# FES in Five

July 2022

# Foreword

## Navigating to a Net Zero British energy system for all

Since last year's Future Energy Scenarios, the world has continued to change at pace. The impact from the pandemic is still being felt, while the devastating war in Ukraine is testing supply chains and access to fossil fuels for homes and industry. The past year has sparked recognition of the importance of a faster transition to Net Zero, to support energy security and reduce exposure to volatile international fossil fuel prices, by harnessing abundant renewable and low carbon resources. In the grips of a cost-of-living crisis, it is crucial that we never lose sight of the consumer while also focusing on delivering the broader societal benefits that can come from the transition. As a result, the Electricity System Operator (ESO)'s mission has never been more important: to drive the transformation to a fully decarbonised electricity system by 2035 which is reliable, affordable and fair for all.

The **Future Energy Scenarios** (FES 2022) sets out credible ways that the UK can achieve Net Zero by 2050, as well as the UK Government's commitment to a decarbonised electricity system by 2035. Based on extensive stakeholder engagement, research and modelling, each scenario considers how much energy we might need; where it could come from; and how we maintain a system that is reliable. We explore how different parts of the energy system can help lower emissions across the economy – whether through smart and digital technologies, electrification, deploying new hydrogen opportunities, or incorporating Carbon Capture Usage and Storage (CCUS) into industrial clusters.

We know the threat of climate change is not theoretical – we are all witnessing its impact. This has mobilised Great Britain (GB) to deliver one of the fastest decarbonising electricity systems in the world.

We are working hard with the industry to deliver carbon free operation by 2025, such as through our Pathfinder projects to find innovative new ways of operating the electricity system, keeping costs down for consumers. By 2035, we want to run a fully decarbonised electricity system all the time - helping the UK on its way to meeting its legally binding target of Net Zero by 2050. Through reducing our reliance on fossil fuels and moving towards 100% renewable and low carbon energy, we can create long-term energy security and deliver sustainable economic opportunities across the country.

# Foreword



Changing our energy mix will make us less dependent on uncertain foreign supplies, create sustainable new jobs, grow our economy and help keep the UK's place as a global innovator in green technologies. In practice, we need to generate economy-wide solutions to help **investment in the infrastructure** across GB to onboard booming renewable generation. As an entire industry we need to **inform and support consumers** about straightforward ways to reduce their energy bills – with energy companies ensuring the best tariffs are readily available. We need **reform of the GB energy market**, to ensure we can best utilise the low-cost, low-carbon electricity where and when it is available. We recently published a detailed report to inform the debate on how to reform GB's wholesale electricity market to reduce consumer costs, and this summer we published our Pathway to 2030: incorporating the Holistic Network Design (HND) report, an integrated approach to support the delivery of electricity from offshore wind to consumers across GB.

As the cost of living is rising around the world, it is right for Government to look at various measures to reduce the impact on individuals and families. To stop decarbonising will mean higher costs for households, communities and businesses and put our vital energy security at risk. Investing in a renewable and low carbon future now will help bolster energy security in the future.

As custodians of this vital public service, and as we transition to the 'Future System Operator', it is our responsibility to clearly explain the impact we think that various energy scenarios will have now and in the future. Overall, the UK's Net Zero timetable is achievable if we work together, however there are many ways to get there. Delivering it will require a strong partnership between industry and policymakers, and full engagement across society and consumers. **Never before has collaboration been more important – and, as our Future Energy Scenarios 2022 demonstrates, we must be ready to act now to secure a clean and fair system for all.**

Fintan Slye
Executive Director,
Electricity System Operator (ESO)

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## What are the Future Energy Scenarios and why are they important?

Our Future Energy Scenarios (FES) outline four different, credible pathways for the future of energy between now and 2050. Each one considers how much energy we might need and where it could come from to try to a build a picture of the different solutions that may be required.

FES is widely used by our stakeholders across the energy industry to:

- underpin energy network development
- support investment decisions
- inform national and regional policy

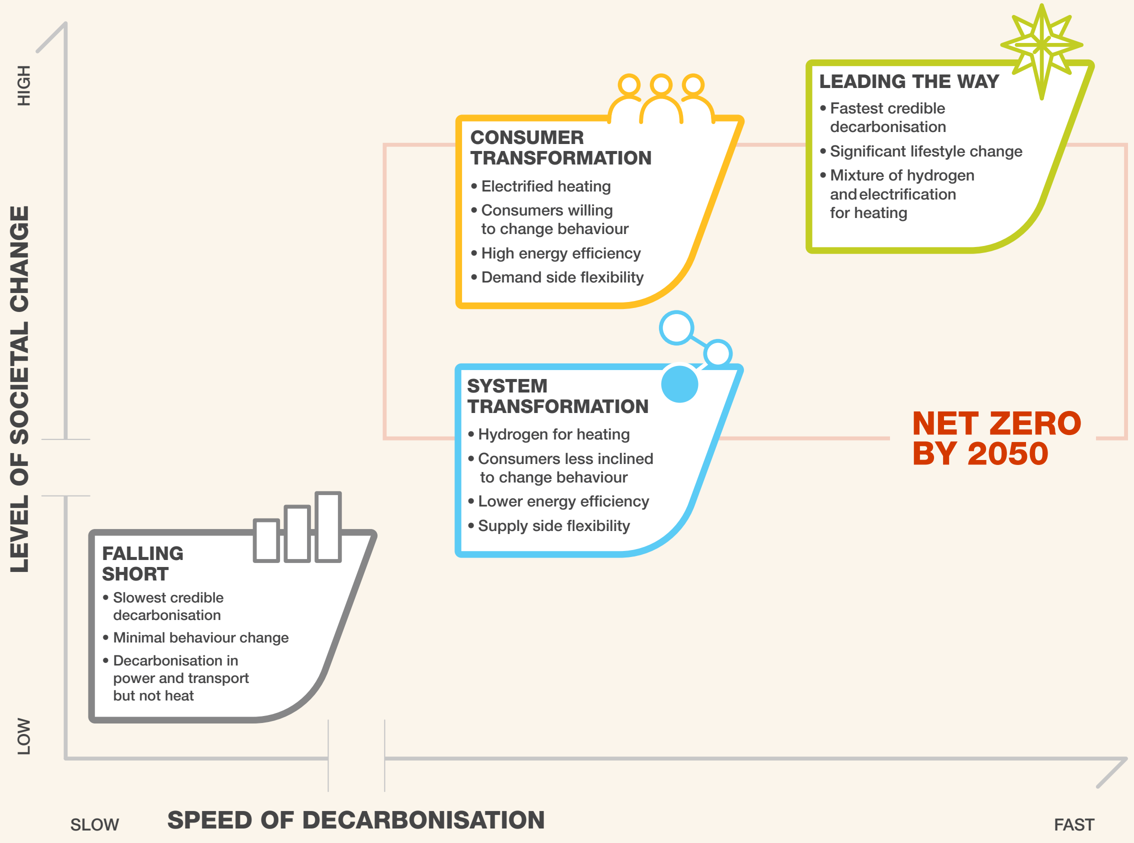
As well as producing FES for our stakeholders, feedback is collected as part of our comprehensive engagement work and incorporated alongside our own analysis and research to ensure that our data and insights remain robust and up to date. We also endeavour to make our data publicly available so that it can be used in academic work and innovation projects as well as to encourage challenge and collaboration.

FES in Five provides you with the key headlines and statistics from the full FES report which can be found here.

