Real-Time Upstream Emissions of Electric Vehicles During Recharge

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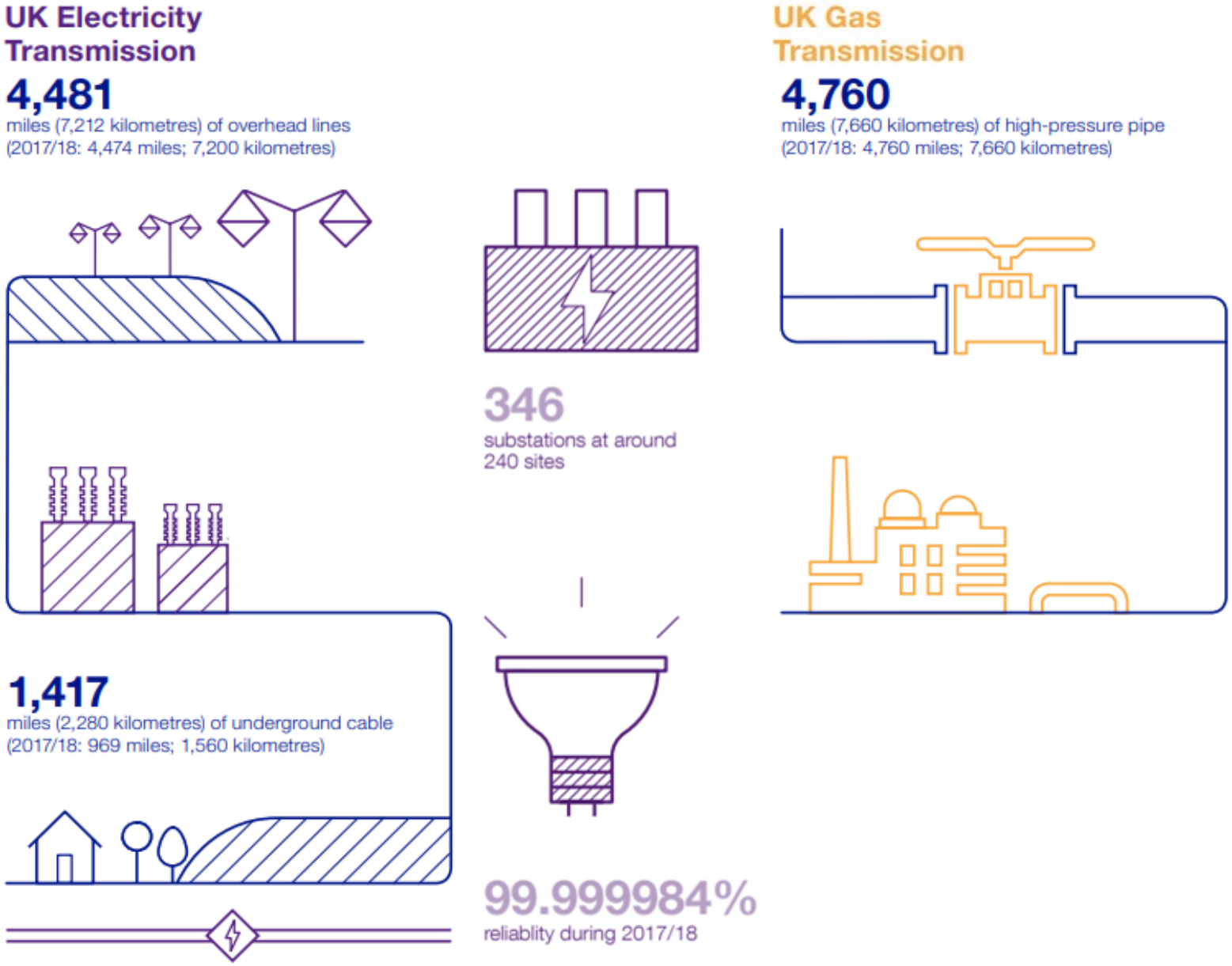
nationalgrid UNECE

