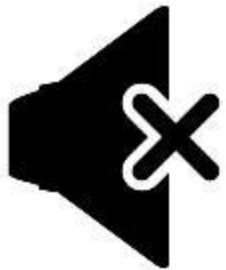


# 2020 Future Energy Scenarios Costing The Energy Sector

Due to a large audience,  
**please put yourself on  
mute and turn your video  
off**



Please use Slido (mobile or laptop) for all questions and comments. We will also ask you questions via Slido.

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This will be recorded

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November 2020

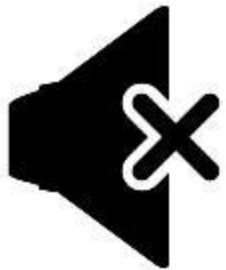
# 2020 Future Energy Scenarios Costing The Energy Sector

Expanding the context of the  
Future Energy Scenarios.



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# Project Background

## ***Expand the context of the Future Energy Scenarios***

- The aim of the costing project was to cost the FES 2020 scenarios for the energy sector, providing a comparison across the four scenarios
- Respond to stakeholder feedback

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## *Published Documents*

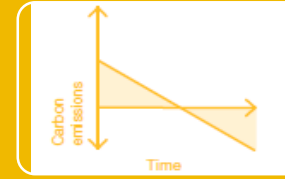
- Documents will be published on the 1<sup>st</sup> of December
- Documents will include
  - Report
  - Data workbook

# FES Key Messages

Builds upon the FES Scenarios

Supports the FES Key Messages

## FES Key Messages



Reaching net zero carbon emissions by 2050 is achievable. However, it requires immediate action across all key technologies and policy areas, and full engagement across society and end consumers.



Hydrogen and carbon capture and storage must be deployed for net zero. Industrial scale demonstration projects need to be operational this decade.



The economics of energy supply and demand fundamentally shift in a net zero world. Markets must evolve to provide incentives for investment in flexibility and zero carbon generation.



Open data and digitalisation underpin the whole system thinking required to achieve net zero. This is key to navigating increasing complexity at lowest cost for consumers.



# Scope

Some costs have been excluded from the scope of the project to either being considered outside of the energy sector or due to lack of data.

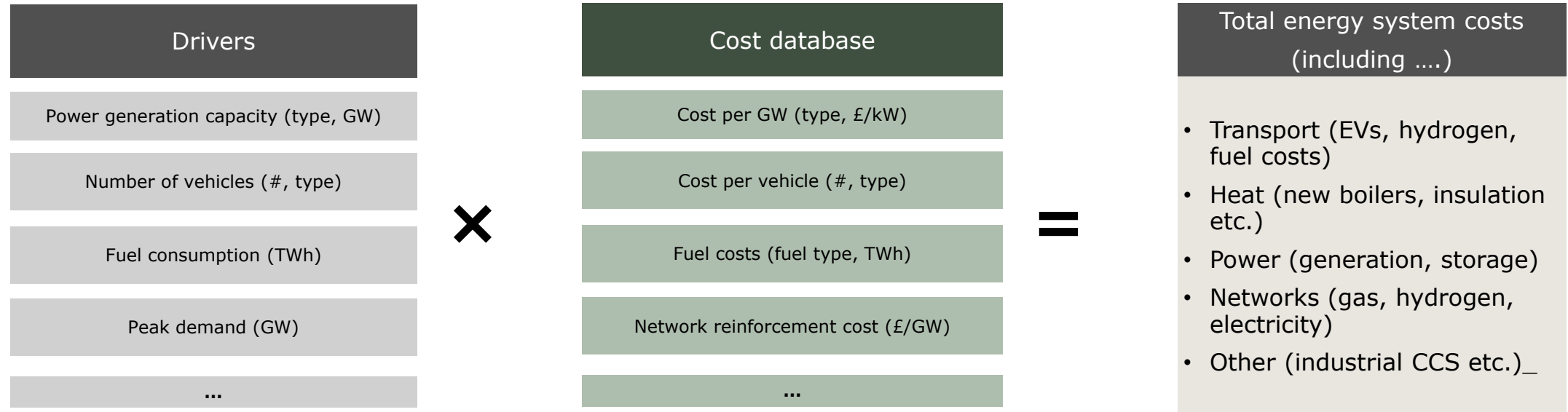
## Included in costing

- **Electricity**
  - Networks
  - Generation
  - Fuel
  - Import
- **Natural Gas**
  - Networks
  - Fuel
- **Hydrogen**
  - Networks
  - Production
  - Storage
  - Import
- **Road Transport**
  - CapEx
  - OpEx
  - Charging facilities
- **Residential Heating**
  - Heating Solution
  - Insulation

## Excluded from costing

- Areas outside the energy industry, i.e. Agriculture
- Other forms of non-road transport, i.e. rail, aviation, shipping
- Heat costs for the industrial and commercial sector
- Appliance capex costs (e.g. fridges, washing machines etc)

# Modelling Approach



All drivers have come from the FES outputs

The Costs used are based on Afry's Cost Database with some updates based on costs published in FES

When presenting the net present value a 3.5% social discount rate has been considered as per HM Treasury Greenbook recommendation.

FES assumes an unconstrained network. For the costing project we have included some basic cost assumptions for the networks.

When studying the costs we have included the costs at the point where the driver increases and not spread them over the lifetime of the asset.

# FES 2020 Scenarios

## Consumer Transformation (CT)

- Electrified heating
- Consumers willing to change behaviour
- High energy efficiency
- Demand side flexibility

