Understanding the UK's energy needs: from natural gas to renewables

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Understanding the UK's energy needs…

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… from natural gas to renewables

- UK natural gas and electricity supply
- Challenges facing grid infrastructure
- Energy needs in the context of decarbonisation
- Infrastructure transitions
- Barriers to investment and clean power transition

UK natural gas: a brief history

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1964: first North Sea gas field discovered

- 1966: first commercial-size discovery in 1966
- 1968: commercial production begins

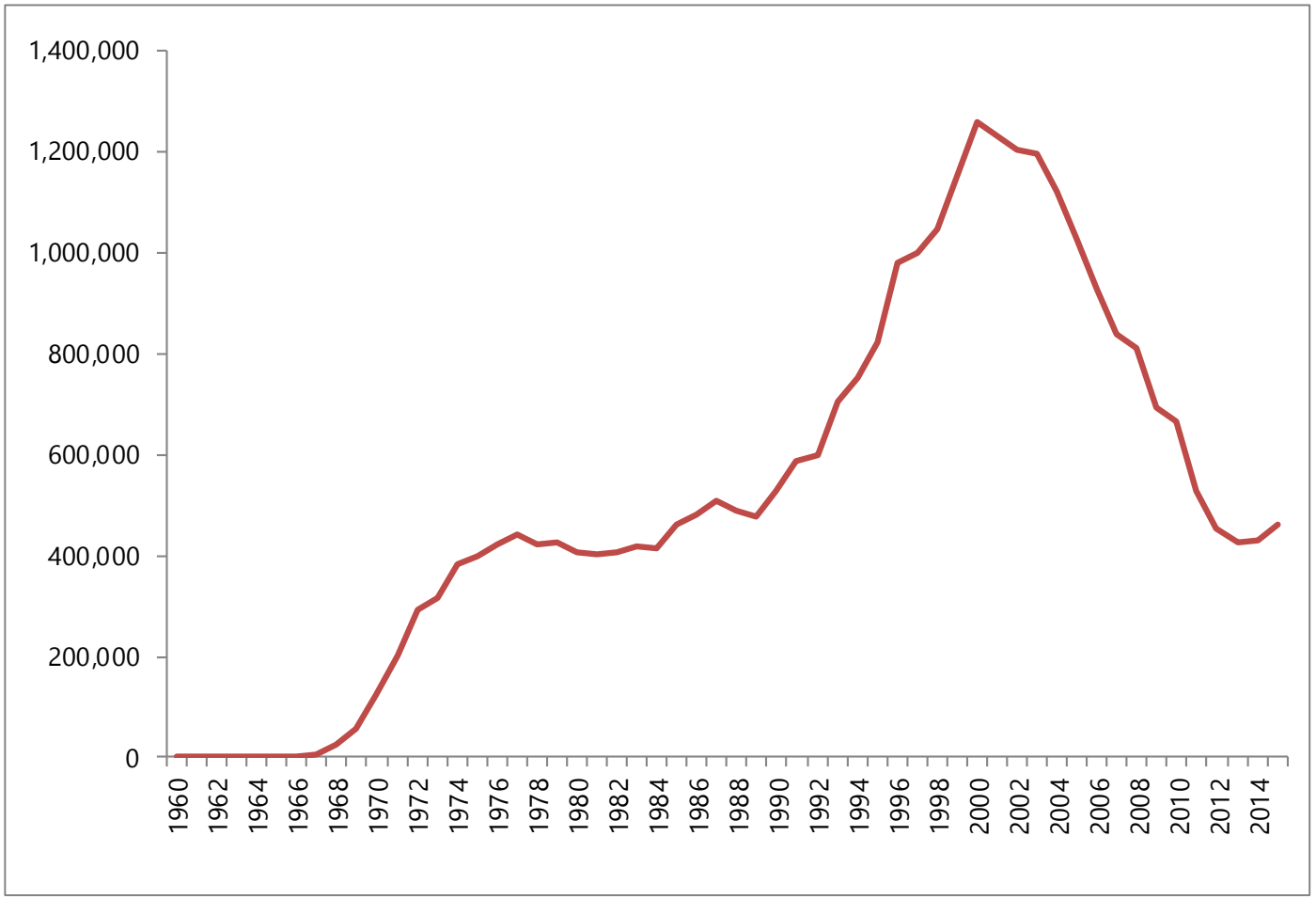
1970s: construction of national grid across the UK

- Gas import beach terminals and pipelines
- Conversion of domestic grid and appliances

1990s: 'Dash for Gas' and a new generation of CCGTs

- Change of rules on using gas for power generation
- **1992**: First CCGT commissioned
- **1999**: 16GW on the network (23pc of capacity)

UK gas production has peaked



UK natural gas production 1960-2014, GWh

BEIS (2016)