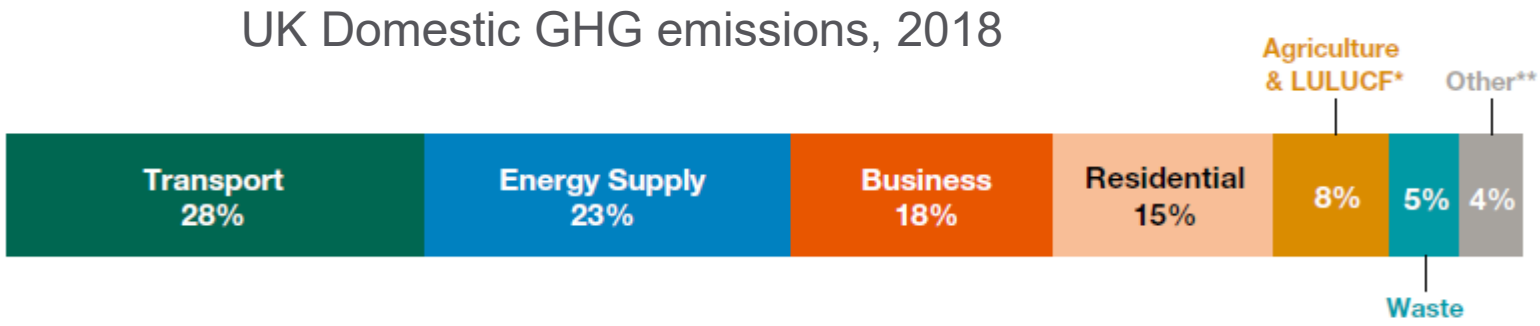
National Grid: who are we?

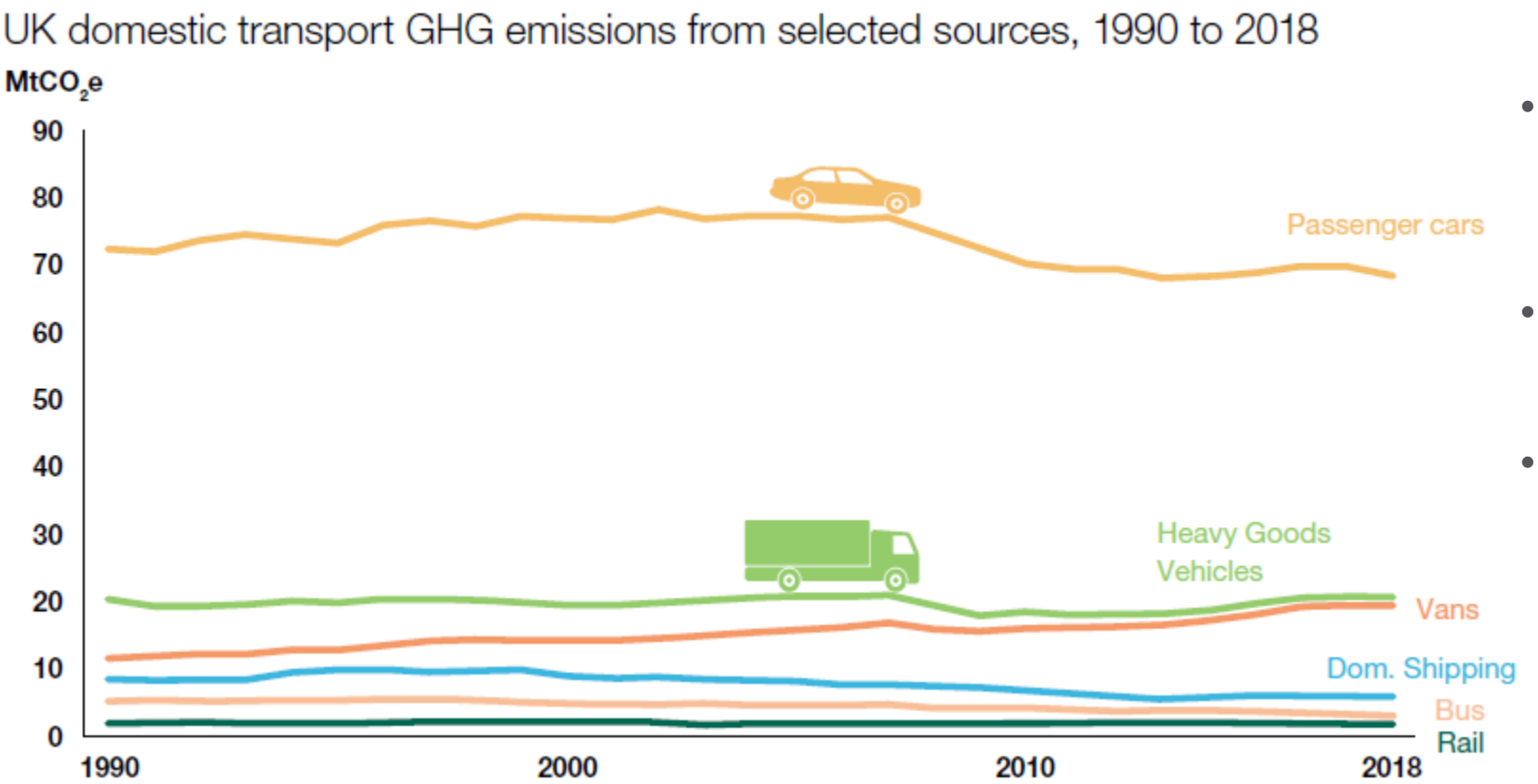
We own the high-voltage electricity transmission network in England and Wales.