## System Transformation (ST)

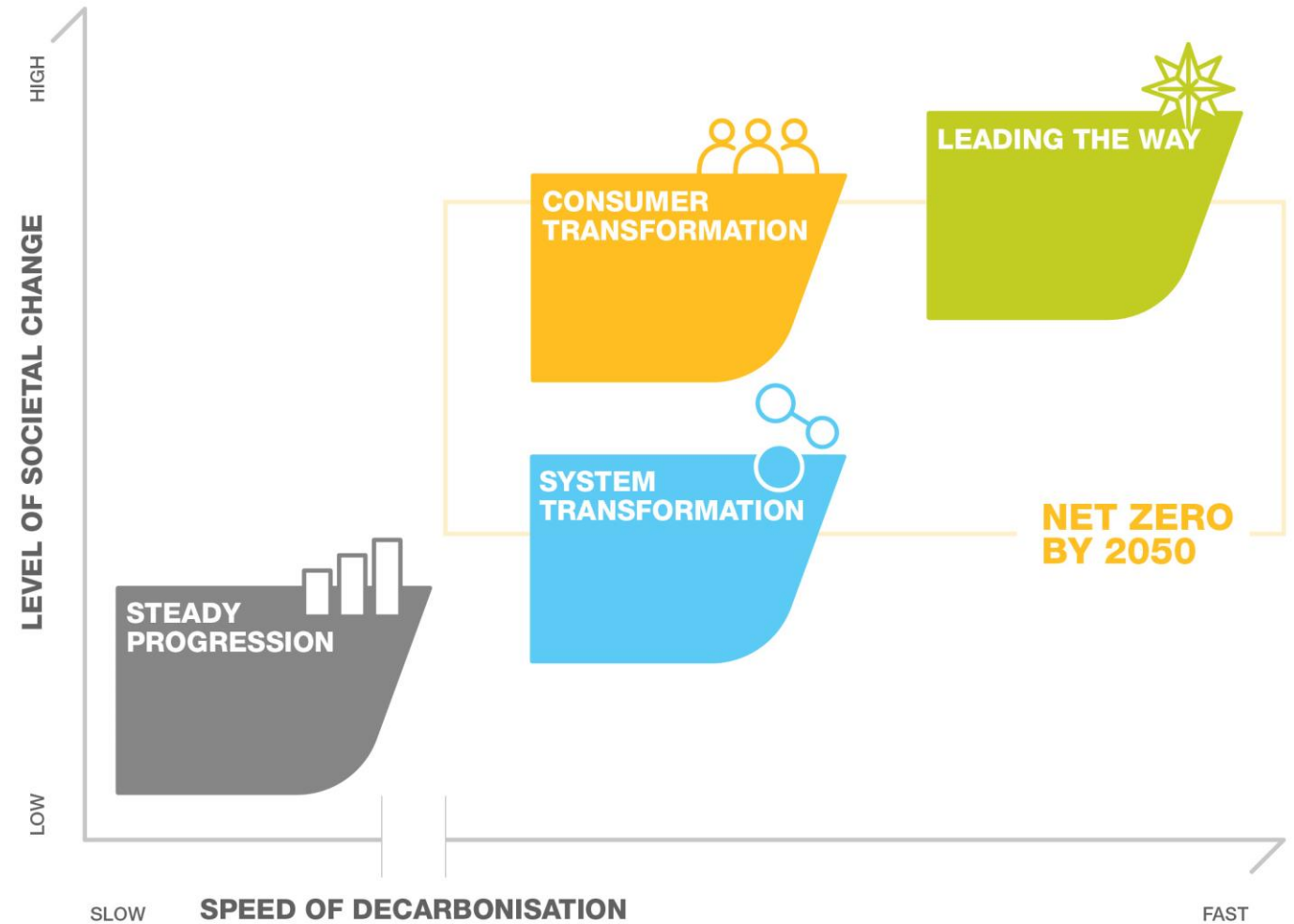
- Hydrogen for heating
- Consumers less inclined to change behaviour
- Lower energy efficiency
- Supply side flexibility

## Leading the Way (LW)

- Fastest credible decarbonisation
- Significant lifestyle change
- Mixture of hydrogen and electrification for heating

## Steady Progression (SP)

- Slowest credible decarbonisation
- Minimal behaviour change
- Decarbonisation in power and transport but not heat