**The COP26 event in Glasgow in November 2021 showed how important it is for the world to reach Net Zero emissions by 2050 if global temperatures are to remain below 1.5 degrees. Reaching this target in the UK while also delivering an energy system for all that is secure, clean, affordable and fair is possible but will require a transition in how energy is both consumed and supplied.**

## The Scenario Framework

In line with stakeholder feedback, the top-level scenario framework remains broadly unchanged compared to recent years. However, the Steady Progression scenario has been renamed as Falling Short to reinforce how this scenario does not meet the UK Net Zero target by 2050. All the scenarios meet the relevant security of supply standards across the different fuels in every year.

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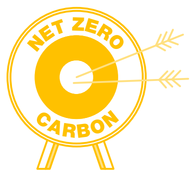
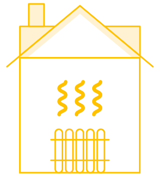
Key Message

# Policy and delivery

**Significantly accelerating the transition to a decarbonised energy system can help to address security and affordability concerns at the same time as delivering Net Zero milestones.**




Leading the Way reaches Net Zero in **2047**

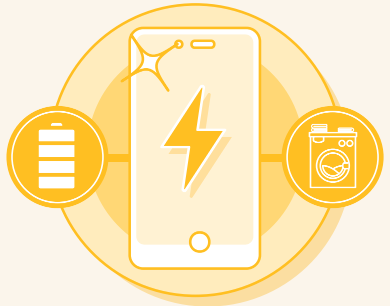


Overall end consumer demand reduces by over 40% by 2035 in Leading the Way

Leading the Way has no unabated natural gas generation capacity after **2035**

Levelised costs of wind and solar are much lower than unabated natural gas generation for projects commissioning in 2025

## Key recommendations



### Demand side strategy

The British Energy Security Strategy addresses long term strategic priorities by ensuring greater levels of low carbon energy supply.

A corresponding demand side strategy that incentivises more flexible electricity consumption, long duration storage and early hydrogen uptake is also required to avoid significant volumes of renewable energy being wasted during periods of oversupply as well as to ensure capacity adequacy.

### Energy efficiency

Improving energy efficiency is a no-regrets policy solution that can provide immediate benefits in terms of both affordability and energy security while also facilitating more enduring decarbonisation.

A plan to roll out thermal insulation to buildings alongside associated financing is urgently needed to unlock these benefits.

### Regional focus on heat

A ‘one-size fits all’ approach to decarbonisation of residential heat is not optimal due to differences in consumer preferences, availability of resources and proximity to energy infrastructure.

Within a national strategy, delivery of the targeted solutions and investment required by consumers should take place at a more regional level to leverage local knowledge and improve affordability.

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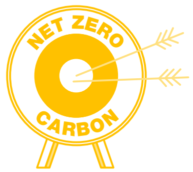
Key Message

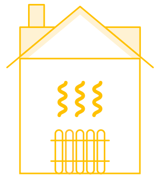
# Consumer and digitalisation

**Consumer behaviour is pivotal to decarbonisation – how we all react to market and policy changes, and embrace smart technology, will be vital to meeting Net Zero.**

BEIS Public Attitudes Tracker, Spring 2022, UK

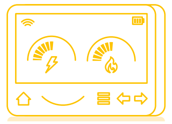



84% of people said that they were concerned about climate change, with 41% saying they were “very concerned”



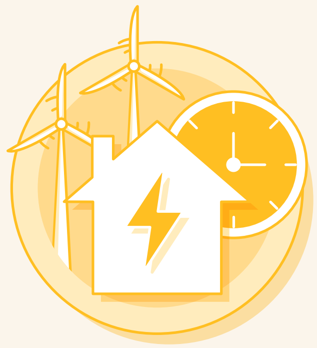
82% of people said they had given either a lot, or a fair amount, of thought to saving energy in the home

In our scenarios, consumer engagement in smart EV charging ranges from 43% (FS) to 92% (LW) in 2035



As at the end of March 2022, only 45% of installed energy meters were smart and operating in smart mode

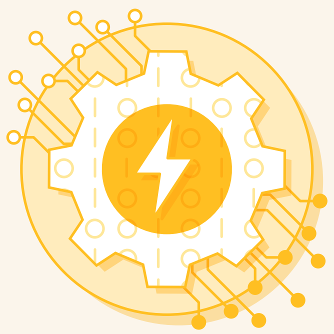
## Key recommendations



### Driving change

Significant levels of demand side flexibility are required to operate the electricity system without unabated natural gas after 2035.

Suppliers must be further supported to increase the availability of flexible time-of-use-tariffs so that consumers can respond to market signals and benefit from low prices at times of high renewable output.



### Digitalisation and innovation

Even the most engaged consumers won’t manually adjust their demand in line with prices and so smart digital solutions will be required to do this for them automatically and seamlessly.

To facilitate developments in smart technology and better understanding of regional trends, data must be made available to innovators while ensuring that appropriate consumer protection is maintained.

### Consumer information

Consumers are willing to make changes to meet Net Zero but need to be reliably informed about both how they can help as well as the affordability benefits of low carbon solutions.

Targeted campaigns, led by trusted bodies, are required to provide consumers with the information they need to decarbonise and embrace new technology.

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Key Message

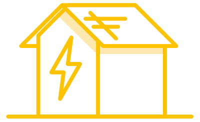
# 3 Markets and flexibility

**Reforming energy markets to improve price signals will help unlock the flexible solutions needed to integrate renewables efficiently.**

Wind and solar generation currently make up 43% of GB energy supply and this rises to at least 66% across the scenarios by 2030

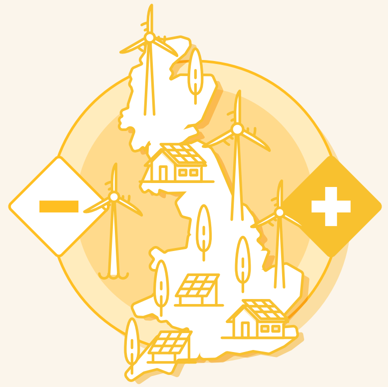
Annual transmission constraint costs have increased from £170m in 2010 to £1.3bn in 2022 and are expected to continue rising

In Leading the Way, demand side flexibility reduces unmanaged peak demand by over 40% by 2035



Consumer Transformation and Leading the Way have more than 115 GWh of electricity storage in 2035 compared to less than 30 GWh today

## Key recommendations



### Flexibility requirement

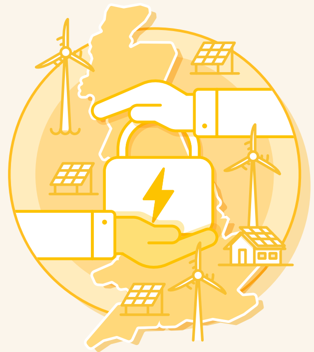
Operating a future energy system with high levels of renewables and no unabated natural gas generation will require significantly more flexible capacity than we have today.

Current market signals mean that flexible assets cannot contribute their full value to the system and may at times exacerbate network constraints - the impact of this will only increase in the future if changes are not made now.

### Locational signals

ESO analysis shows that market reform is needed to provide the dynamic real-time locational signals required to optimise dispatch and siting decisions of flexible capacity on the whole energy system.

Improving locational signals has the potential to deliver significant cost savings to consumers without any adverse impact on renewable targets.



### Market participation

The energy market of the future must harness the vast potential of demand side flexibility to integrate renewables and ensure security of supply at least cost for all.