Changing face of power generation

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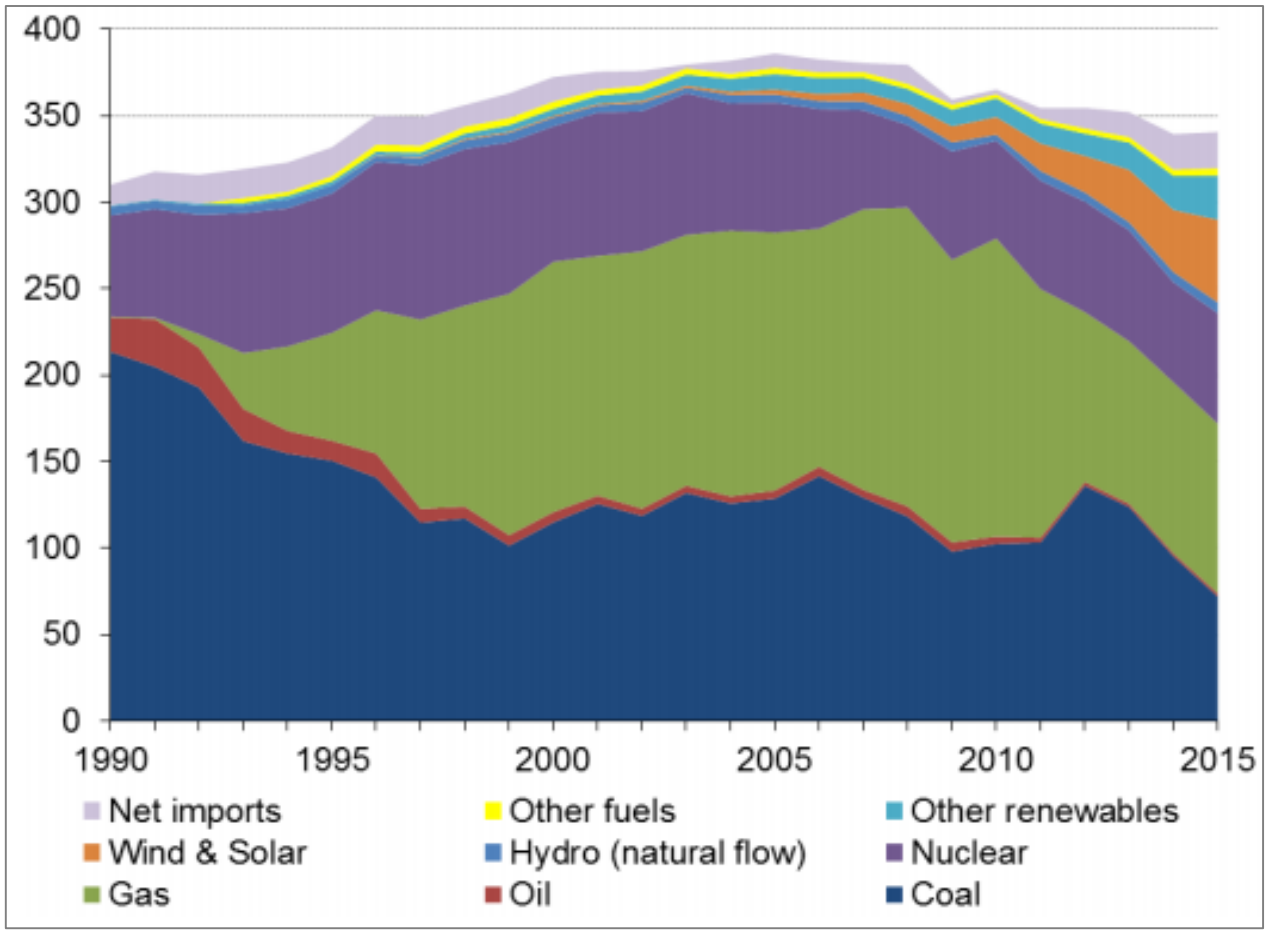
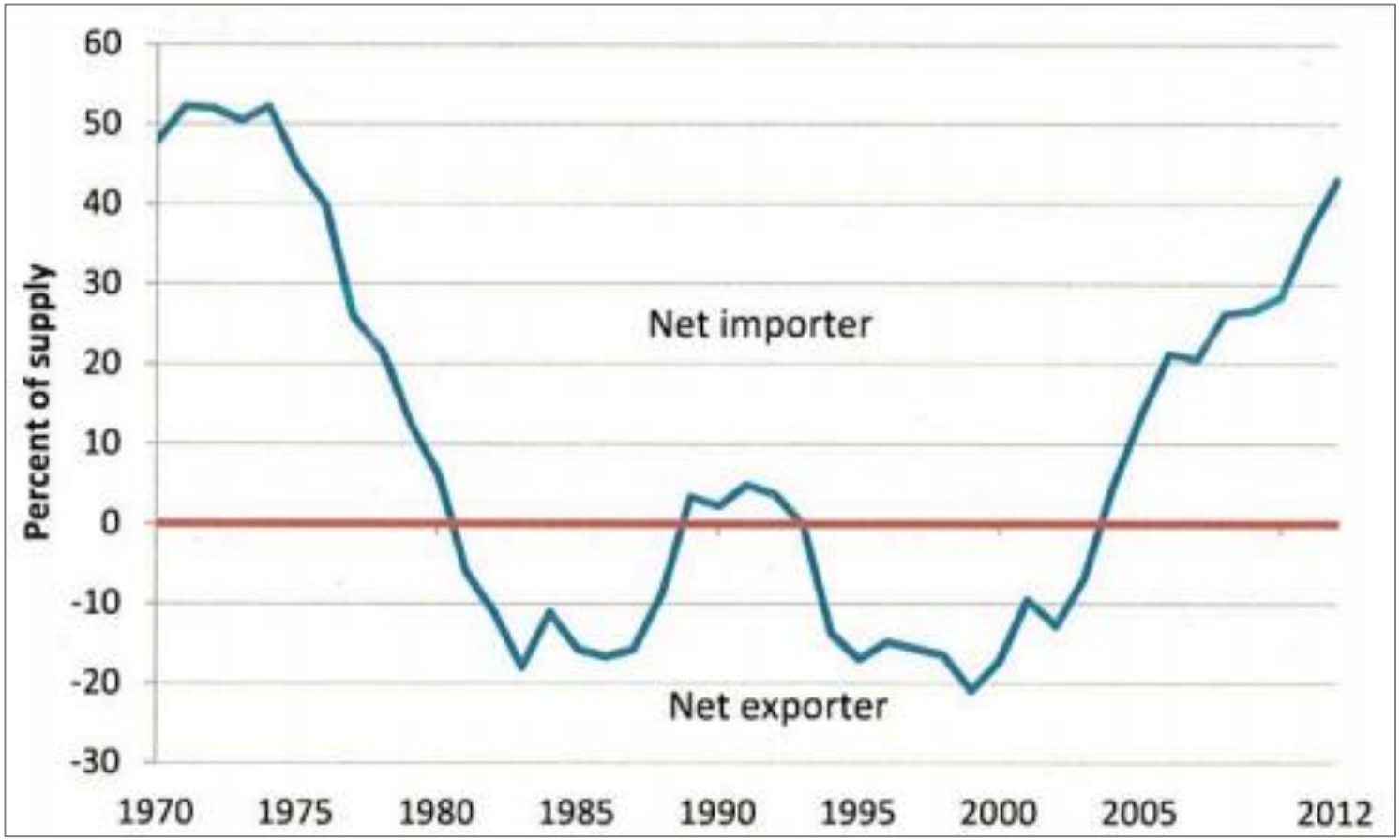