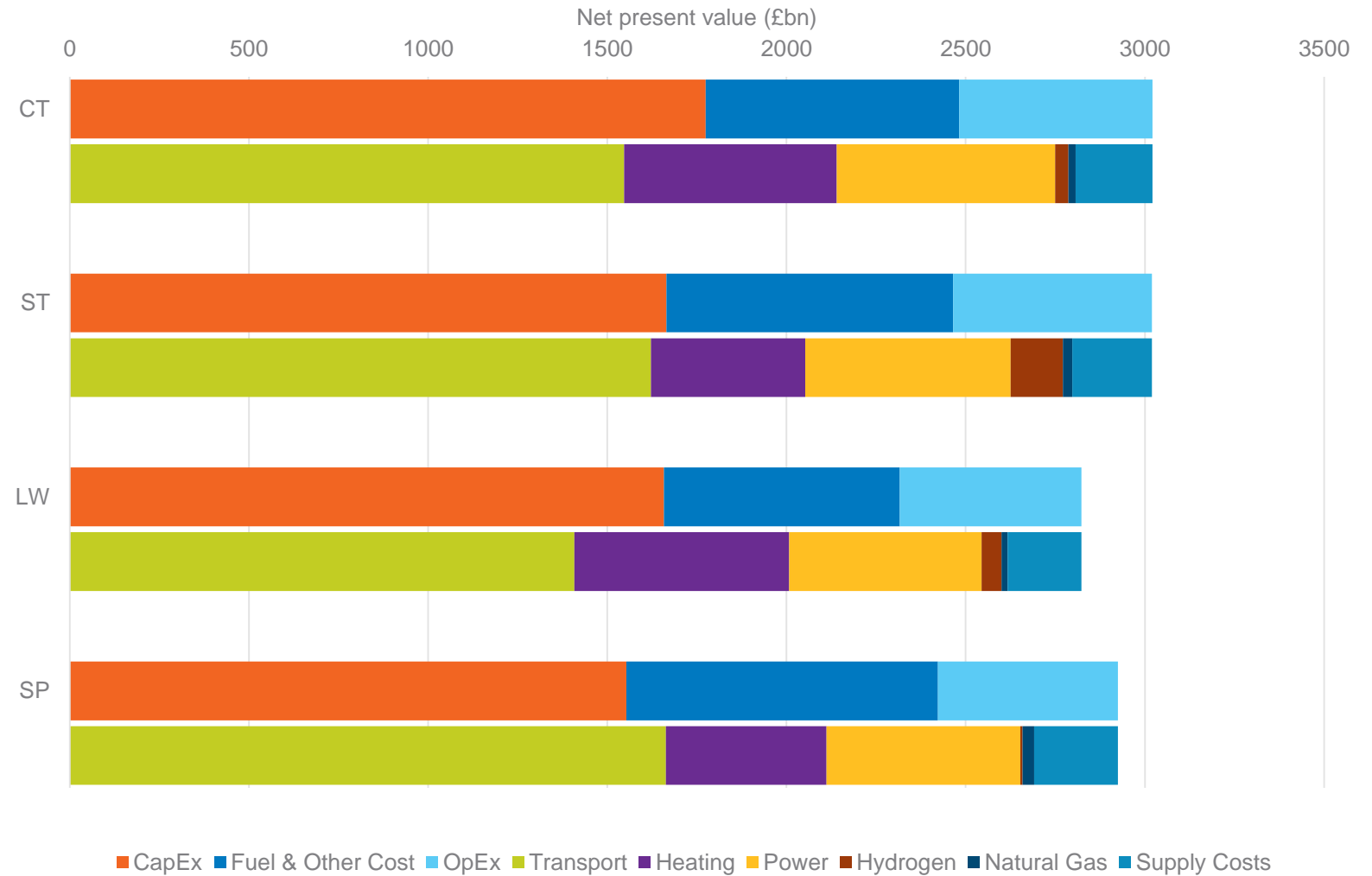
# Overview of Results

There is only a 7% difference in overall costs across the scenarios

Transport and Heating are big factors in the overall costs.

Increased consumer engagement, negative emissions and energy efficiency drives the cheapest scenario.

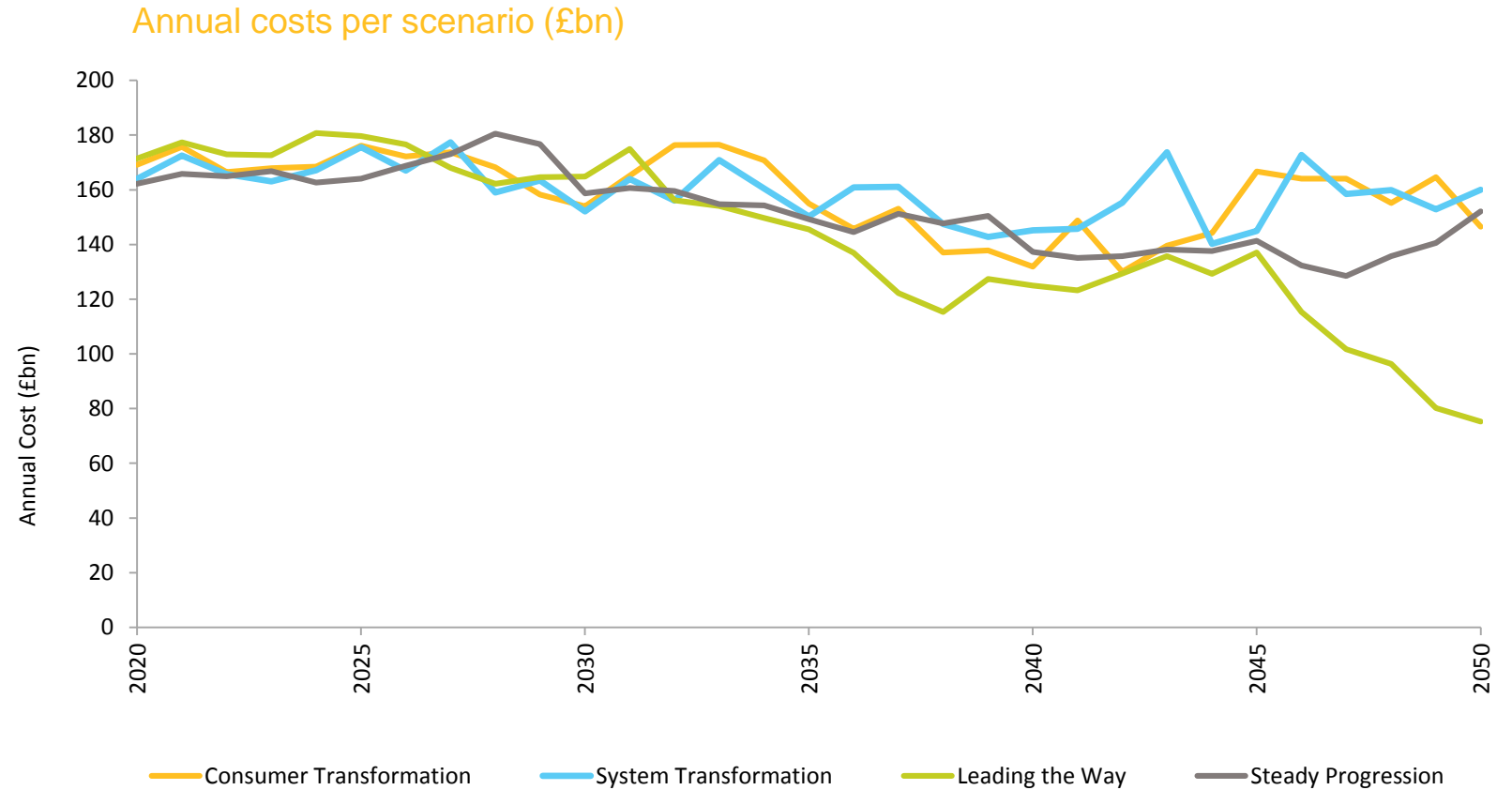
Net present value breakdown of total costs per scenario (£bn)



# Overview of Results

There is no major cost difference between scenarios until 2045 with cost remaining around the same levels as today.