Market changes must facilitate flexible tariffs, support innovation and reduce barriers to participation for new market entrants from the industrial and commercial sector or in the form of aggregated residential demand.

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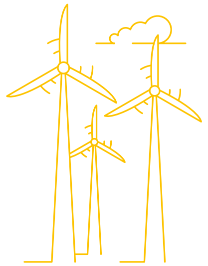
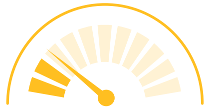
Key Message

# Infrastructure and whole energy system

**Strategic investment in the whole energy system is urgently required to keep pace with Net Zero ambitions and strengthen energy security.**

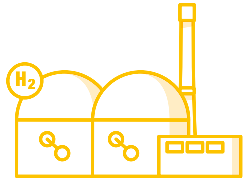


Across the scenarios, at least 31 GW of offshore wind is connected in 2030 with 51 GW in Leading the Way



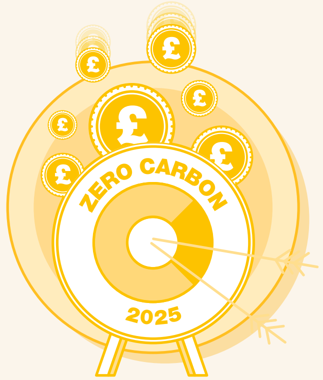
At least 15 TWh of electricity is curtailed in the Net Zero scenarios by 2030


There are over 40 GW of network-connected electrolysers in Leading the Way and System Transformation in 2050




56 TWh of Hydrogen storage is required in System Transformation by 2050

## Key recommendations




### Strategic whole system thinking

Delivery of the British Energy Security Strategy requires urgent anticipatory investment to ensure the energy system is not a blocker to Net Zero.

Strategic coordination and whole system thinking, especially across the electricity and hydrogen sectors, is required to achieve decarbonisation targets and avoid unmanageable network constraints and potential curtailment.

### Inter-seasonal storage

The whole energy system of the future will require strategic storage to balance inter-seasonal demand and supply and increase resilience against external security of supply risks.

This will include large-scale geological hydrogen and electricity storage projects which must commence now to support an electricity system without unabated natural gas after 2035.

### Whole system competition

To ensure affordable delivery of new infrastructure, competition in delivery must be established for large projects.

Competition is also required at a local level to ensure different regions can adopt the low carbon solutions that are most suited to the needs of their consumers.

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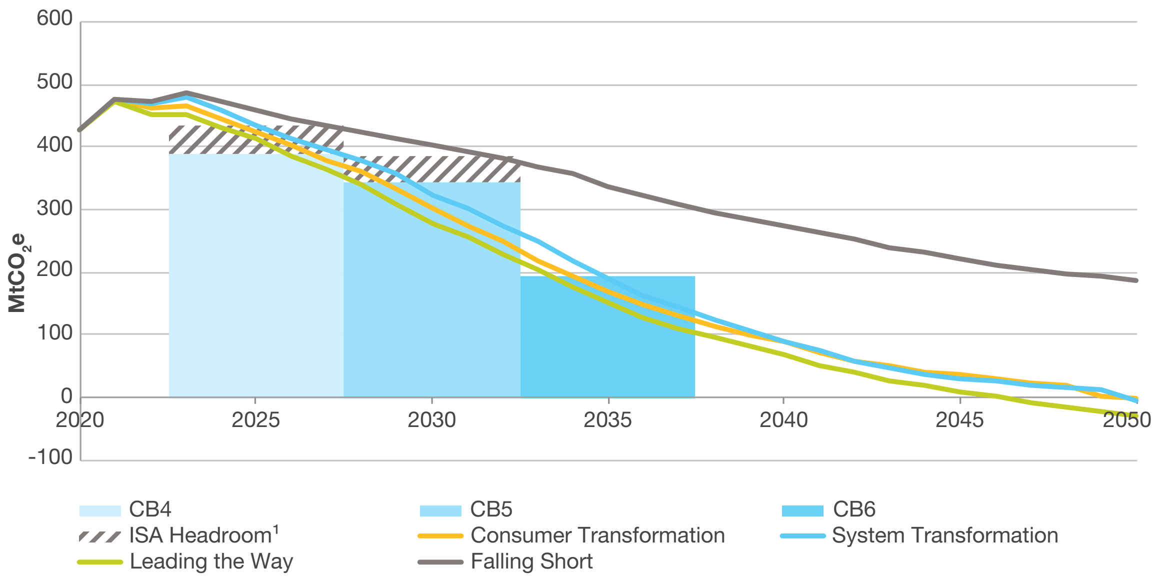
# Navigating a fair transition to Net Zero

The chart below shows how total greenhouse gas emissions from the different scenarios compare against both the 2050 Net Zero target and the associated Carbon Budgets (CBs).

