## **GB's Grid Development Journey and Energy Transition Challenges**

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## **Overview: our electricity business in GB**

- The National Electricity Transmission System (NETS) is mainly made up of 400kV, 275kV and 132kV assets connecting separately owned generators, interconnectors, large demands and distribution systems.
- **NG Electricity System Operator** moves electricity around GB second by second keeping supply and demand in perfect balance.
- **NG Electricity Transmission** owns and maintains the transmission network in England and Wales.
  - 230,000 km of overhead lines and underground cables.
- NG Electricity Distribution owns and operates the largest distribution system in the UK.
  - Over 185,000 transmission and distribution substations.
- NG Ventures has a diverse portfolio of flexible and low carbon energy businesses across the UK, Europe, and US including sub-sea electricity interconnectors.
  - 7.8GW capacity of interconnectors in operation or under construction. Approx. 2,200 km of subsea cable connecting to 5 countries.



#### Where we are now



Electricity Generation Capacity (GW) and Output (TWh) 2021



Future Energy Scenarios 2022

The measure of CO2 emissions per unit of electricity consumed has reduced by **66%** since 2013, with 2020 being the **greenest year** on record.

In GB gas has played a major role in the transition from coal. The question is what source of energy would enable other countries to move away from coal in a cost-effective, reliable, and sustainable manner?

## Grid Development Journey: 2000- future

## **Growing importance of policy & government commitments**

• In this period, GB was experiencing a competitive 'self-dispatched' market. A range of 'sustainability- and security-focused' policies were needed to support this free market and deliver the government's objectives and commitments.



## GB's energy landscape: 2000 - now

- Up until 2010, the progress towards renewables was slow. Thanks to subsidies, low carbon technologies have reached to the point in their investment journey that for the first time the share of wind energy overtakes the share of coal generation in 2016.
- · As a result of policy and market interventions, a huge increase in the capacity of offshore and onshore wind and solar PV in GB.
- · Coal plants are reaching the end of their life-cycle and the number of coal plants live on the system reduces to only three.
- According to IRENA, the global weighed average total installed cost of utility-scaled solar PV and offshore wind has reduced by 80% and 60%, respectively in 2021 compared to 2010.





#### Shares of Electricity Generated

### Milestones in GB's journey towards grid decarbonisation



Renewable Challenges



#### The gap to fully decarbonised power system



## **Grid Solutions**

## More investment is needed to reinforce the network

• The NGESO's HND sets out the key infrastructure requirements to achieve 50GW of offshore wind by 2030, which established the Accelerated Strategic Transmission Investments (ASTI<sup>1</sup>) projects for NG Electricity Transmission to deliver.



### **NG smart solution examples**

#### **SmartWires**

• Power flow controllers unlock 1.5GW extra capacity without grid reinforcement

•Reduce grid congestion and RES curtailment







Intelligently routes power to maximise our network





#### **National Grid**

## Role of flexibility in high renewables grid

- As increasing levels of renewable generation are deployed, particularly wind and solar, there will be times (i.e. windy days) when supply is significantly higher than demand and the excess of generation should to be **curtailed**.
- By 2035, there could be surplus of generation in more than half of the year.
- Flexibility the ability to adjust supply and demand to balance the system is needed to manage intermittency so that electricity can be
  used when and where it is needed. It would help to reduce peak demand by shifting negotiable demand over different timescales, from
  minutes or less to across seasons or even years.
- 46GW volume of expected within-day flexibility by 2030 in GB.
- · Some sources of flexibility:
  - Dispatchable thermal generation
  - Storage
  - Demand side response (DSR)
  - Vehicle-to-grid (V2G)
  - Hydrogen (electrolysis)
  - Interconnectors

Approx 9.8GW of interconnection either live or under construction.

