

Changes from FES 2019 to FES 2020

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What are the main changes in the framework and approach when comparing *FES 2019* and *FES 2020*?

FES this year presents a new scenario framework, introducing the axis of 'level of societal change' to replace last years' 'level of decentralisation.' This new axis has allowed us to examine the ways in which our economy can decarbonise, along with how quickly this can be done, via the 'speed of decarbonisation' axes which has been part of the framework since FES 2018.

The new framework allows us to build on FES 2019's net zero sensitivity and explore three pathways to meet the UK's legally binding net zero target announced in June 2019. Through these scenarios, we have expanded our whole system lens and accounted for the fundamental changes that will be necessary both from a system and societal perspective. This year, there are two scenarios that meet the net zero target at a similar speed of decarbonising, but with varying levels of societal change, and one that exceeds these, with the highest speed of decarbonisation and levels of societal change.

For further information, please see our **Scenario Framework Document**.

How do the scenarios from *FES 2019* compare with the scenarios from *FES 2020*?

In our FES 2019 net zero sensitivity, we explored a target of 96% emissions reduction by 2050 with existing technologies, the remaining 4% being reliant upon speculative technologies. System Transformation, Consumer Transformation and Leading the Way all build on last years' net zero sensitivity but remove the 'hiding place' provided by speculative technologies. All three scenarios in FES 2020 present 100% emissions reduction by 2050 from 1990 levels.

Due to the change in framework from FES 2019, there is limited value in offering a direct scenario comparison. However, it can be noted that Community Renewables and Two Degrees most closely reflect some of the components for this years' Consumer Transformation and System Transformation scenarios respectively. Steady Progression is formed from the scenario of the same name featured in FES 2019.

Further information about how we developed our FES 2020 framework and scenarios can be found in our **Stakeholder Feedback Document**.

What changes have been made to the modelling approach?

This year, we have incorporated the non-energy sectors of aviation, shipping and agriculture into our modelling to make sure our scenarios are credible and integrated with a whole-of-society net zero target for 2050. We have used existing analysis from the Committee on Climate Change (CCC) to help us to understand the emission pathways for these sectors.

For more detail on changes to modelling methods and approaches, please see our FES 2020 **Modelling Methods Document**.

How has the view of technologies and areas changed?

Transport

Battery Electric Vehicle (BEV) uptake rates have a broadly similar range to last year. System Transformation and Consumer Transformation are modelled as achieving a 2035 ban on Plug-in Hybrids (PHEV) and petroleum powered internal combustion engine (ICE) cars, while Leading the Way is modelled as achieving a 2032 ban. We've seen significant acceleration in the growth of sales of BEVs in 2019. As a result, Steady Progression models a faster uptake than FES 2019 and achieves a 2040 ban.

Impacts on electricity demand are mitigated with smart charging and vehicle-to-grid plays a role in meeting peak demand and absorbing excess generation away from peak in all scenarios. This year, we continue to include Autonomous Vehicles (AVs) in our modelling, which features most notably in Leading the Way, where some households may forego car ownership entirely, using shared mobility solutions for long journeys.

Heat

Our three net zero scenarios this year explore very different pathways to decarbonise heating, compared to last year where there was more of a combination of technology and fuel options deployed in each scenario. System Transformation relies predominately on hydrogen boilers, Consumer Transformation on electric heat pumps, and Leading the Way includes both electrification and hydrogen; including hybrid heat pumps.

In Consumer Transformation, we mitigate peak electricity impacts with the use of thermal storage devices to avoid excessive peak electricity demand. In Leading the Way, this is mitigated via the use of decarbonised gas – usually hydrogen – during times of peak electrical load.

Thermal efficiency assumptions for the 2050 compliant scenarios remain ambitious, with more than 60% of homes achieving an EPC C or higher by 2035 in Consumer Transformation and Leading the Way, and 2040 in System Transformation. The latter is in part due to the majority of homes relying on hydrogen boilers for heating, which do not require high levels of insulation to work efficiently.

Electricity demand

Compared to FES 2019, we see higher annual demands by 2050 in our net zero scenarios. This is partly driven by the fact that there are more BEVs in all scenarios this year, but also relates to the greater uptake of smart charging and vehicle-to-grid.

Electricity generation and flexibility

Greater renewables uptake can be seen across all scenarios to reflect falling costs and political ambition. As such, generation capacities are significantly higher in the net zero scenarios than in FES 2019. Increases in renewable generation capacity also require greater flexibility across the whole system and hydrogen plays an important role here across the scenarios to a greater extent than in FES 2019.

Natural Gas supply and demand

Natural gas remains central to all scenarios, primarily for heating, into the 2030s, after which its use changes significantly (to create blue hydrogen from natural gas and Carbon Capture, Usage and Storage). In FES 2020, natural gas supply varies a great deal between the scenarios, primarily due to the differences in hydrogen production. By 2050, annual demand drops to nearly zero in Leading the Way with Consumer Transformation also being much lower than the Community Renewables scenario in FES 2019. System Transformation requires a higher level of gas supply than Two Degrees as there is a greater reliance on methane reformed hydrogen. In Steady Progression though, demand levels in 2050 are similar to today's, as natural gas is used unabated in heating, transport and industrial and commercial sectors.

Bioenergy

Bioenergy with Carbon Capture and Storage (BECCS), is new to FES 2020. It is central to achieving negative emissions and thus features in all scenarios. Other than in the net zero Sensitivity, BECCS did not feature in FES 2019.

Hydrogen

This year hydrogen plays a much increased role compared to FES 2019, as it could be the solution to many of the hardest parts of the transition to net zero, including for heavy goods vehicles (HGVs) and industrial sectors that are difficult to electrify in addition to provision of flexible demand via electrolysis. We vary the main method through which hydrogen is produced in each scenario: electrolysis in Consumer Transformation and Leading the Way, and via methane reforming with a large requirement for natural gas with CCUS in System Transformation.

More detail on all areas and technologies can be found in the FES 2020 **Data Workbook**. A high-level **Summary of Key Statistics** is also available.

For any queries, contact us at fes.nationalgrideso.com

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<https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2020-documents>