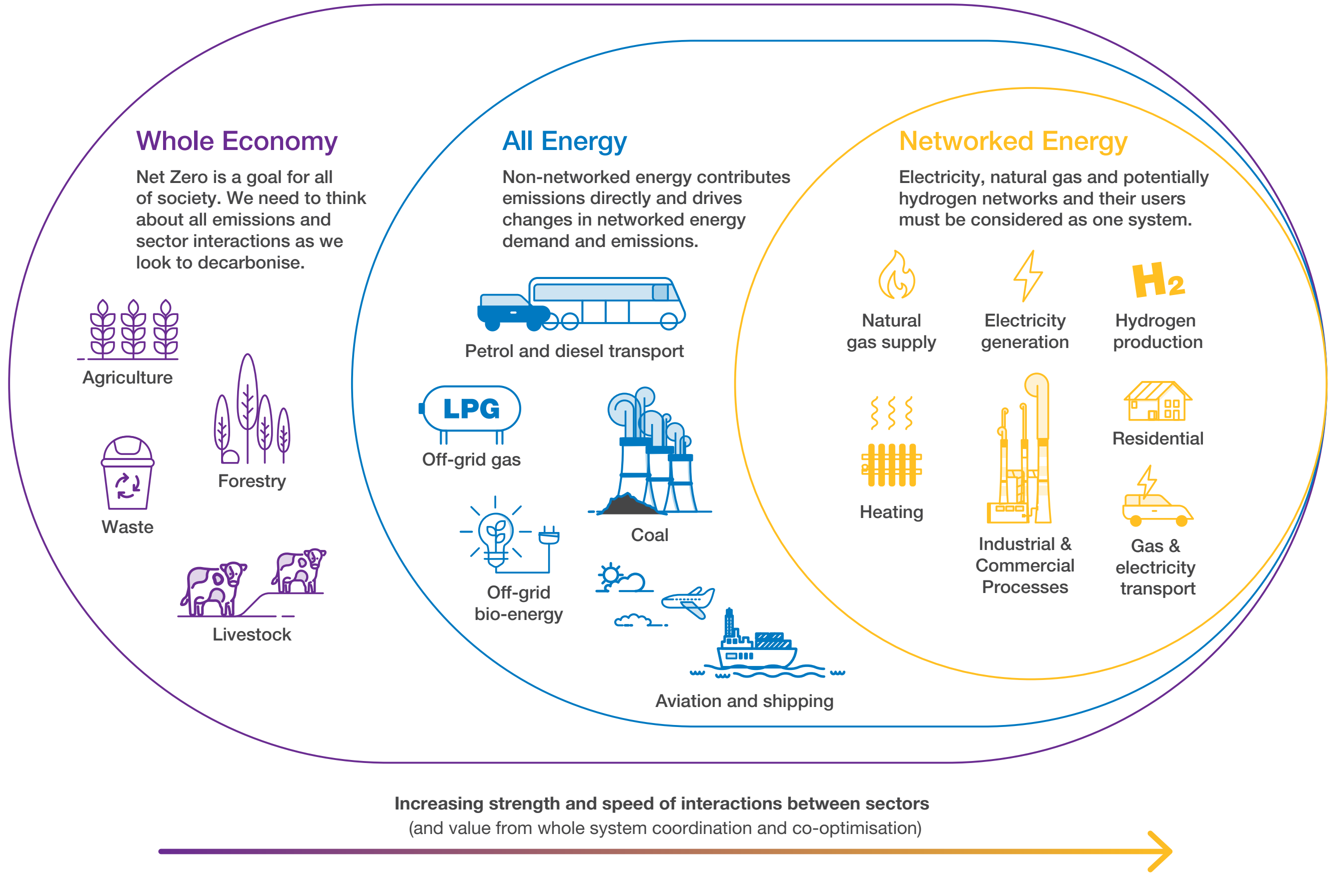



Consumer Transformation and System Transformation both **meet the target** of Net Zero greenhouse gas emissions by 2050 – as well as meeting all the interim carbon budgets. The ways they do this are very different and highlight the varying roles of supply and demand as well as different fuels like electricity and hydrogen.

In Leading the Way, combining high consumer engagement with significant and innovative investment enables the Net Zero target to be met in **2047** with emissions net negative in 2050.

Whilst decarbonisation is slowest in Falling Short, emissions in 2050 are still reduced by almost **80%** of 1990 levels which would have been close to meeting the previous carbon reduction target.

Our FES analysis focuses on the GB energy sector but, as other sectors such as aviation and agriculture contribute greenhouse gas emissions, a whole economy view is needed when assessing Net Zero. Even by 2050, we assume that sectors like these don't fully decarbonise and so some of their residual emissions must be offset by the energy sector becoming net negative.




1 International Aviation and Shipping Headroom

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# Seeing the whole picture

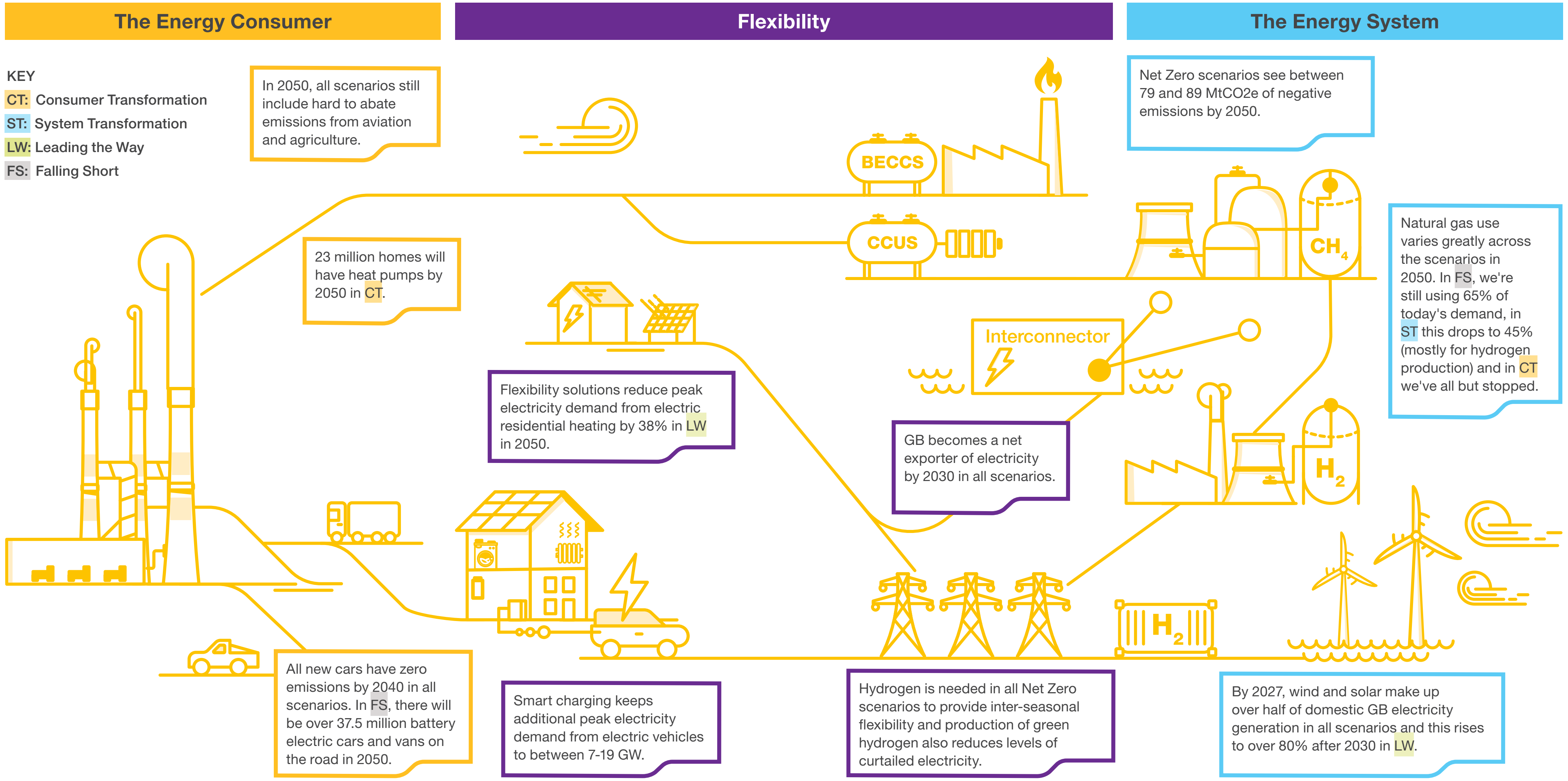
Today, the electricity system is designed and operated to allow flexible supply to meet whatever demand is required but, in the future, demand must be enabled to flex to supply which will come increasingly from weather-driven renewables.

This will involve increased interaction across fuels like natural gas, bio-resources and hydrogen as well as significantly more non-fossil fuel and demand side flexibility.

## As well as a chapter on reaching Net Zero, FES 2022 has the following dedicated chapters:

- “the energy consumer” covers the residential, industrial, commercial and transport sectors and considers how decarbonisation affects individual consumers
- “the energy system” explores how total GB demand is met using decarbonised energy sources such as electricity, hydrogen, natural gas and bioenergy
- “flexibility” ensures energy supply and demand are balanced, and security of supply criteria are met, as the energy system decarbonises

**To develop and operate the whole energy system of the future and deliver value to consumers, each of these three areas must be fully considered.**

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# FES key comparison chart 1

CT Consumer Transformation
LW Leading the Way
ST System Transformation
FS Falling Short
Policy

This chart contains a selection of recent policy targets in relation to Net Zero and energy security and highlights how they compare to the different scenarios. Analysis for FES 2022 commenced before the publication of several key policy documents and does not signify that any individual targets cannot be met across the range of scenarios.