UK electricity generation by source 1990-2015, TWh

BEIS (2016)

UK gas import dependency



UK natural gas import dependency 1970-2012
Carbon Brief (2016)

UK energy sector trends

- **Thermal power generation capacity is falling**
  - 26 fossil-fuel facilities closed in 2011-2016
  - 50% of nuclear capacity to close by 2025 (11 reactors planned)
- **The UK has made the 'gas to coal' transition**
  - Use of a gas as a bridge to a renewable future
- **Rapid growth in deployment of renewables**
  - Installed capacity: 30.4 GW in 2015 from 9.2 GW in 2010
  - Generation: 25% of total output in 2015
- **Electricity demand set to rise on electrification**

Power system transformation

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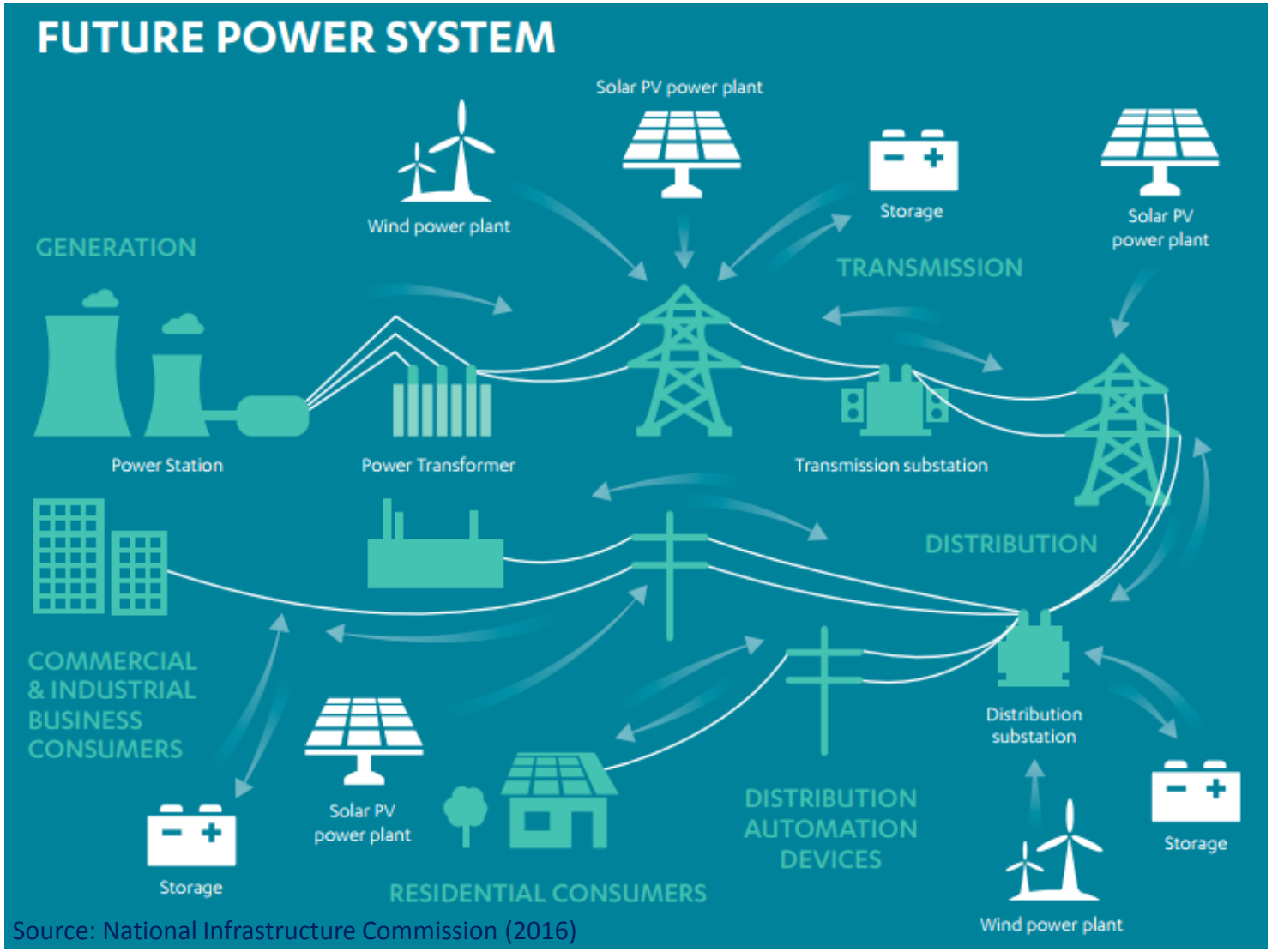
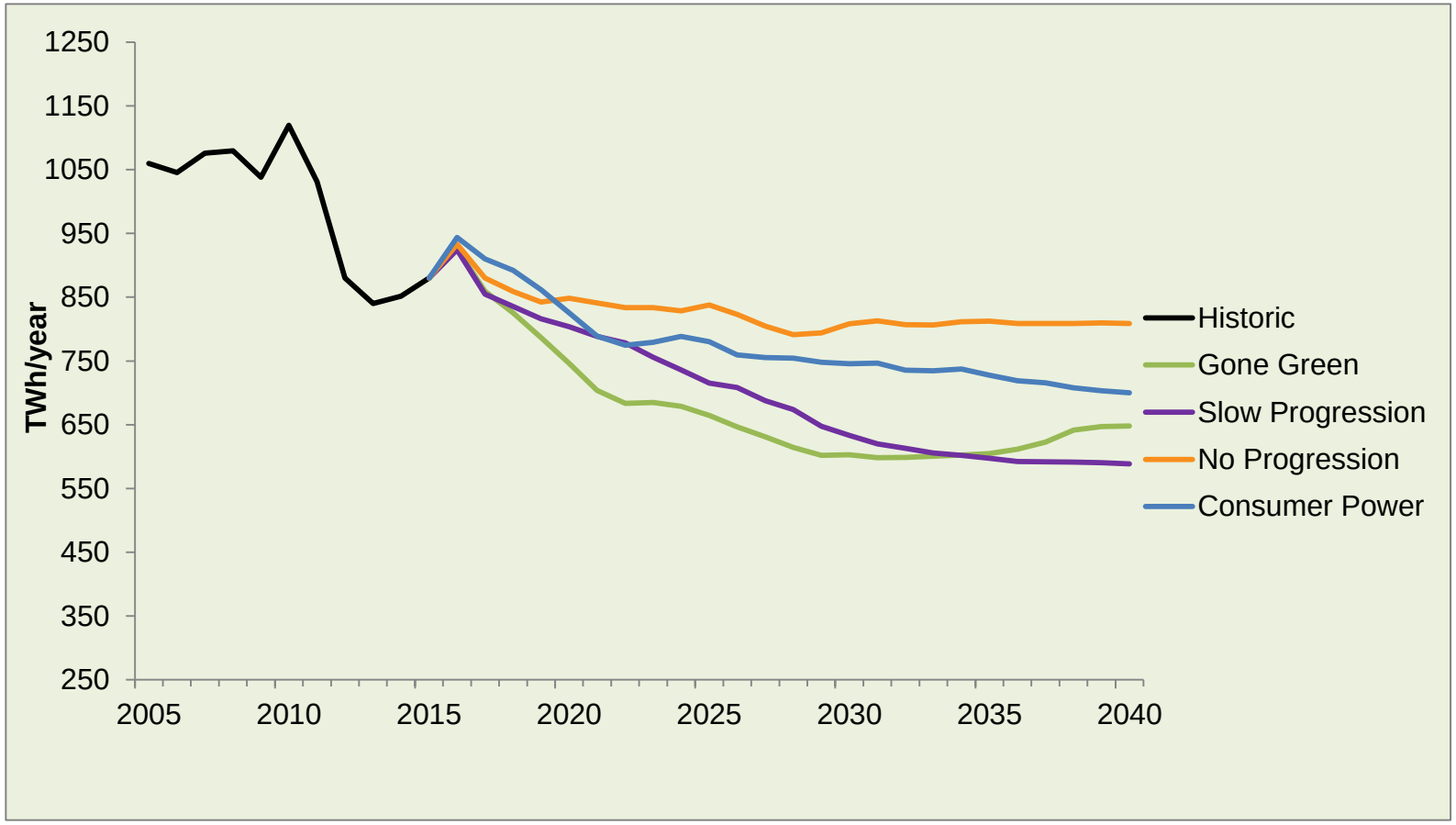


