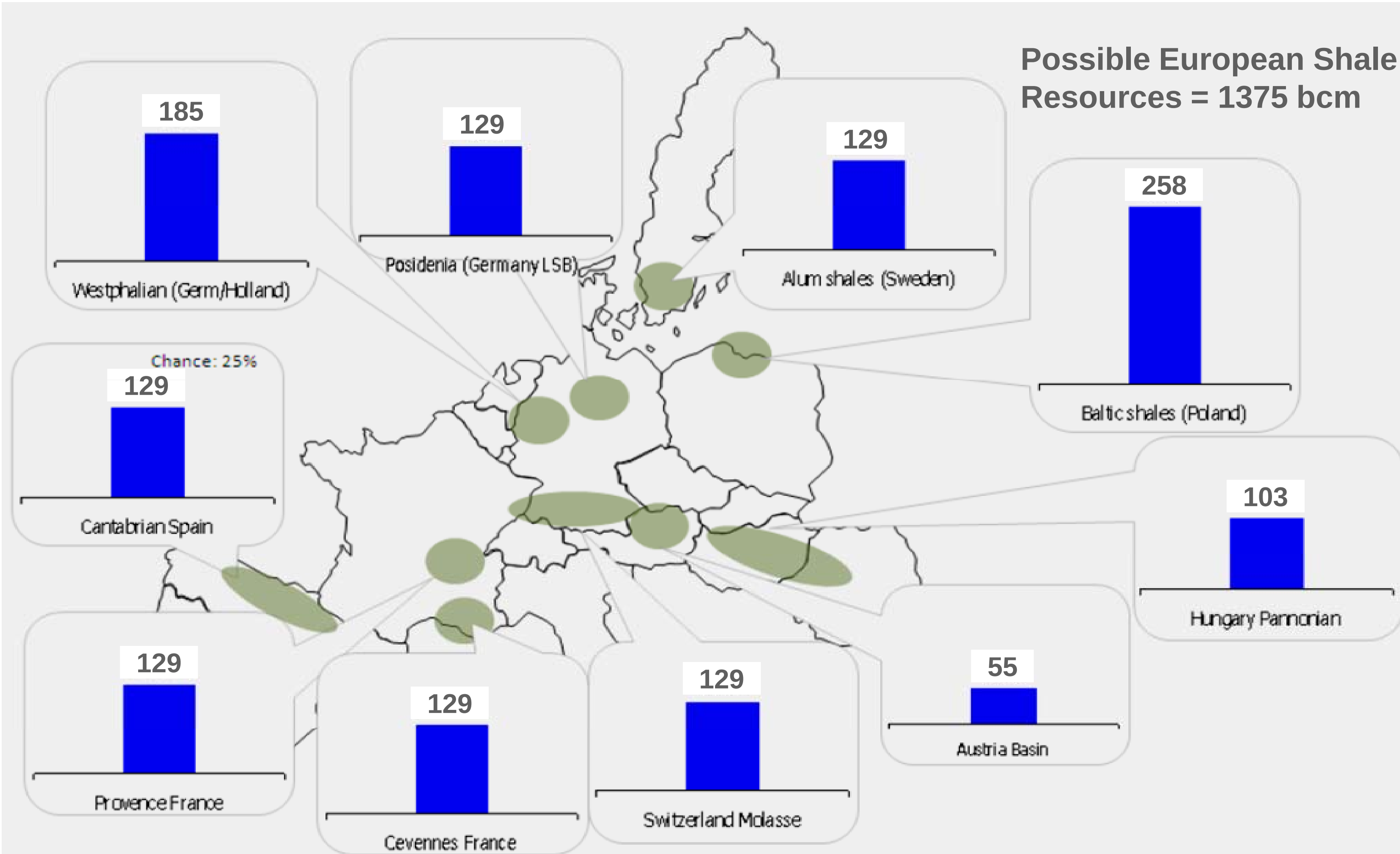
US total gas production



Following years of little or no growth, US gas production is forecast to grow through Shale resulting in lower imports, hence anticipated less need for LNG

Source: EIA, Richard Newell (02-03-2010)