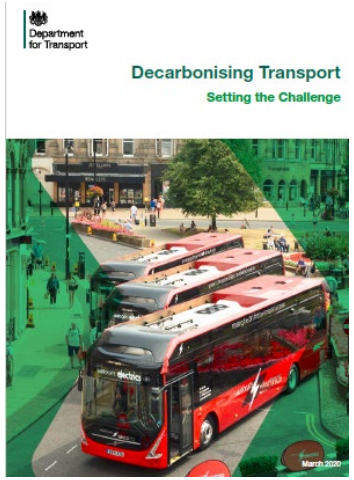
We also own and operate the high-pressure gas transmission network in Great Britain.



Transport emissions - context



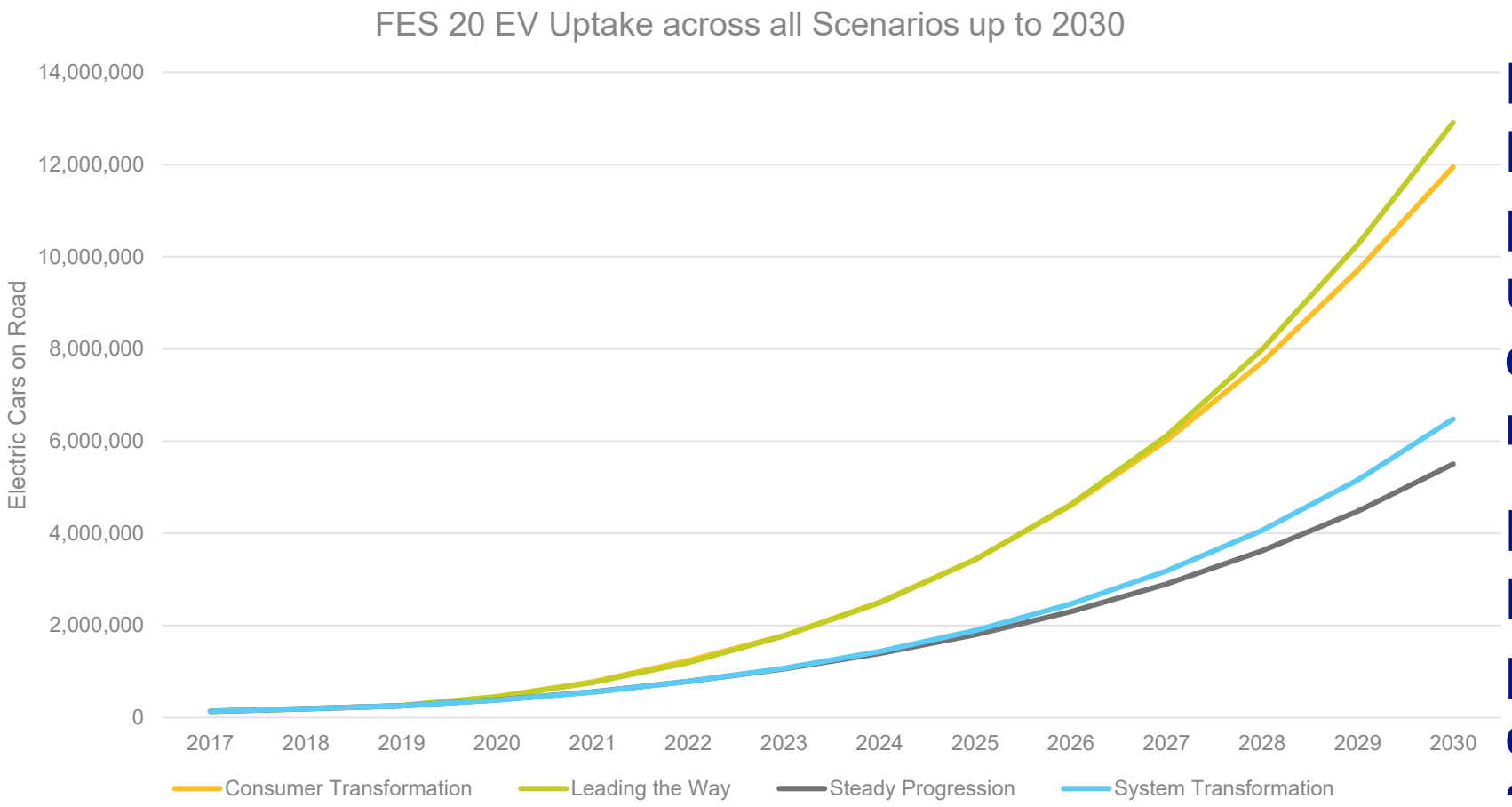




- Transport became the largest sector for UK GHG emissions in 2016
- After cars, HGVs are the second largest emitters of GHG in the transport sector
- Additionally, international shipping and aviation contribute 45 $MtCO_2e$
- These are not currently included in official statistics, but Government has indicated, even without international consensus it will look to include them

* Includes Land Use, Land Use Change and Forestry