Source: National Infrastructure Commission (2016)

The energy gap: gas demand



UK Gas Demand 2005-2040

National Grid Future Energy Scenarios (2016)

The energy gap: electricity demand

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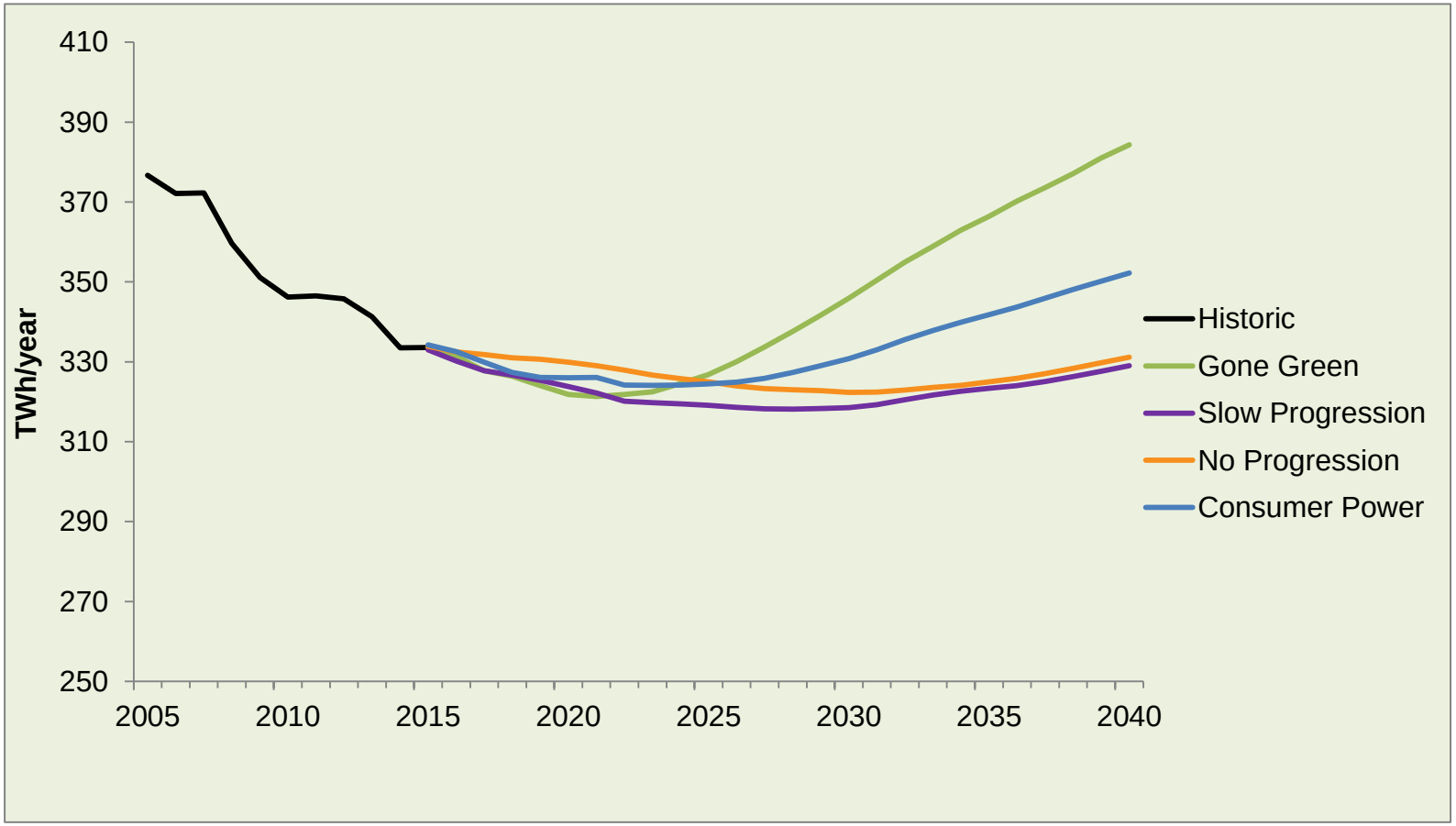

UK Electricity Demand 2005-2040

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The energy gap: generation capacity

