

Decarbonising UK transport: Implications for electricity generation, land use and policy

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1. Background

Net zero emissions by 2050 in the UK

Transport (28%) and energy generation (23%) are the **leading contributors** of greenhouse gas emissions

Reducing tailpipe emissions is **predominant** in European policy.

Ban and phasing out of all new petrol and diesel internal combustion engine vehicles from **2030**. No diesel-only trains from **2040**.

1) What emission reduction will be achieved? and 2) How will low emission transport requirements impact the environment?

2. Methodology

To assess impact on emission reduction land usage, we completed the iterative steps shown below:

Input 1: Projections used Transport Energy and Air Pollution Model for the UK outputs. Giving **distances (weighted by size)** and **total number of cars, buses and trains** from 2020 to 2050.

Calculation 1: Network energy requirement dependant on power source electric or hydrogen transport.

Input 2: Output from **Calculation 1** combined with **generation mix** (2019 baseline) across renewables (wind (76% offshore and 24% onshore and solar), nuclear (average nuclear power station and a Hinkley Point C equivalent) and fossil fuels (gas power station) and the **energy density**. Interconnection supply were excluded.

Calculation 2: Total area required for energy source given its expected energy requirement to fuel the transport sector.

3. Installed Generation Capacity

Between 2020 and 2050, renewable energy generation will be the primary energy generation source

- Total capacity required is expected to peak in 2050 and 2040 for renewables and nuclear respectively.
- Fossil fuels are expected to reduce to almost 10% of its 2020 energy generation.

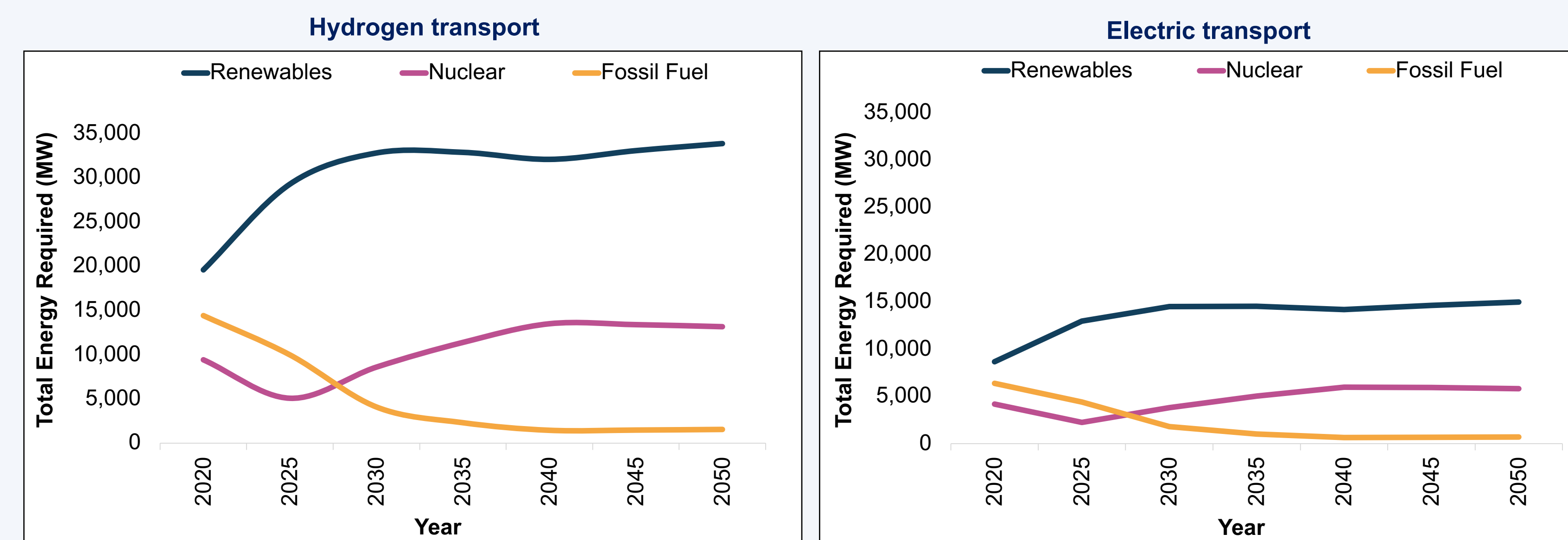


Figure 1: Installed generating capacity required for electric and hydrogen cars, buses and trains based on the energy generation mix

4. Total area demand

Offshore wind turbines will contribute one third of total area required for energy generation. Impacts on natural capital and ecosystem services are yet to be seen due to this technologies developmental stage.