** Includes Public and Industrial Processes emissions

What could uptake look like



National Grid Future Energy Scenarios predict we could see up to 13 million electric cars on the road

Bloomberg New Energy Finance predicts 5.5 million in cumulative sales by 2030

National Grid are technology agnostic

We are here to support all solutions, regardless of technology and fuel.

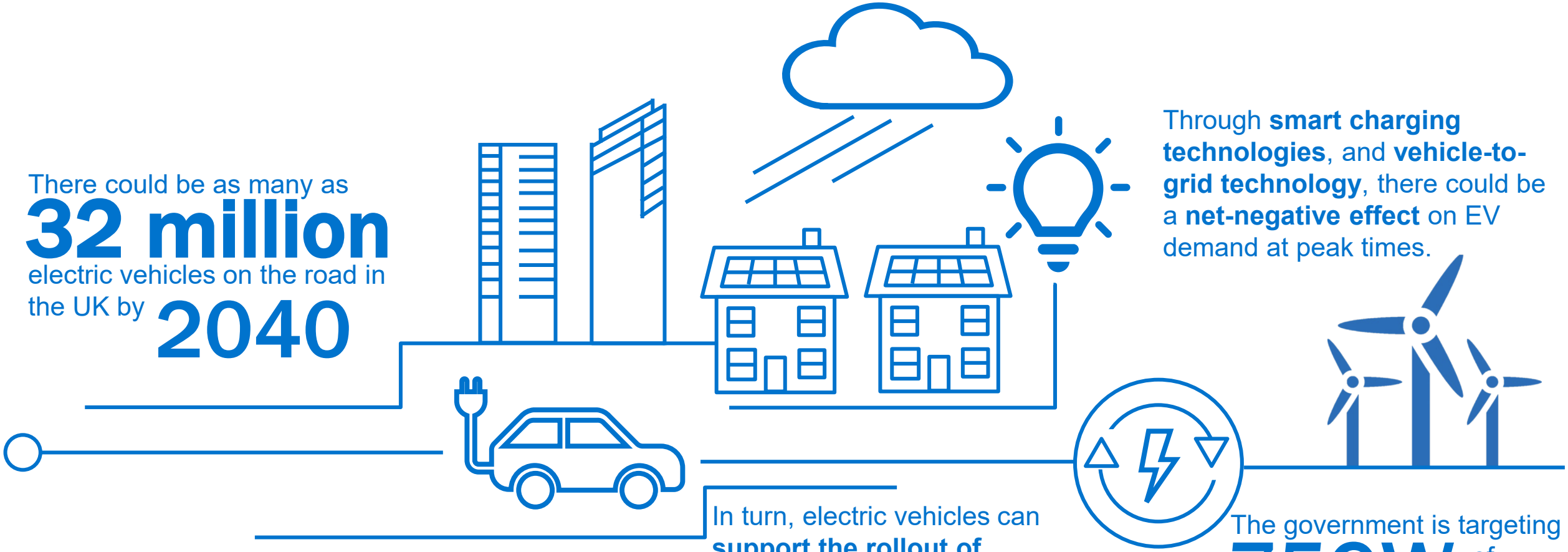
There are four main types of ULEV – Battery Electric Vehicles (BEVs), Plug-in hybrids (PHEVs), Extended-Range EVs (E-REVs) and Hydrogen fuel cell electric vehicle (FCEVs).