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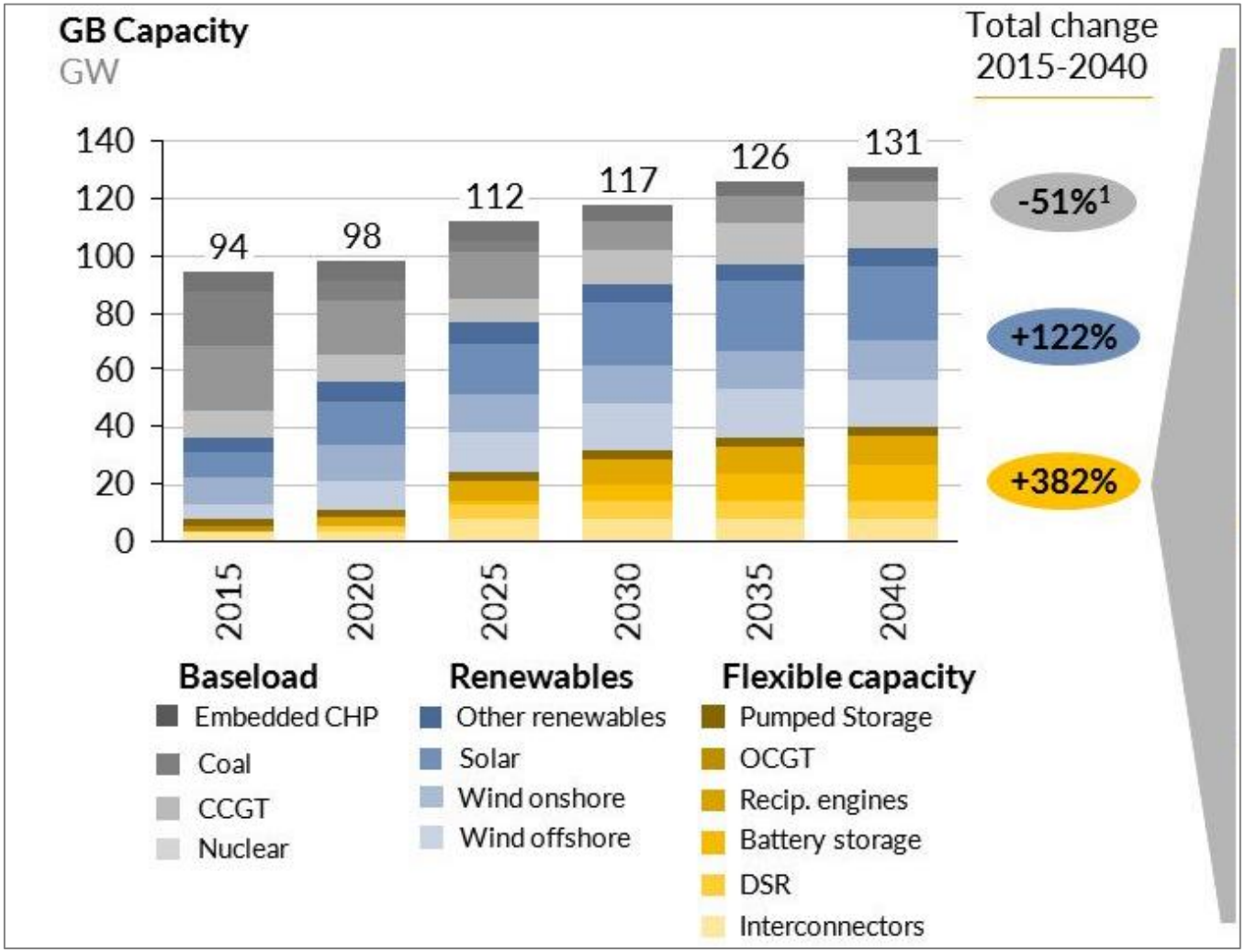

Source: Aurora Energy Research (2017)

Risk of stranded assets

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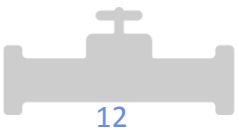
- **UK faces a flexibility challenge – not a generation capacity one**
  - Thermal capacity to fall, but not total generating capacity
- **Over-capacity and under-utilisation across UK (and EU)**
  - NG: demand turn-up and generator turn-down
  - CCGTs from 'Dash for Gas' closed and mothballed
  - Negative wholesale electricity pricing
- **Natural gas import capacity under-utilised**
  - UK demand fallen/flat since 2004 – lowest since pre-1990s
  - EU: 2016 LNG terminal average utilisation below 20pc
  - Nordstream 2 and Turk Stream = 15% of EU demand (which is falling)



Investments for now or the future?