| | | 2021 | By 2025 | By 2030 | By 2035 | By 2040 | By 2045 | By 2050 | Maximum potential by 2050 |
|---|---|---|---|---|---|---|---|---|---|
| **Emissions** | Meets 2050 Net Zero target | | | | | | | CT LW ST | |
| | Meets 5th carbon budget | 499 MtCO2e emissions | | CT LW ST | FS | | | | Net Zero by 2047 LW |
| | Meets 6th carbon budget | | | | CT LW ST | | | | |
| **Electricity Generation** | 50 GW of offshore wind | 13 GW | | LW | CT ST | FS | | | 110 GW CT |
| | Up to 5 GW floating offshore wind | 0 GW | | | CT LW ST | FS | | | 25 GW CT |
| | Up to 70 GW of solar | 13 GW | | | | LW | | CT | 92 GW CT |
| | No unabated natural gas-fired generation capacity (subject to security of supply) | 35 GW | | | | LW | ST | CT | LW reaches this target in 2036 LW |
| | Up to 24 GW nuclear generation capacity | 7.6 GW | | | | | | | 15 GW CT |
| **Hydrogen** | 10 GW low carbon hydrogen production capacity | <1 GW | | LW | ST | | CT | | 83 GW ST |
| | 5 GW hydrogen production from electrolysis | <1 GW | | LW | ST | CT | | | 55 GW LW |
| | Up to 2 GW of low carbon hydrogen production capacity in operation or construction[2] | <1 GW | | ST LW | CT | | | | 83 GW ST |
| | 4 hydrogen clusters | 0 | | ST LW | | | | | 5 Clusters ST |
| **Natural Gas** | 40% reduction in gas consumption | | | LW | CT | ST | | | 96% reduction ST |
| **Bioenergy** | *Strategy expected this year – bioresource supply consistent with CCC Carbon Budget 6* | | | | | | | | |

2 FES scenarios on this chart represent operation rather than construction as well as a mix of blue and green hydrogen.

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# FES key comparison chart 2

CT Consumer Transformation
LW Leading the Way
ST System Transformation
FS Falling Short
Policy

This chart contains a selection of recent policy targets in relation to Net Zero and energy security and highlights how they compare to the different scenarios. Analysis for FES 2022 commenced before the publication of several key policy documents and does not signify that any individual targets cannot be met across the range of scenarios.

| | | 2021 | By 2025 | By 2030 | By 2035 | By 2040 | By 2045 | By 2050 | Maximum potential by 2050 |
|---|---|---|---|---|---|---|---|---|---|
| **Transport** | Sales of petrol and diesel cars and vans banned | 1.6m petrol and diesel cars and vans sold | | CT LW | ST | FS | | | 37m battery electric cars and vans FS |
| | Zero tailpipe emissions for all new cars | 7% of cars sold | | | CT LW ST | FS | | | Zero ICE cars still on the road CT ST LW |
| | Zero tailpipe emissions for all new HGVs | <1% of HGVs sold | | | | CT LW ST | FS | | Zero ICE HGVs still on the road CT ST LW |
| **Heating** | 600,000 heat pumps installed per year | Approximately 60,000 | LW | CT | ST | FS | | | 1.1m per year CT |
| | 4 in 5 homes not using natural gas boiler as primary heat source | 1 in 5 | | | | LW | CT ST | | 100% CT ST LW |
| **Natural Gas** | Gas grid connection for new homes ends | >60% | CT LW | | ST | | | | 0% LW |
| **Data centres** | Additional demand for data centres exceeds 5 TWh | <0.5 TWh | | CT LW | ST | | FS | | 20 TWh LW |
| **Industry** | Annual industrial hydrogen demand over 10 TWh | <0.5 TWh | | | LW ST | | CT | | 88 TWh (45 TWh target by 2035 narrowly missed in ST) ST |
| **Energy storage** | 100 GWh of non-battery electrical storage | 2.4 GW / 26 GWh | | | LW | | CT | | 132 GWh LW |
| | 30 GWh of battery electrical storage | 1.6 GW / 1.6 GWh | | LW | CT | | | ST | 62 GWh LW |
| **Interconnectors** | 18 GW capacity | 6 GW | | LW | CT | ST | | | 27.4 GW LW |

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# Key statistics

| | 2021 | 2030 | | | | 2035 | | | | 2050 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emissions** | | CT | ST | LW | FS | CT | ST | LW | FS | CT | ST | LW | FS | **Emissions** |
| Annual average carbon intensity of electricity (g $CO_2$/kWh) | 156 | 40 | 47 | 15 | 106 | -26 | -26 | -12 | 43 | -53 | -51 | -19 | -12 | Annual average carbon intensity of electricity (g $CO_2$/kWh) |
| **Electricity** | | | | | | | | | | | | | | **Electricity** |
| Annual demand (TWh)[1] | 294 | 339 | 321 | 368 | 323 | 463 | 392 | 476 | 370 | 710 | 716 | 672 | 566 | Annual demand (TWh)[1] |
| Peak demand (GW)[2] | 59 | 69 | 64 | 63 | 67 | 87 | 73 | 82 | 78 | 113 | 100 | 98 | 114 | Peak demand (GW)[2] |
| Total installed capacity (GW)[3] | 107 | 191 | 171 | 211 | 156 | 266 | 225 | 286 | 190 | 382 | 318 | 363 | 276 | Total installed capacity (GW)[3] |
| Wind and solar capacity (GW) | 40 | 104 | 90 | 124 | 70 | 156 | 136 | 175 | 94 | 237 | 189 | 226 | 138 | Wind and solar capacity (GW) |
| Interconnector capacity (GW) | 6 | 13 | 13 | 19 | 13 | 19 | 13 | 25 | 13 | 22 | 16 | 27 | 13 | Interconnector capacity (GW) |
| Total storage capacity (GW)[4] | 4 | 20 | 15 | 30 | 12 | 36 | 19 | 51 | 16 | 63 | 40 | 71 | 27 | Total storage capacity (GW)[4] |
| Total storage capacity (GWh)[5] | 28 | 59 | 47 | 118 | 42 | 116 | 56 | 147 | 48 | 165 | 113 | 195 | 63 | Total storage capacity (GWh)[5] |
| Total vehicle-to-grid capacity (GW)[6] | 0 | 2 | 0 | 3 | 0 | 14 | 1 | 28 | 0 | 34 | 16 | 39 | 8 | Total vehicle-to-grid capacity (GW)[6] |
| **Natural Gas** | | | | | | | | | | | | | | **Natural Gas** |
| Annual demand (TWh)[7] | 878 | 592 | 676 | 489 | 789 | 402 | 593 | 332 | 742 | 27 | 392 | 75 | 572 | Annual demand (TWh)[7] |
| 1-in-20 peak demand (GWh/day) | 5555 | 3985 | 4823 | 3368 | 5331 | 2593 | 3858 | 1987 | 4950 | 282 | 2086 | 509 | 3962 | 1-in-20 peak demand (GWh/day) |
| Residential demand (TWh)[8] | 340 | 242 | 292 | 200 | 314 | 152 | 213 | 113 | 284 | 0 | 1 | 0 | 142 | Residential demand (TWh)[8] |
| Imports (TWh) | 552 | 432 | 463 | 309 | 517 | 301 | 433 | 228 | 465 | 24 | 386 | 55 | 393 | Imports (TWh) |
| **Hydrogen** | | | | | | | | | | | | | | **Hydrogen** |
| Annual demand (TWh) | 0 | 3 | 36 | 38 | 1 | 17 | 148 | 77 | 3 | 114 | 431 | 244 | 11 | Annual demand (TWh) |
| Blue hydrogen production (TWh)[9] | 0 | 0 | 25 | 7 | 0 | 1 | 104 | 26 | 1 | 1 | 218 | 26 | 6 | Blue hydrogen production (TWh)[9] |
| Green hydrogen production (TWh)[10] | 0 | 3 | 10 | 31 | 1 | 15 | 23 | 44 | 2 | 104 | 160 | 179 | 5 | Green hydrogen production (TWh)[10] |
| **Bioresources** | | | | | | | | | | | | | | **Bioresources** |
| Bioresource demand (TWh) | - | 109 | 110 | 140 | 120 | 190 | 190 | 151 | 134 | 250 | 251 | 177 | 160 | Bioresource demand (TWh) |