Leading the Way shows divergence from the mid 2040s





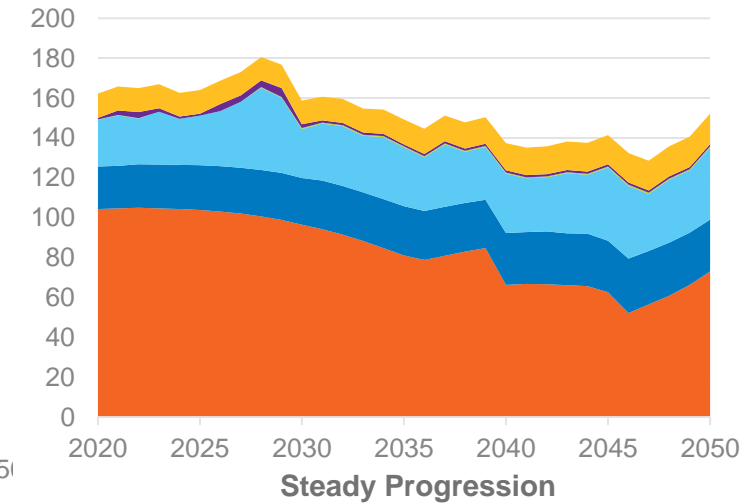
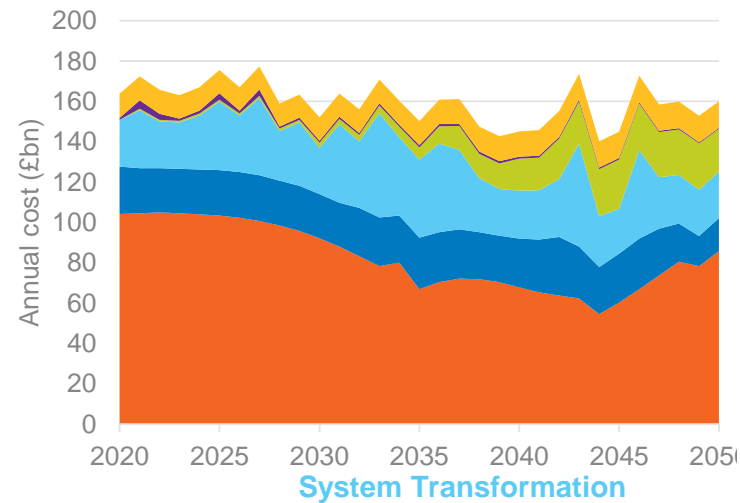
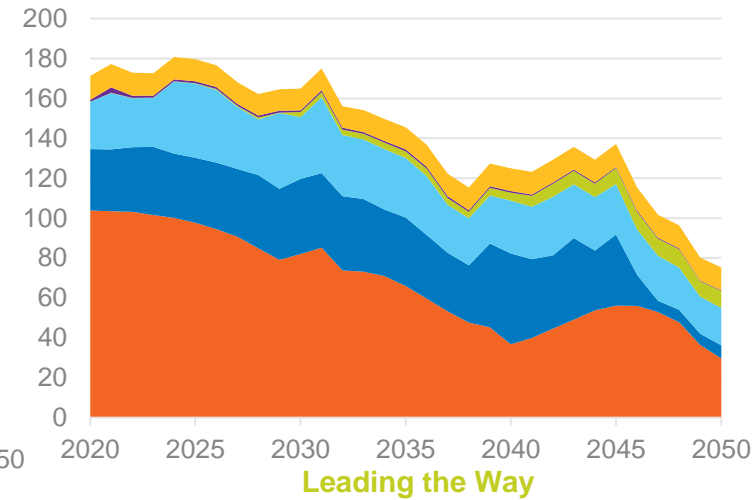
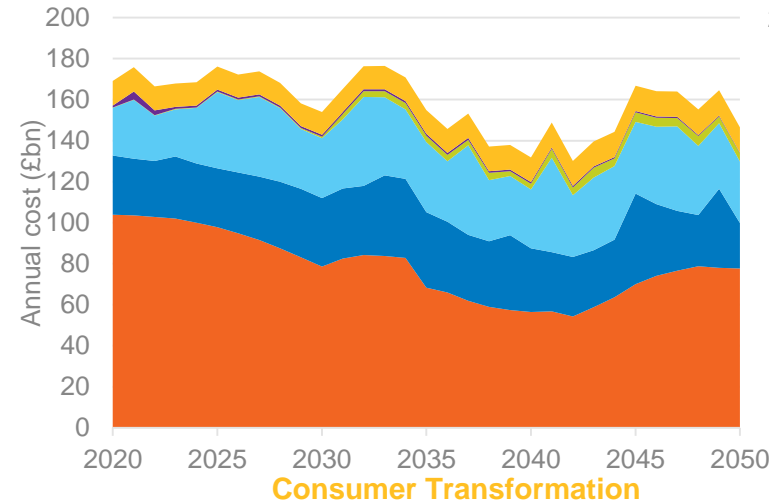
# Annual costs by sector per scenario