Electric: People can charge their cars at home or work, but with fleets or a large number or vehicles, the amount of power will be significantly greater, and hence need improved infrastructure.

Hydrogen: Hydrogen should be green (electrolysis generated by renewables) or blue (carbon emissions captured and stored/reused). Currently, 97% of Hydrogen is grey – generated by non-net zero methods. Infrastructure is clearly needed for topping up hydrogen vehicles.

Electric vehicles can unlock greater renewable utilisation

There could be as many as **32 million** electric vehicles on the road in the UK by **2040**



Through **smart charging technologies**, and **vehicle-to-grid technology**, there could be a **net-negative effect** on EV demand at peak times.

In turn, electric vehicles can **support the rollout of renewables** by **storing excess generation** and by providing electricity back into the system when needed.

The government is targeting **75GW** of **offshore wind** by 2050 as part of their climate change mitigation targets

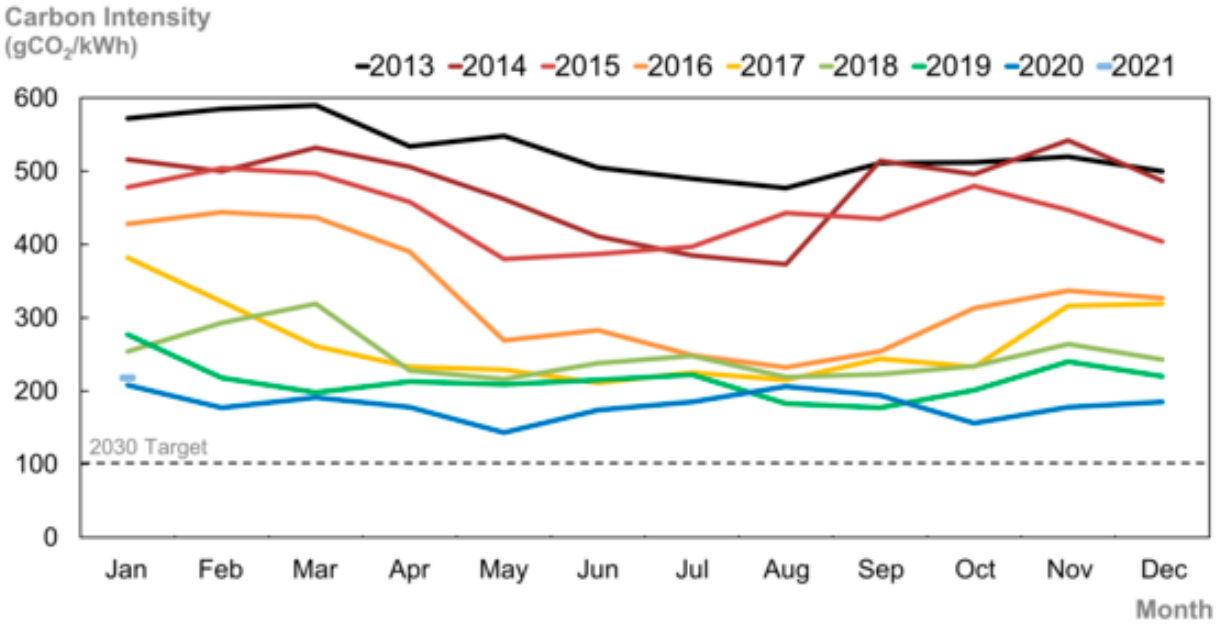
Understanding Carbon Intensity

What is Carbon Intensity?