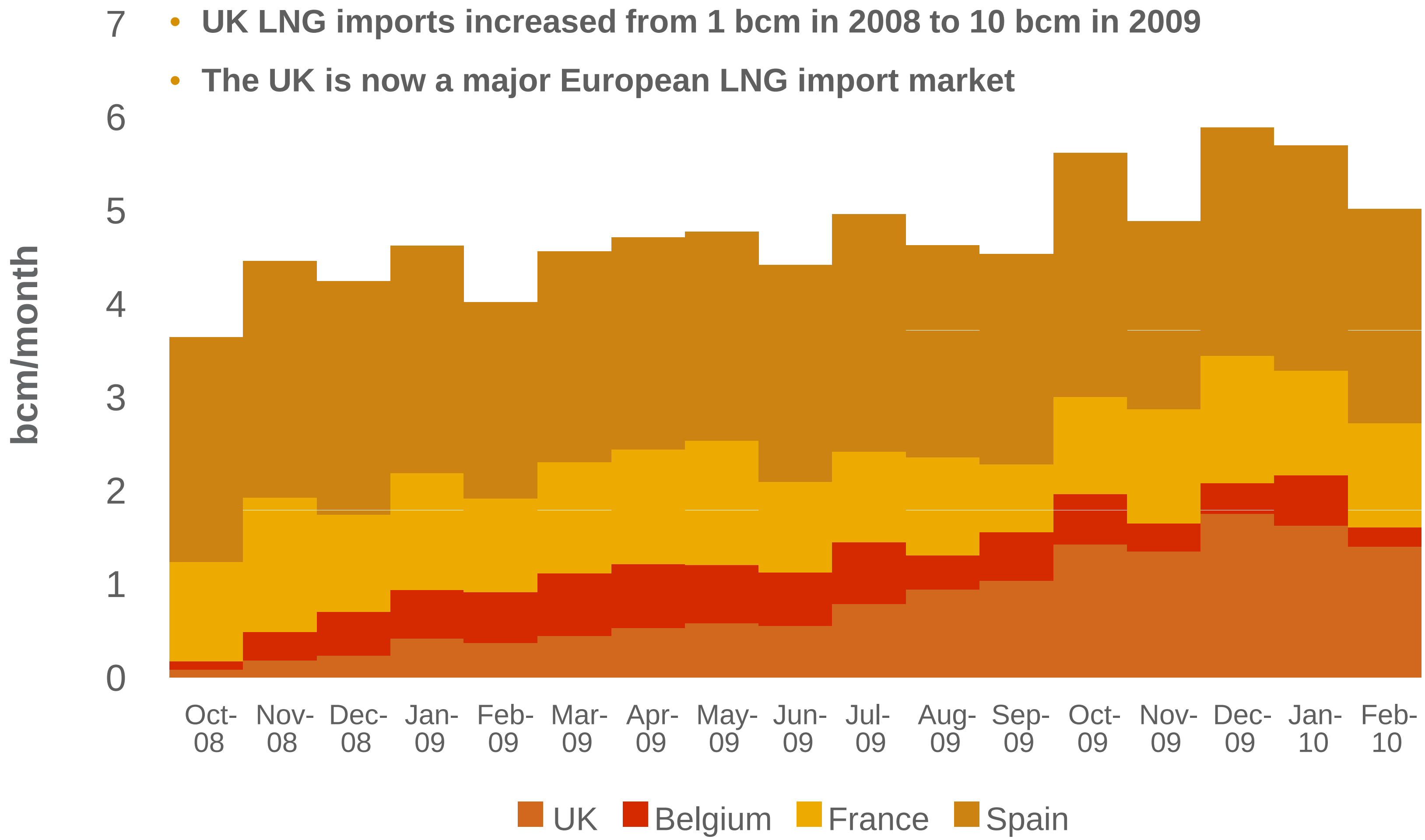
Estimated shale resources Europe (bcm)