- The dip in area required in ~2040 potentially due to the interaction of technological improvements and increasing energy demand.

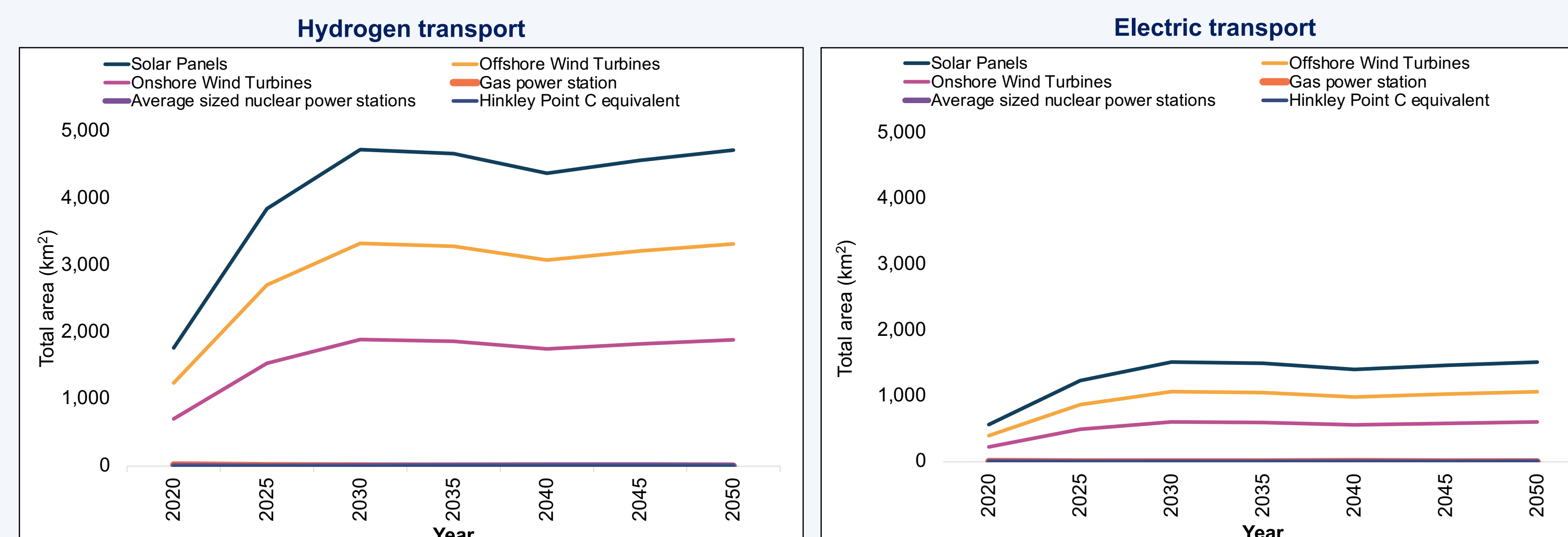


Figure 2: Total area required for onshore and offshore wind turbines, solar panels, nuclear power stations (average nuclear power stations and a Hinkley Point C equivalent) and gas power stations to meet electricity demand for total electric and hydrogen transport.

5. Conclusions

Results have highlighted that the **location** of expanding renewable generation will be extremely important to consider for policymakers **reducing the impact** on natural capital and ecosystem services.

- Up to ~2% UK land area needs to be used for **transport energy supply under current energy mix projections**.

Personal vehicles demand 92.5% (electric) or 93.3% (hydrogen) of the total energy demand estimated within this study's scope.

Electric transport will require a **third less energy** than hydrogen transport by 2050

- Therefore will have a **lower impact on natural capital and ecosystem services**

Take home messages

Future planning should optimise high area requirement renewable energy sources within development plan for all areas

- Increased roof top solar panels reduces conflicts with other land use requirements.

More rapid deployment of emission mitigation and renewable energy technologies will flatten the area requirement curve reducing cumulative ecosystem services and natural capital impacts.

To meet the net zero emission reductions, **switching to electric and hydrogen trains and buses are required**.

- Yet another **challenge in the COVID era**: How do we get individuals **back on public transport**?