1. Customer demand plus on-grid electrolysis meeting GB hydrogen demand only, plus losses, equivalent to GBFES System Demand Total in ED1 of data workbook
2. Refer to Data Workbook for further information on winter average cold spell (ACS) peak demand
3. Includes all networked generation as well as total interconnector and storage capacity (including vehicle-to-grid available at winter peak)
4. Includes vehicle-to-grid capacity available at winter peak
5. Excludes vehicle-to-grid
6. Less capacity will be available during winter peak 5-6pm due to vehicle usage
7. Includes shrinkage, exports, biomethane and natural gas for methane reformation
8. Residential demand made up of biomethane and natural gas
9. Blue hydrogen is created using natural gas as an imput, plus CCUS
10. Green hydrogen is created via electrolysis using zero carbon electricity (this figure does not include hydrogen produced directly from nuclear or bioenergy)


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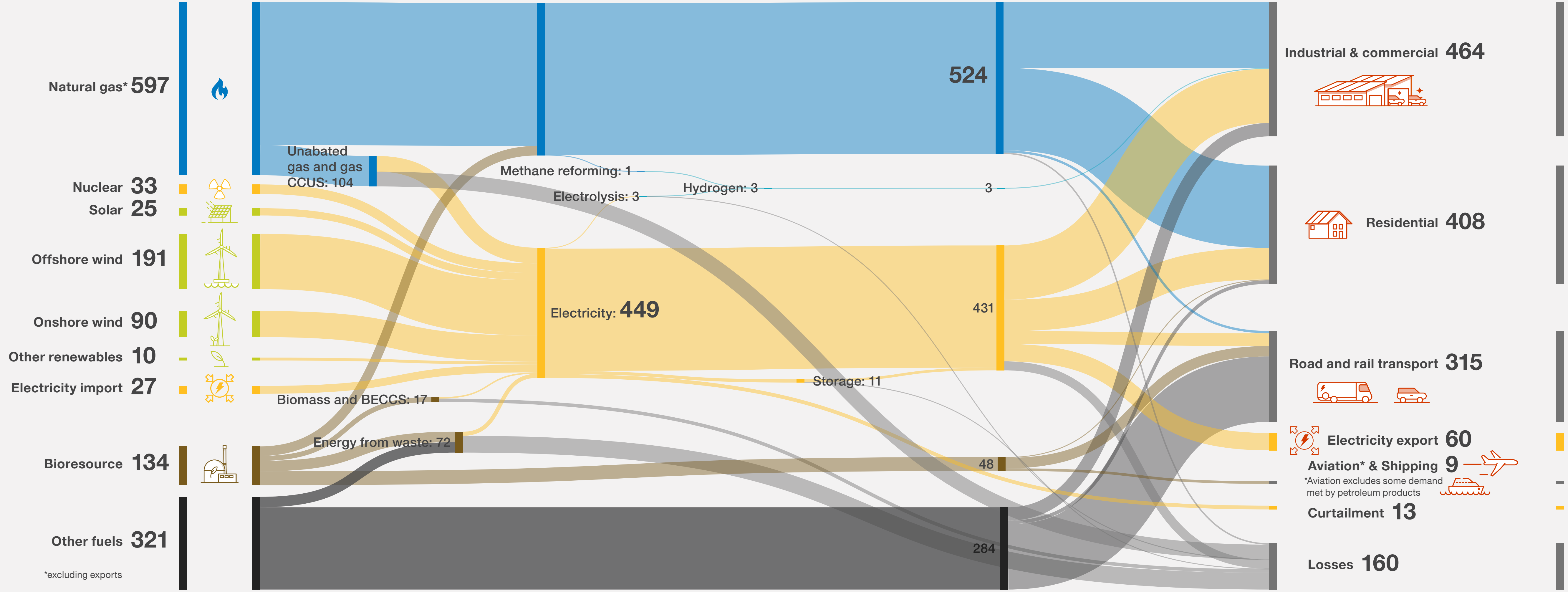
# 2035 energy flows

For FES 2022, energy flow diagrams have been included for Falling Short and Leading the Way in **2035** to highlight the differences between the slowest and fastest decarbonising scenarios in relation to the target for no unabated natural gas in the power sector by this year.

## Falling Short (1428 TWh)

- Minimal difference to today with continued reliance on both oil-based fuels as well as natural gas
- Main area of progress is in surface transport where increased electrification and use of biofuels reduces demand for oil-based products
- Significant increase in electricity generation from renewables but unabated gas-fired generation still contributes heavily
- Use of oil-based fuels in residential heating largely replaced by electric heat pumps





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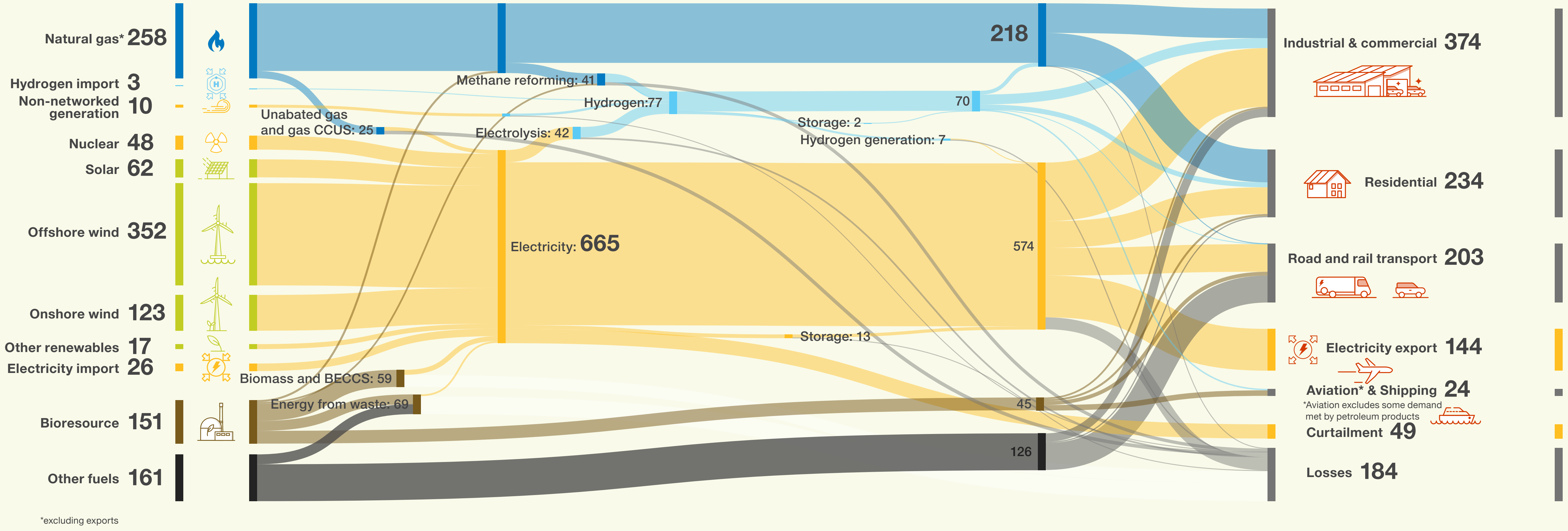
# 2035 energy flows

For FES 2022, energy flow diagrams have been included for Falling Short and Leading the Way in **2035** to highlight the differences between the slowest and fastest decarbonising scenarios in relation to the target for no unabated natural gas in the power sector by this year.