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Large scale infrastructure lifetime: ~ 40yrs

Large scale infrastructure delivery: ~15yrs

Today - 2020	2020-25	2025-30	2030-50
• EU 20% target on GHG reductions • EU: 30% of UK electricity from RES • EU: 15% of energy needs	• G7: phase out of fossil fuel subsidies	• EU target: 40% CO2 reduction • UK 5th Carbon Budget: 57% reduction	• UK Climate Change Act: 80% CO2 reduction • EU economy decarbonised in line with the Paris Agreement

Infrastructure transitions

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- **Distributed electricity networks and demand management**
  - Embedded generation (e.g. rooftop solar)
  - Electric vehicles, storage batteries, flexible demand
  - Co-develop storage with solar to lower costs

- **Re-purposing of networks for 'low-carbon' gas**
  - Move from natural gas (methane) to hydrogen, biogas
  - Gas refurb instead of electrification of heating?
  - Dependent on the use of CCS

- **UKCS decline – locked in to imported gas without transition?**
  - Growing imports = less control over pricing and supply (*price caps*)
  - South Hook LNG pipeline to grid: UK's 'N-1' supply infrastructure

GB electricity interconnection

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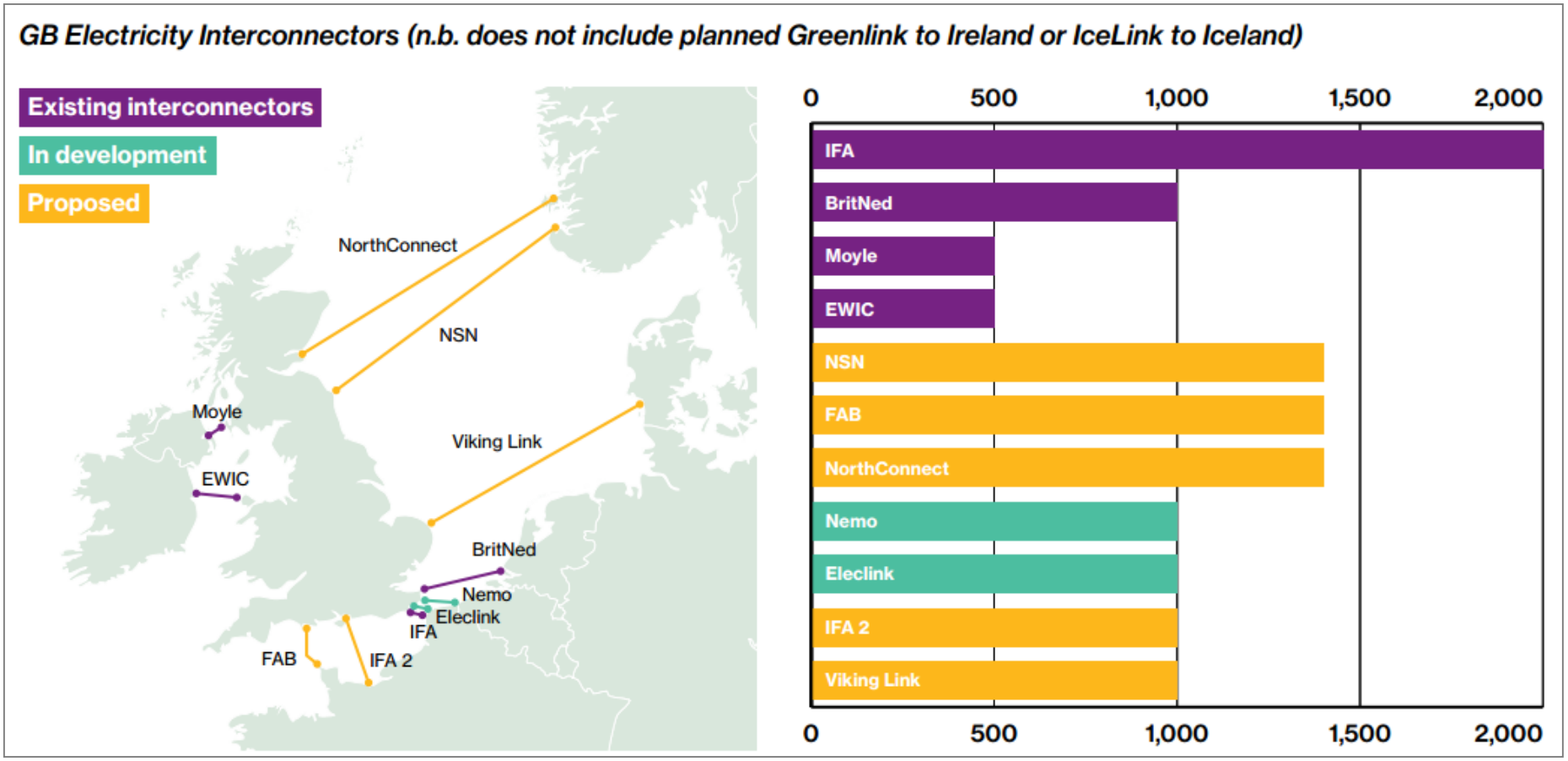

Source: Reuters (2015); Willis Towers Watson (2016)

GB electricity interconnection

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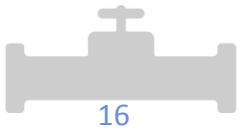
- **Key part of UK electricity supply going forward**
  - Low carbon electricity supply (wind, hydro, geothermal)
- **System balancing tool to cope with intermittent renewables**
  - Import and export of electricity around supply and demand
- **Crucial to functioning of the EU single energy market**
  - 'North Seas Countries' Offshore Grid Initiative' (NSCOGI)
- **Government still wants to build new interconnectors after Brexit**
  - How will future interconnectors be regulated post-Brexit?