Transport costs dominate annually in all scenarios

Three scenarios see broadly similar annual costs out to 2050

Leading the Way sees sharp annual cost reductions post-2045

Year-on-year costs by sector and scenario



Transport Heating Power  
Hydrogen Natural Gas Supply Costs

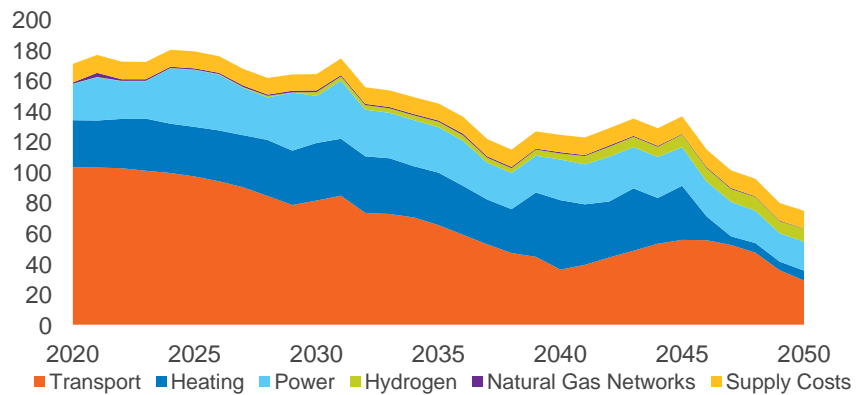
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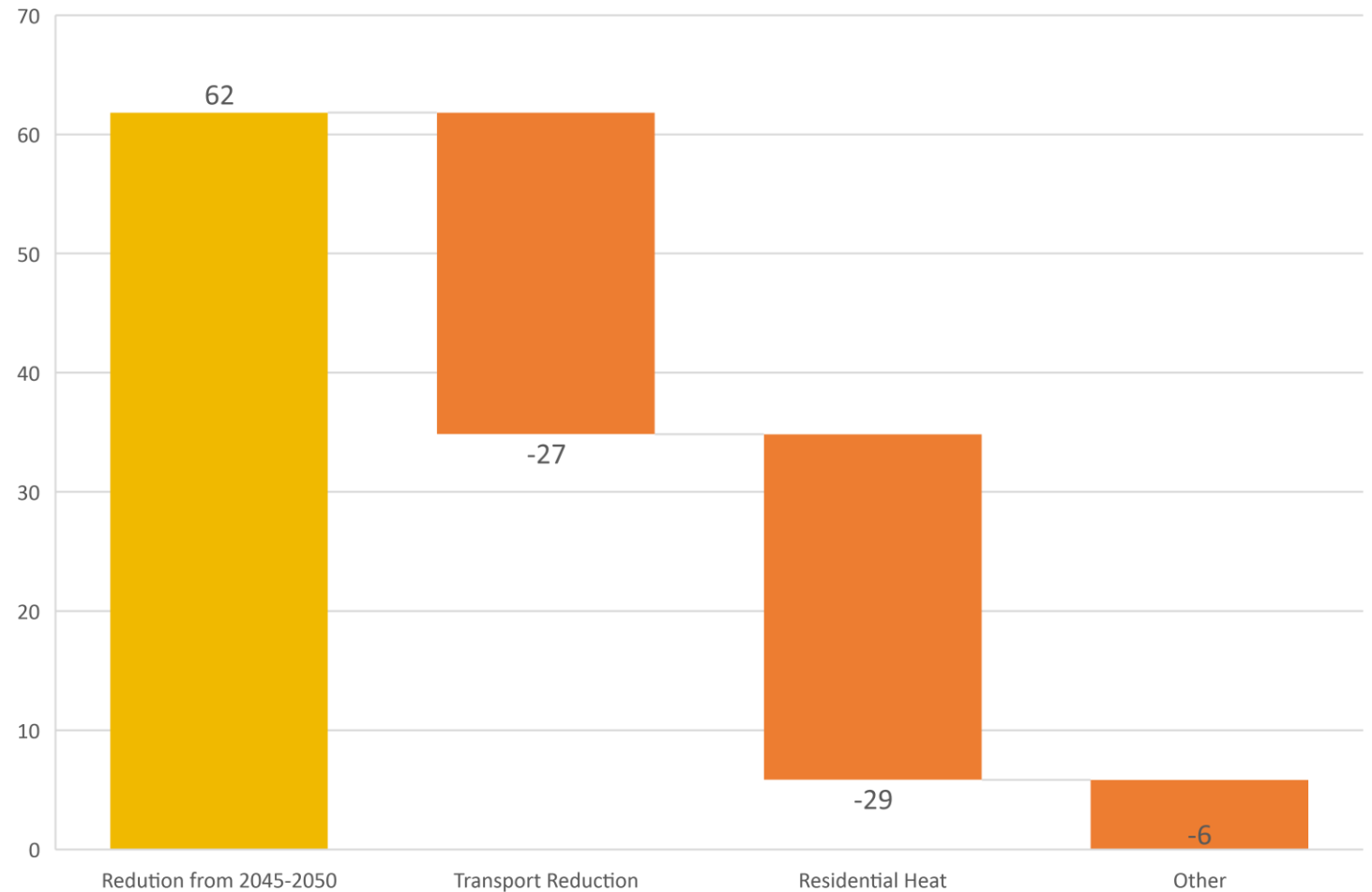
Three scenarios see broadly similar annual costs out to 2050

Leading the Way sees sharp annual cost reductions post-2045

Year-on-year Leading the Way (£bn)



Reduction in annual costs from 2045 to 2050 in Leading the Way (£bn/yr)



# Road Transport

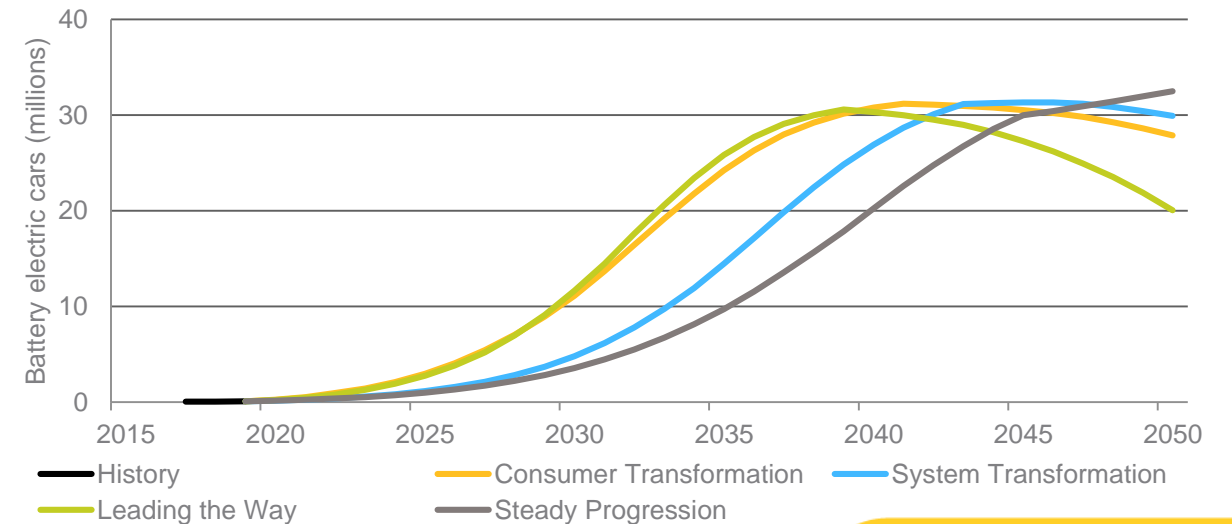
Leading the Way has fewer cars and hence lower transport costs

Road transport has the biggest swing in cost of scenarios

Undiscounted Accumulated Road Transport Cost £bn



FES scenario projections for uptake of battery electric cars

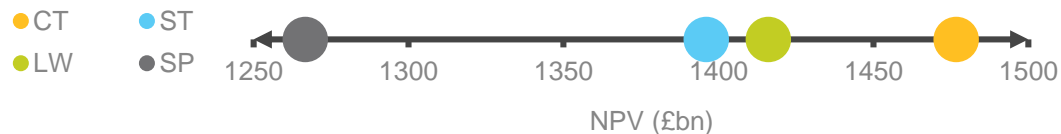


# Road Transport

Leading the Way has fewer cars and hence lower transport costs

Road transport has the biggest swing in cost of scenarios

Excluding road transport from the net present value brings the 3 net zero scenarios within 3% of each other