## Leading the Way (1211 TWh)

- Virtually no unabated natural gas used for electricity generation
- Half of energy demand for road and rail transport sector is met by electricity
- Significant hydrogen production has commenced from a broadly equal combination of electrolysis and methane reformation
- High levels of electricity curtailment already beginning to be seen (this reduces to almost nothing by 2050)



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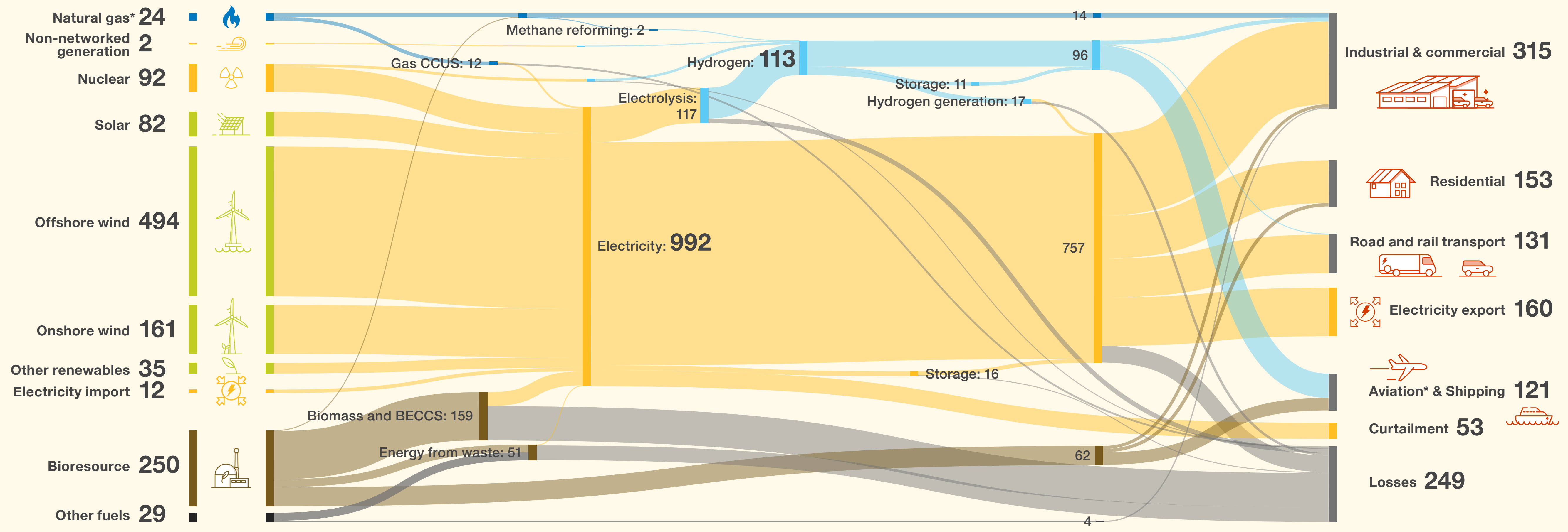
# 2050 energy flows

## Consumer Transformation (1182 TWh)

- Home heating, transport and industry largely electrified
- High levels of energy efficiency combined with large-scale electrification lead to lowest end user energy demands across the scenarios
- Electricity generation capacity and output is highest in this scenario to meet high annual electricity demands
- High levels of renewable generation with low hydrogen production leads to highest levels of electricity curtailment across the scenarios




*excluding exports

*Aviation excludes some demand met by petroleum products

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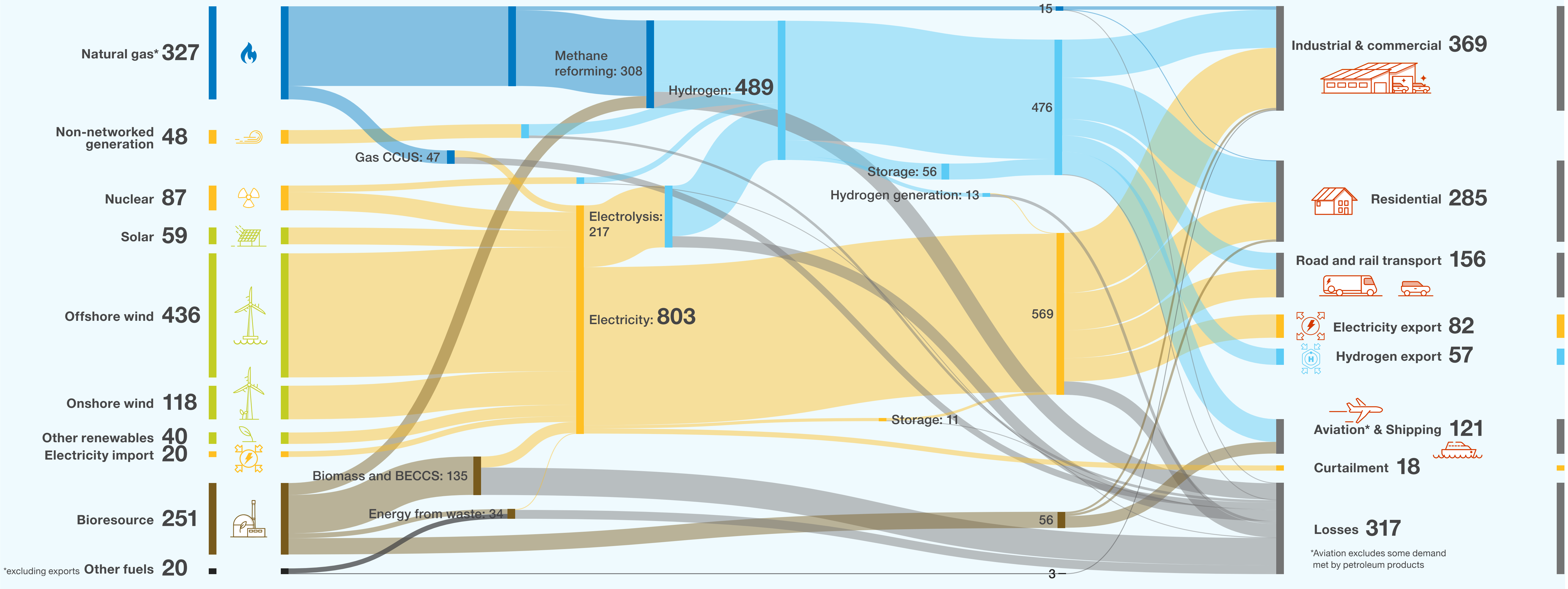
# 2050 energy flows