The number of grams of carbon dioxide (CO_2) that it takes to make one unit of electricity a kilowatt per hour (kW/hour). The **lower** the carbon intensity, the **greener** the electricity. Carbon Intensity varies by hour, day and season due to changes in electricity demand, lo-carbon generation and conventional generation.

When electricity is generated using coal power stations, the carbon intensity value is high as carbon dioxide (CO_2) is produced as part of the power generation process.

Renewable forms of generation such as hydro or solar produce almost no emissions, so their carbon intensity is very low.



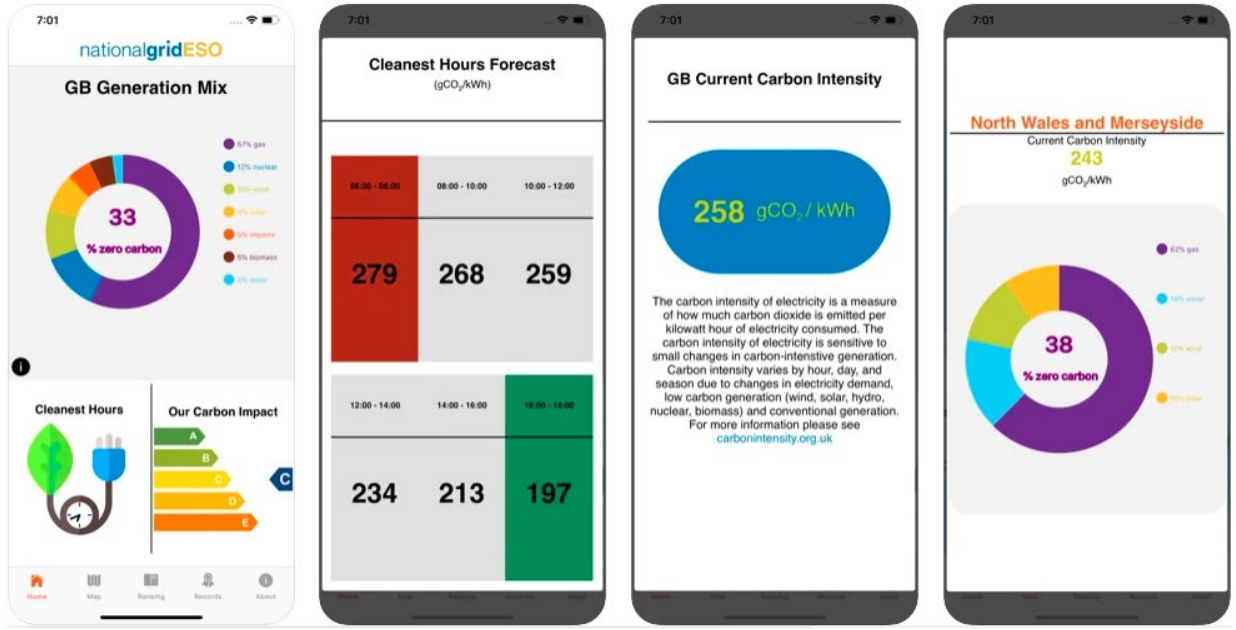
65.8% decrease
from 2013 to 2020

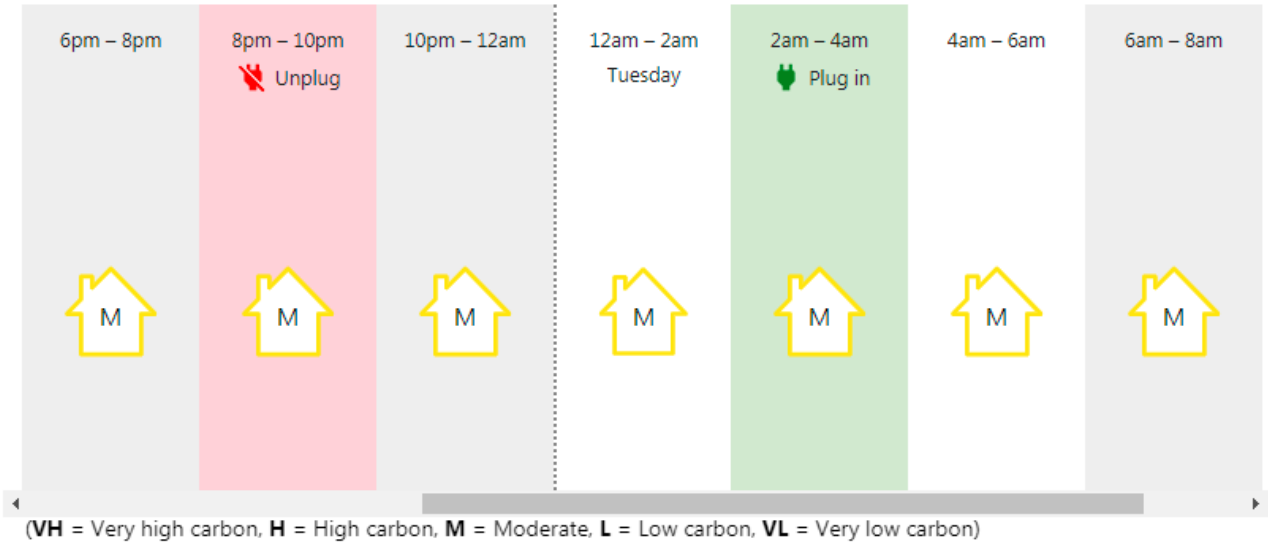
2013	**529** gCO_2/kWh
2014	**477** gCO_2/kWh
2015	**443** gCO_2/kWh
2016	**330** gCO_2/kWh
2017	**266** gCO_2/kWh
2018	**248** gCO_2/kWh
2019	**215** gCO_2/kWh
2020	**181** gCO_2/kWh

nationalgridESO Carbon Intensity App