Source: EPRC

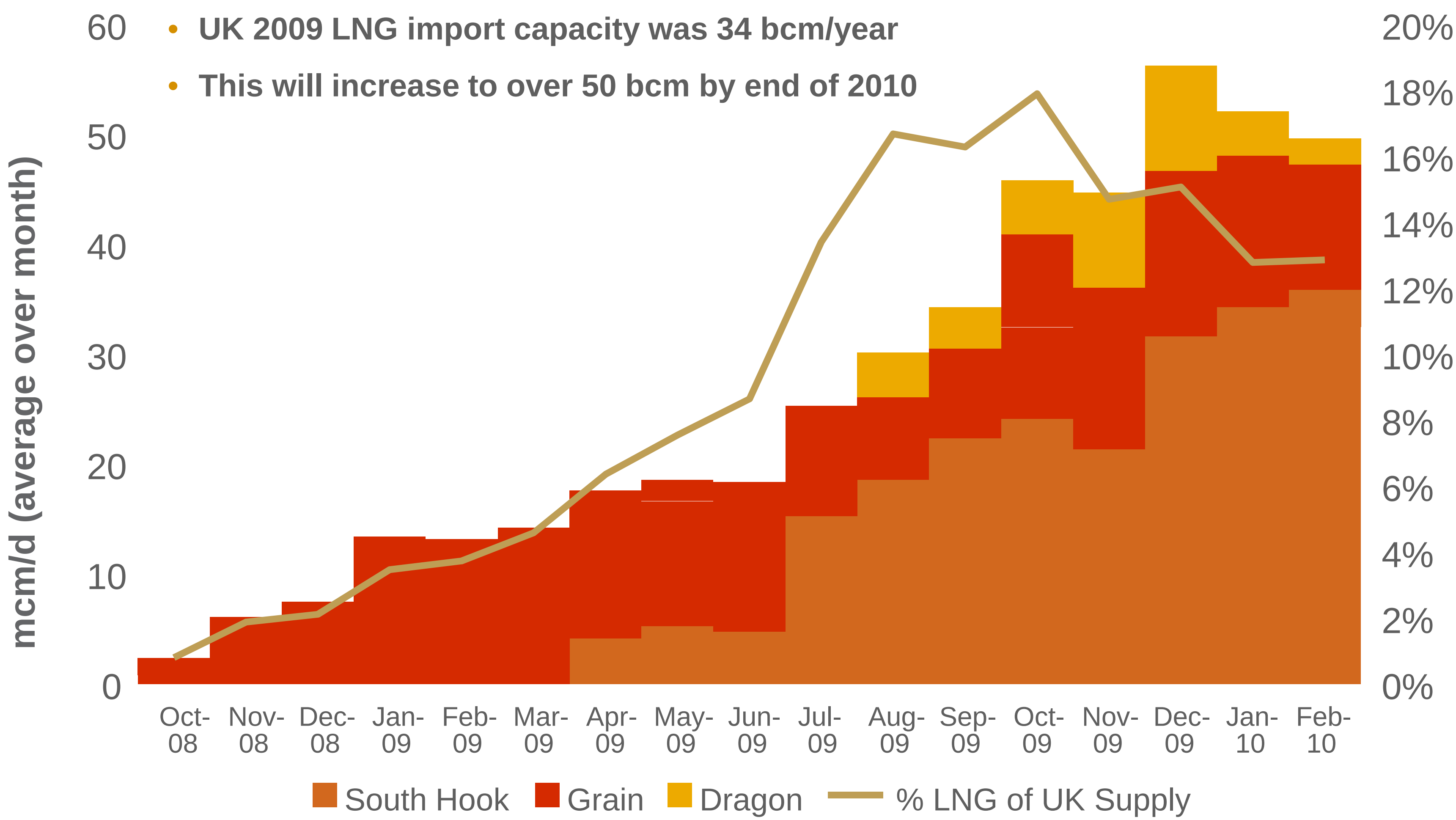
UK becomes a major European LNG importer

- UK LNG imports increased from 1 bcm in 2008 to 10 bcm in 2009
- The UK is now a major European LNG import market