## System Transformation (1406 TWh)

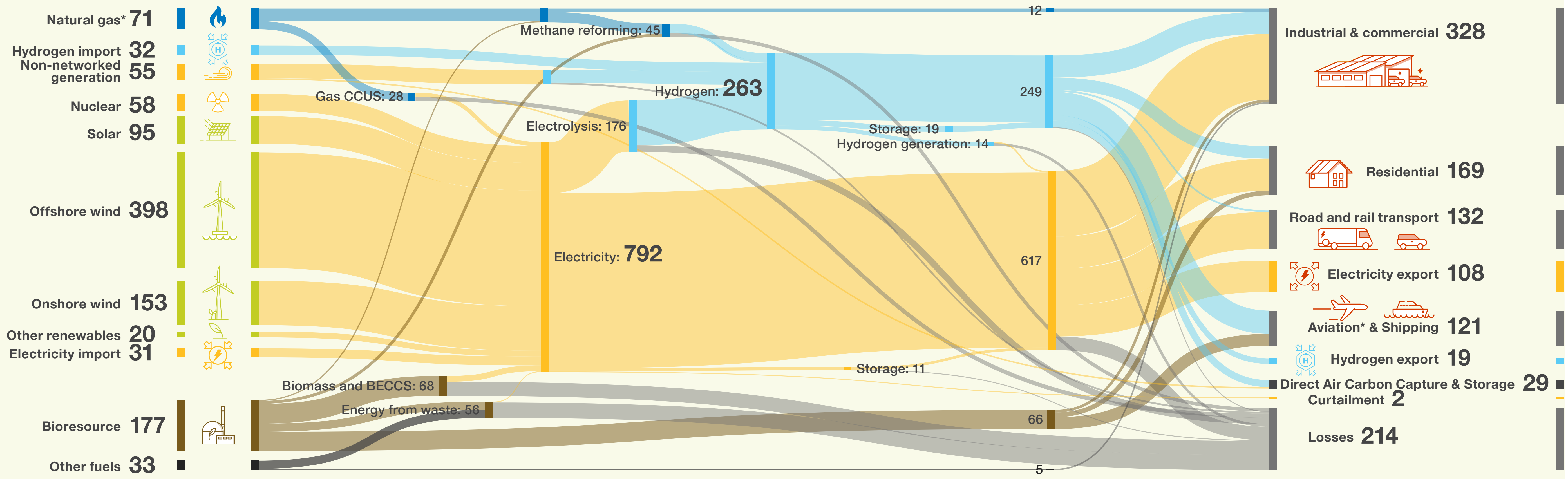
- Highest proportion of hydrogen across the scenarios with widespread use for home heating, industry and HGVs
- All hydrogen is produced in the UK from a combination of methane reformation and electrolysis
- High levels of hydrogen production enable an export market to form
- Joint highest level of bioresource use with Consumer Transformation - biomass used to produce both hydrogen and electricity



# 2050 energy flows

## Leading the Way (1123 TWh)

- Combination of hydrogen and electricity used in industry and to heat homes
- Imports and exports of hydrogen to provide maximum levels of system flexibility
- Lowest level of electricity curtailment across the scenarios
- Direct air carbon capture and storage (DACCS) used for negative emissions




*excluding exports

*Aviation excludes some demand met by petroleum products

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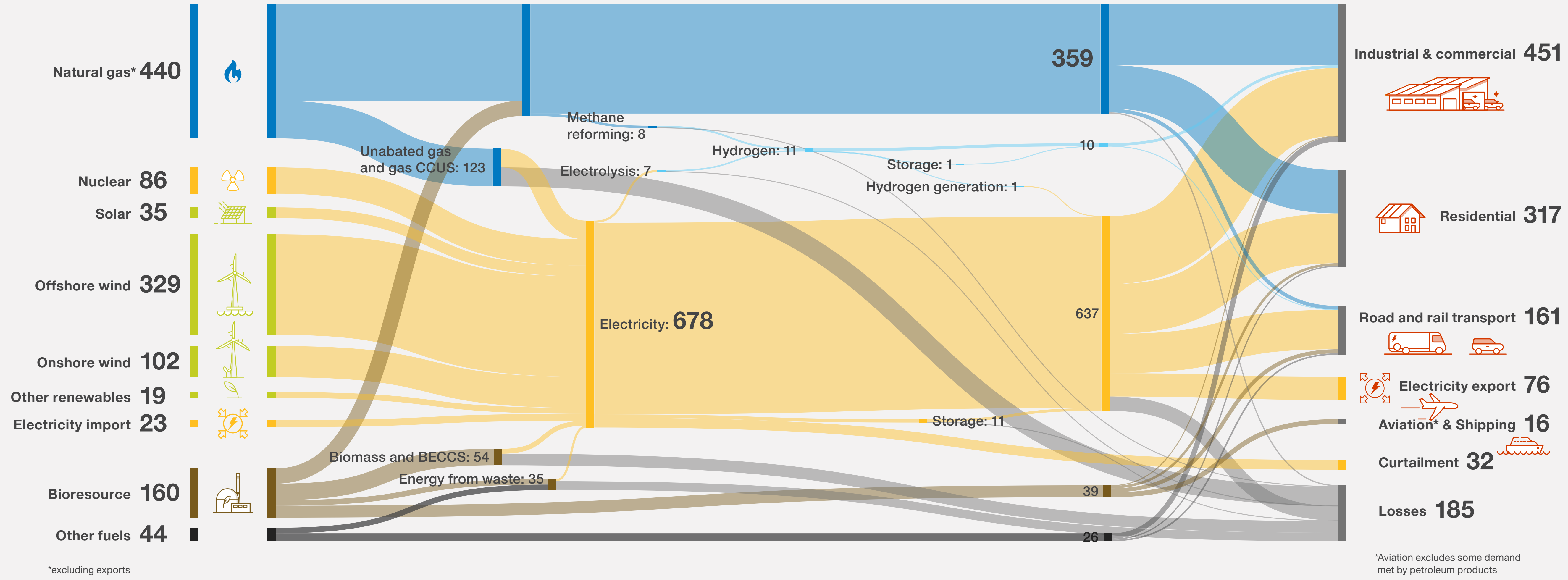
# 2050 energy flows

## Falling Short (1237 TWh)

- Continued high usage of natural gas, particularly for domestic heating and industry
- Small private vehicles fully electrified (including some plug-in hybrids) whilst HGVs rely on fossil fuels
- Low use of hydrogen as production isn't decarbonised
- Highest total end-user energy demand due to minimal increase in energy efficiency measures and reliance on inefficient fossil fuels





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# Thanks for your time, we hope you found FES 2022 interesting and useful!

## Continuing the Conversation

In terms of next steps, we now move into our main stakeholder engagement stage of the FES cycle, using your comments and questions about FES 2022 to inform our analysis and insights. We're also increasing the regional focus of our work, so particularly welcome your local insights.

Similar to previous years, we will be using FES 2022 as a basis for the next iteration of 'FES - Bridging the Gap to Net Zero'. If you'd like to know more, please click here.

## Ways to connect and stay in touch

Keep an eye out for any surveys, thought pieces and engagement opportunities via our FES newsletter. If you are not already subscribed, you can do so via https://subscribers.nationalgrid.co.uk, the ESO website www.nationalgrideso.com/ or use the FES email address opposite.

Email us with your views on FES or any of our future of energy documents at: fes@nationalgrideso.com and one of our team members will be in touch.

Access our current and past FES documents, data and multimedia at: www.nationalgrideso.com/future-energy/future-energy-scenarios.

Get involved in the debate on the future of energy and join our LinkedIn group Future of Energy by National Grid ESO.

For further information on ESO publications please visit: https://nationalgrideso.com.

Write to us at:
**Energy Insights & Analysis**
**Electricity System Operator**
**Faraday House**
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