The Carbon Intensity App, built in partnership with the WWF, Environmental Defense Fund Europe and the University of Oxford department of Computer Science and provides **real-time insights** into how power is being produced and which areas of the UK are greenest at any given time.

A built-in API can also help users to plan their energy use, switching devices on when energy is **green.** This can help EV users to plan their next charge.

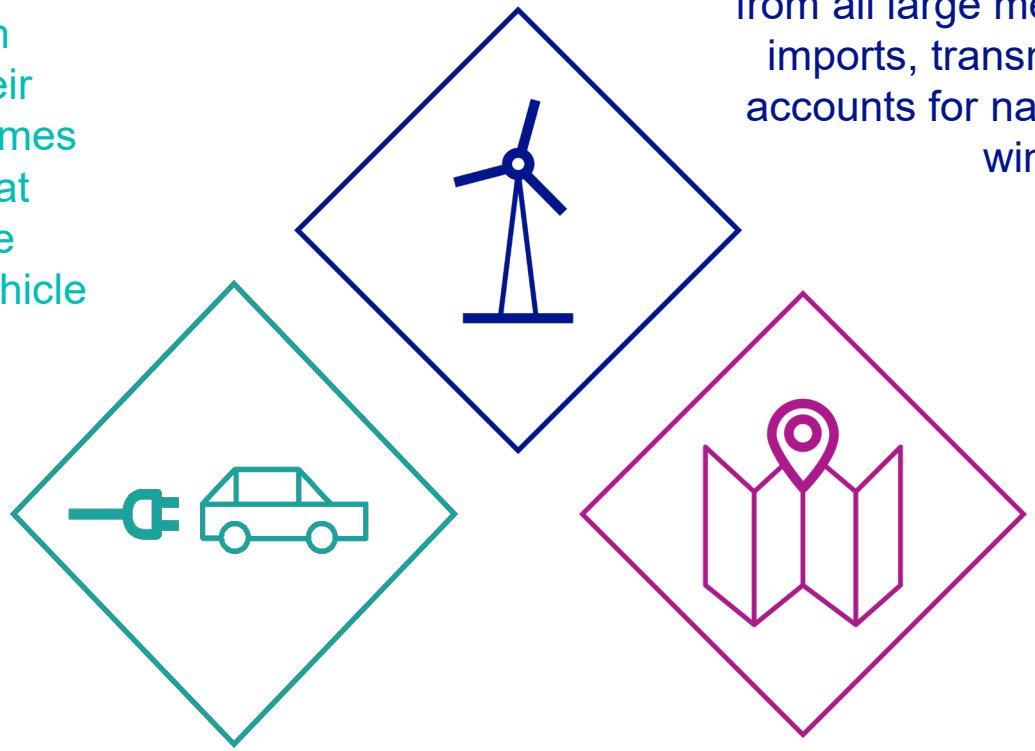




Carbon Intensity & Generation Mix Forecasts

The Carbon Intensity API uses state-of-the-art Machine Learning and sophisticated power system modelling to provide carbon intensity and generation mix forecasts 96+hours ahead of real-time

A built-in API helps users plan their energy use to ensure their usage is at the most ‘green’ times of the day. This feature is great for EV users who can view the forecast to plan when their vehicle charging will take place.