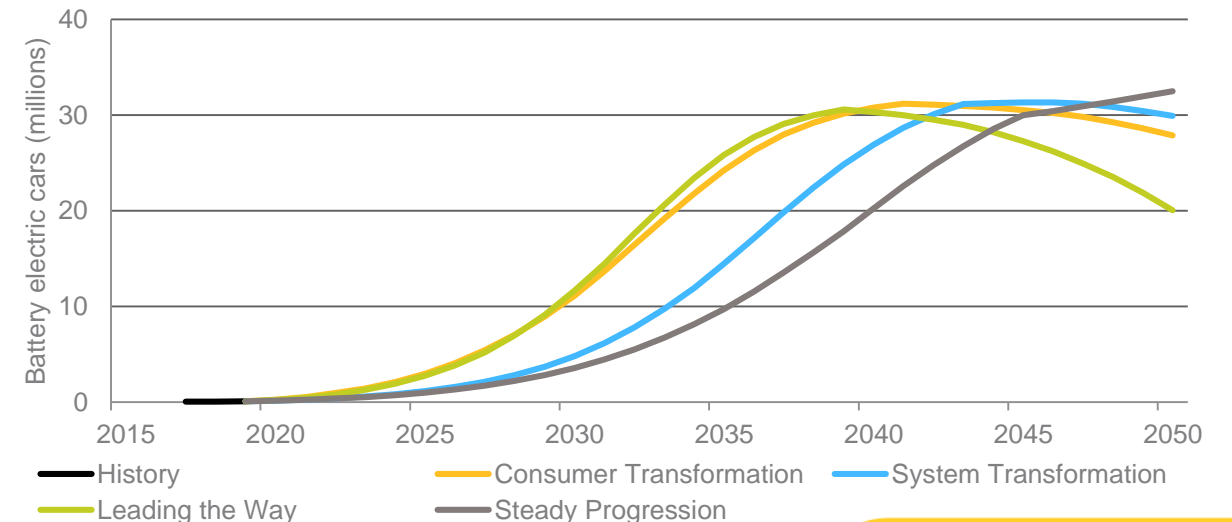


Total scenario net present values excluding road transport costs

Undiscounted Accumulated Road Transport Cost £bn



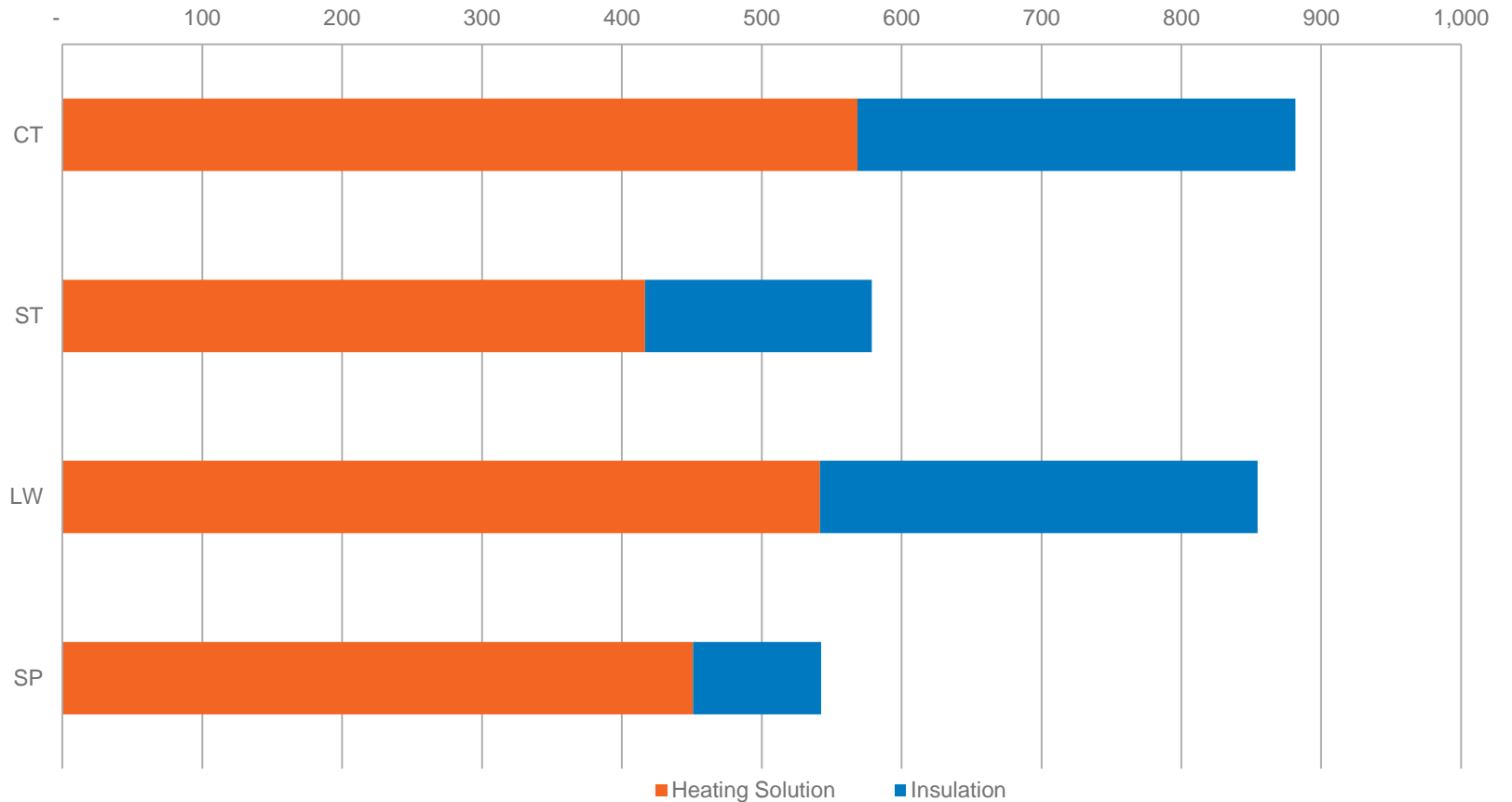
FES scenario projections for uptake of battery electric cars



# Residential Heating

Heating sector costs vary significantly, driven by insulation levels and heating technology type