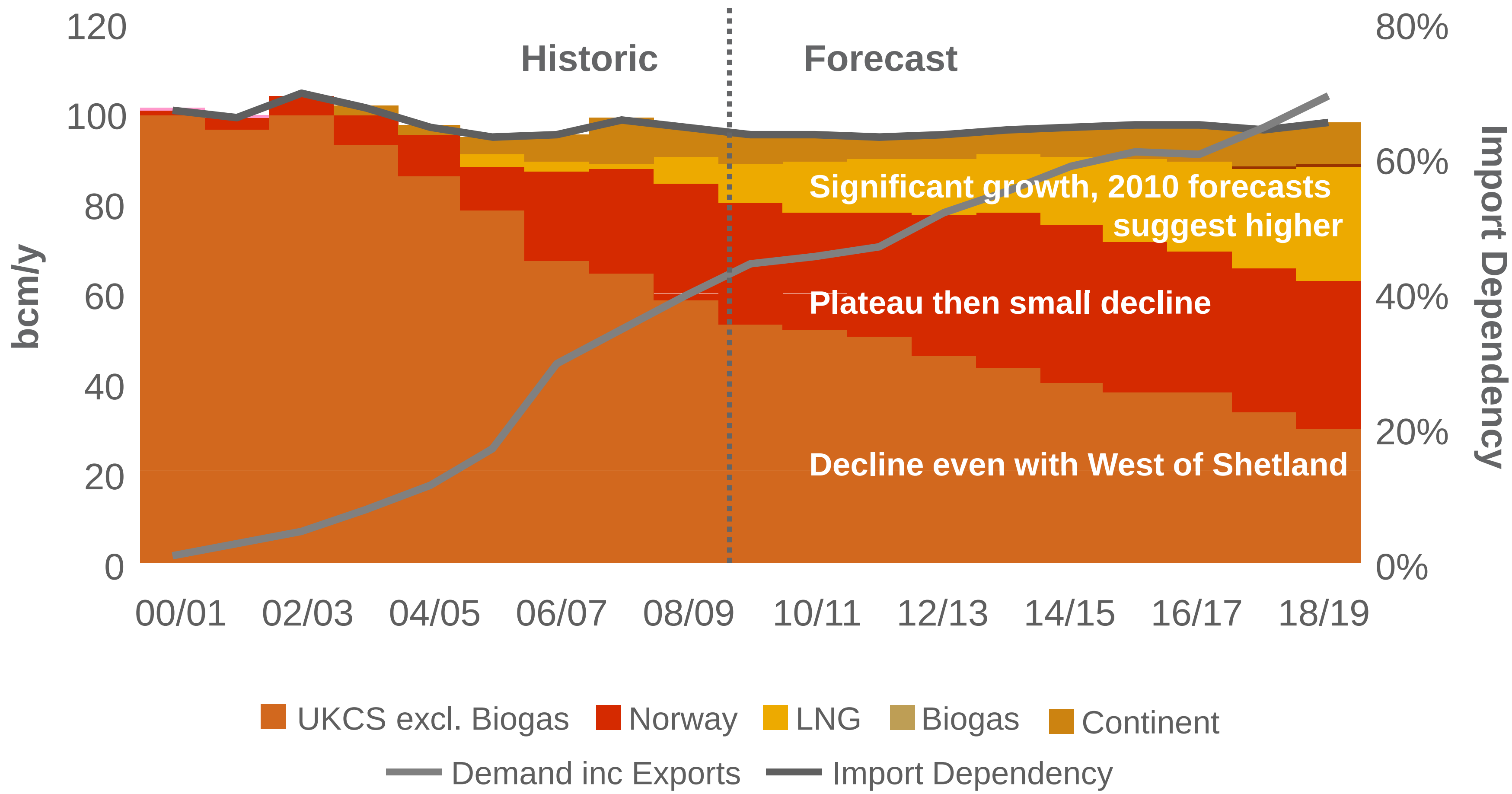


Source: National Grid, Fluxys, Enagas, GRTgaz

UK LNG deliveries



UK historic and forecast supplies



Drivers of change

- Fundamental changes in UK gas flows to continue as UKCS declines to 20% by 2020
  - Until recently supplies, demand and system flows have been predictable
  - New order typified by higher supply uncertainty and wider permutations of flow
  - Increasing evidence of price sensitivity in use of CCGT and lower domestic demand through higher gas price / improved appliance efficiencies and insulation
  - Though demand may reduce out to 2020 and beyond, requirements for system flexibility are increasing
  - Considerable storage is planned for the UK but very little is under construction

Drivers of change (cont.)

- EU renewable targets driving growth in wind, and creating greater intermittency in CCGT operation
- UK network may increasingly become a European transit route, rather than an extremity
  - Increasing reliance on imports and growth in interconnectors may lead to more volatile gas flows
- Nature of UK market can lead to a glut of gas in country when conditions are favourable, but scarcity of supply during European or worldwide shortages
- Longer term, decarbonisation of energy will further change the role of gas
  - Gas CCS?
  - Biogas?