The Carbon Intensity forecast includes CO2 emissions from all large metered power stations, interconnector imports, transmission and distribution losses, and accounts for national electricity demand, embedded wind and solar generation.

The app offers forecasts of the carbon intensity and generation mix of electricity consumed across 14 geographical regions in Great Britain. The boundaries are defined by DNO boundaries and are ranked based on the forecast

En-route charging – grid investment can enable market

Government committed

£950M

in the March budget over the next 5 years to support the rollout of fast-charging network for EVs, including the Rapid Charging Fund to aid with connection costs.

Office for Low Emission Vehicles

6,000

Project Rapid targets six high power, open access chargepoints at MSAs by 2023, and 6,000 in total by 2035

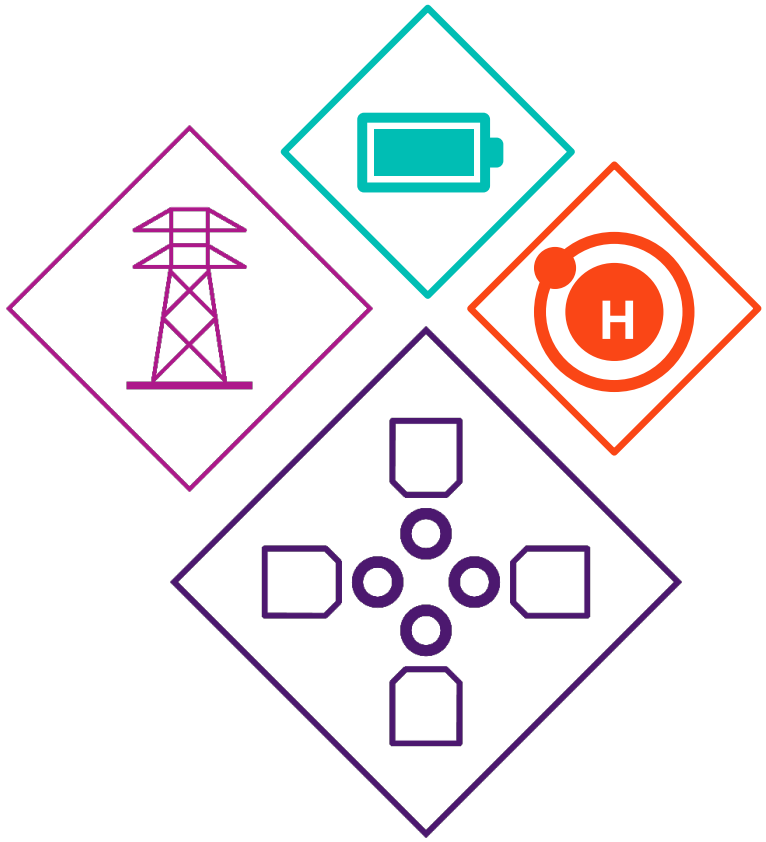
30 miles

OLEV then published Project Rapid, a strategy even more ambitious than our original – ensuring motorists are always within 30 miles of an ultra-rapid charging station, and inclusive of not only motorways.

EV Charging: challenges and barriers

Challenge and barriers…	*…meaning that…*	*…and can result in…*
Uncertainty / utilisation risks	Near term revenues have a large impact on business model	Patchy charging network developed Not all GB consumers have access to rapid chargers Range anxiety still an issue, slowing EV ownership Risk of higher costs due to inefficient build out
Coverage: costs and revenues vary across sites	Some charging locations less attractive to developers / investors	
Asset lifetime vs developer timescales	Mismatch between incremental demand and efficient infra solutions	

Grid infrastructure is key to enable the rapid uptake of Electric Vehicles and improving air quality



Electricity infrastructure is **critical** to enable the decarbonising of transport

Thinking about grid requirements is needed **upfront** to deliver timely and cost-effective infrastructure to support this decarbonisation

Collaboration will be key. If we engage early, we can deliver the best options.

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