Undiscounted Accumulative Cost of Residential Heating (£bn)

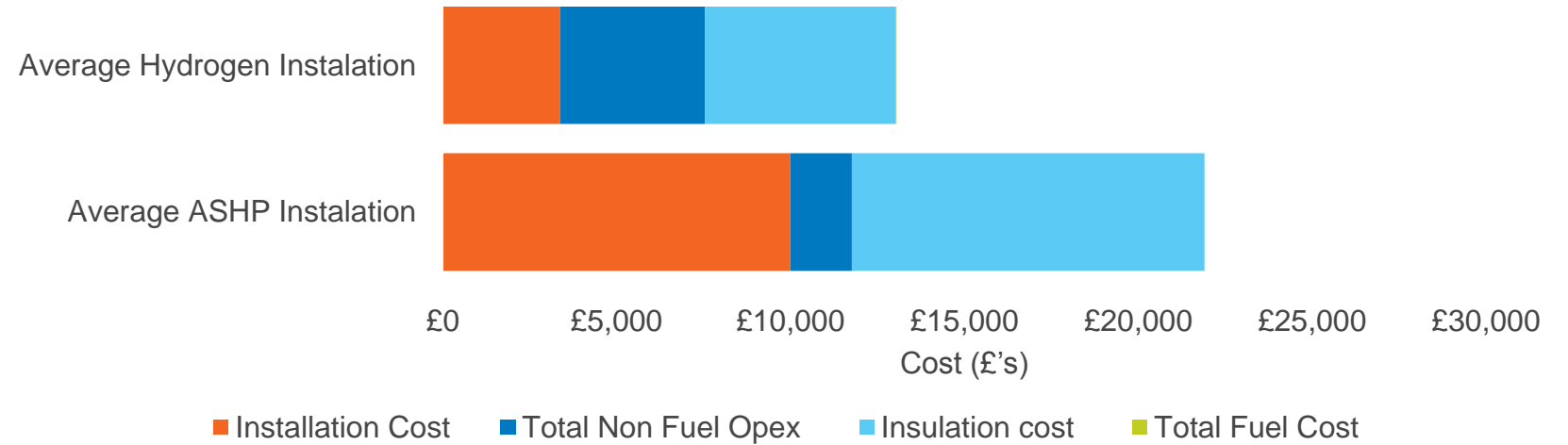




# Residential Heating

The cheapest solution varies according to assumptions on electricity and hydrogen unit prices

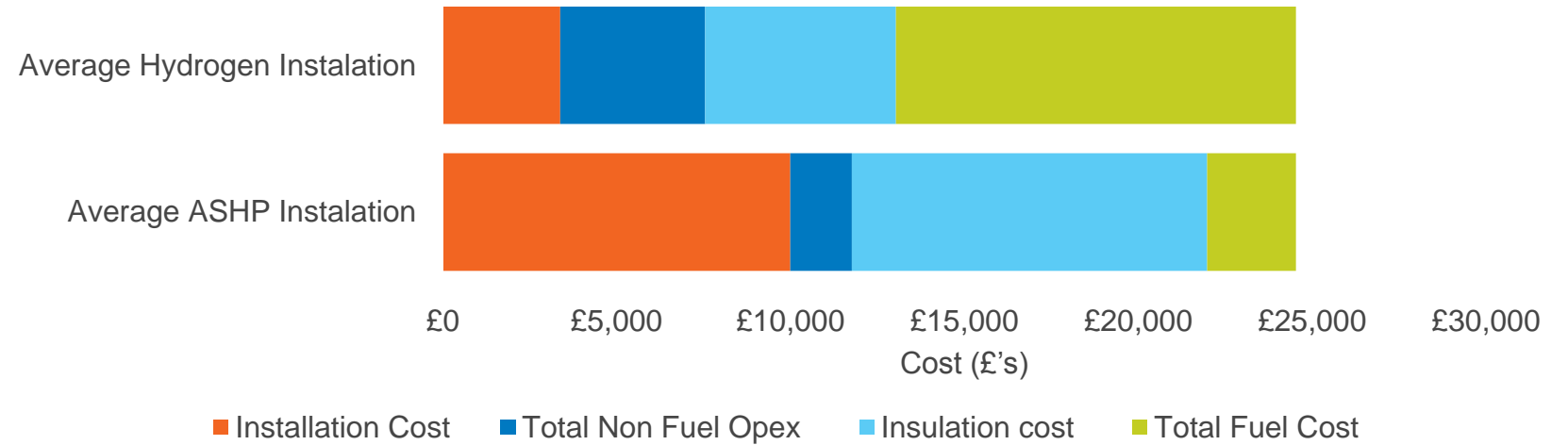
Example of break even point for Electricity price vs hydrogen price for residential heating for an average property in 2030