Barriers to new infrastructure

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- **Localised opposition to overhead lines, substations, traffic**
  - Support for renewables is high – just not near developments
  - Perceived lack of local benefits despite the disruption

- **Instability and unclear direction of government policy**
  - Onshore wind, PV tax rate, Solar ROCs, Hinkley Point, EMR, price cap
  - Restructuring of energy department (energy with industrial policy)
  - Civil service budget cuts: DECC by 22%, DEFRA by 15% (2015)

- **Difficult to invest with certainty* post-2019**
  - Cross-border electricity interconnection (EU and non-EU)
  - Physical and virtual energy trading, services, regulation

Renewables sector investment

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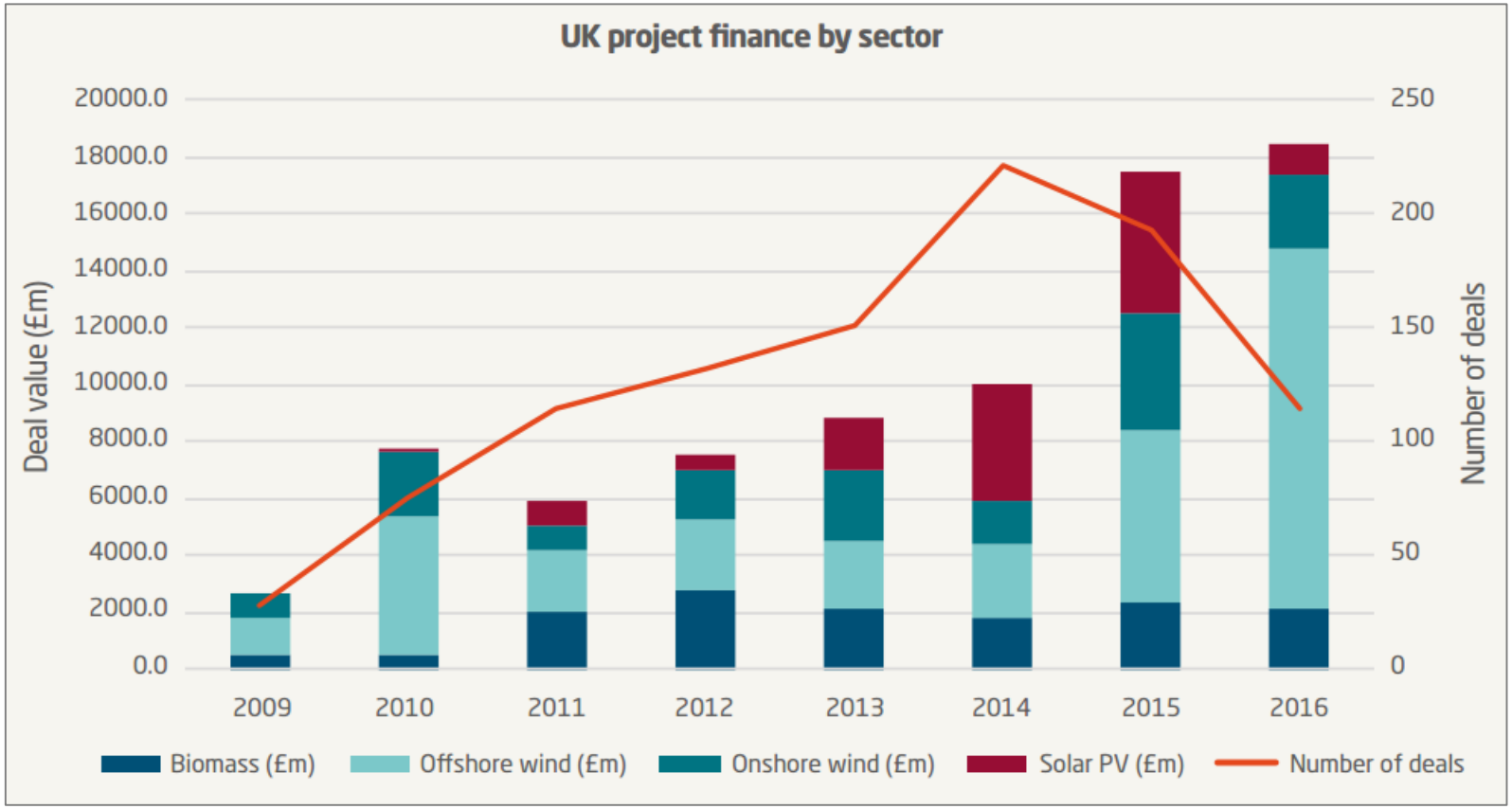

Source: TLT/Clean Energy Pipeline (2017)

Key messages

- Electricity demand is expected to rise, but not gas
- The UK needs more flexibility, not generation capacity
- Investments must be in-line with decarbonisation goals
- Interconnection with other markets growing in importance
- Government needs to ensure right signals for investors