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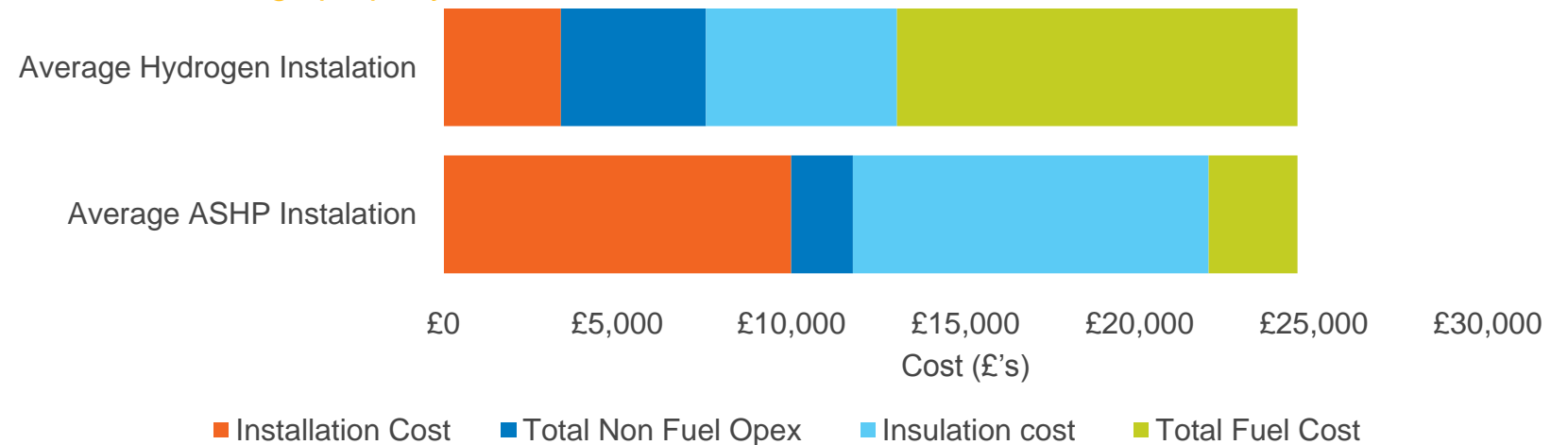
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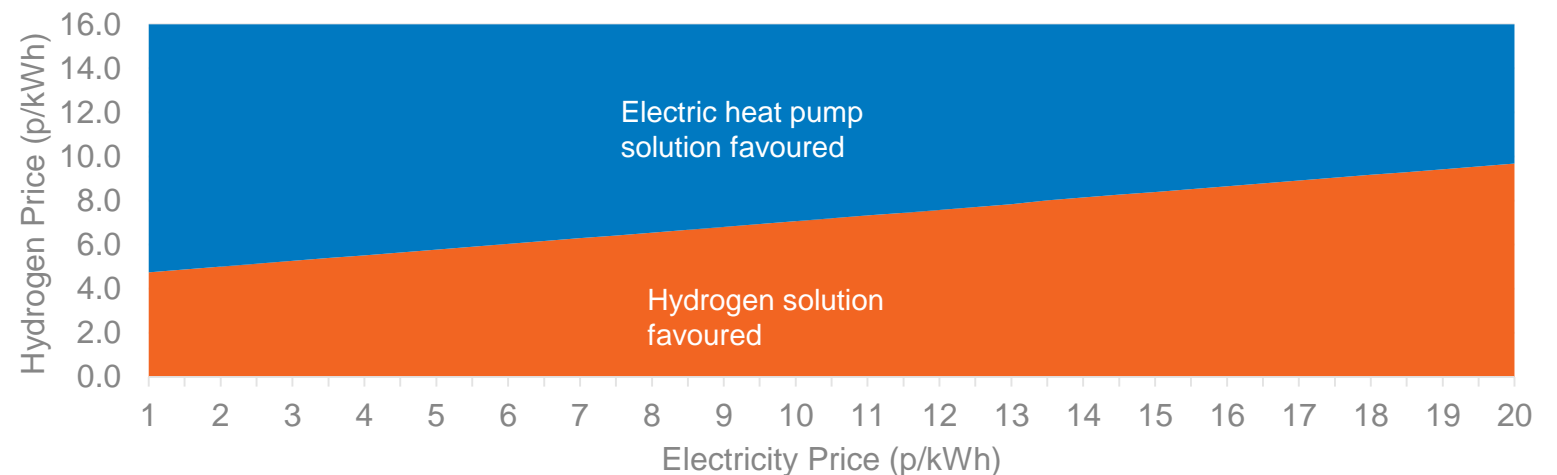
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Electricity price vs hydrogen price for residential heating for an average property in 2030

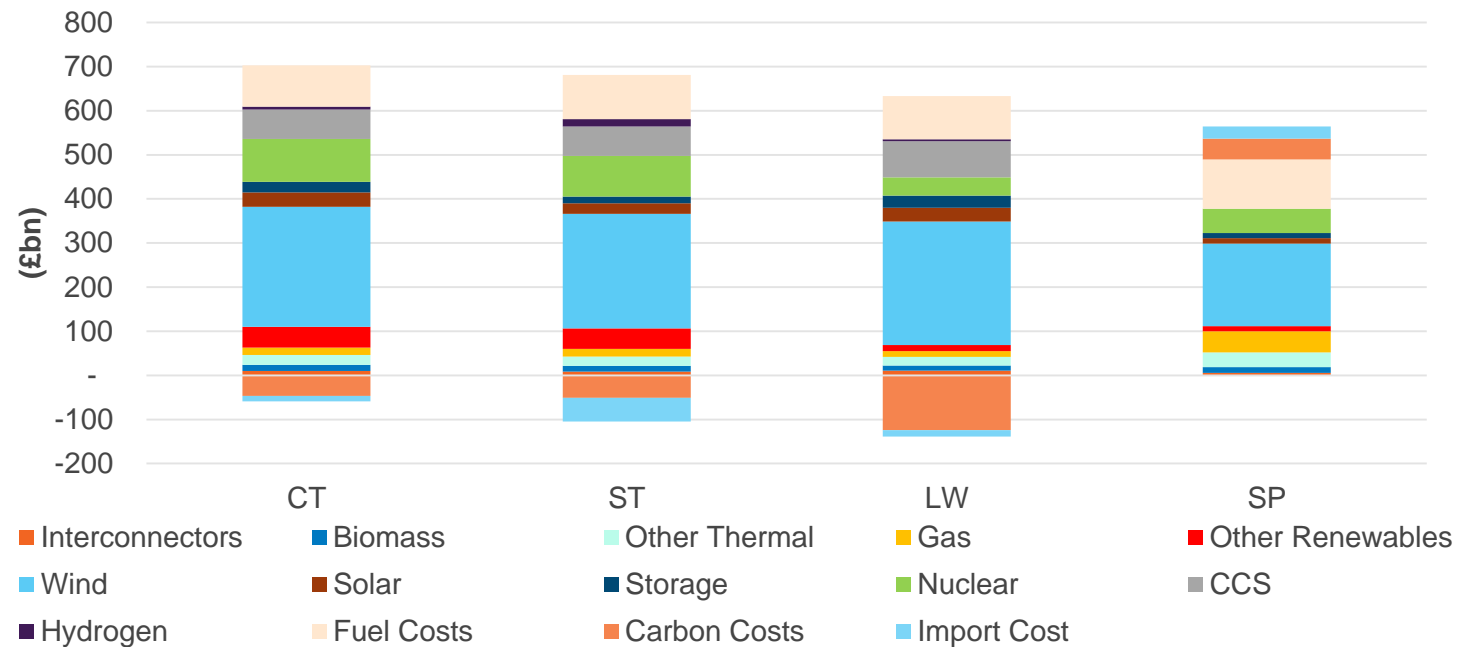


# Electricity Generation

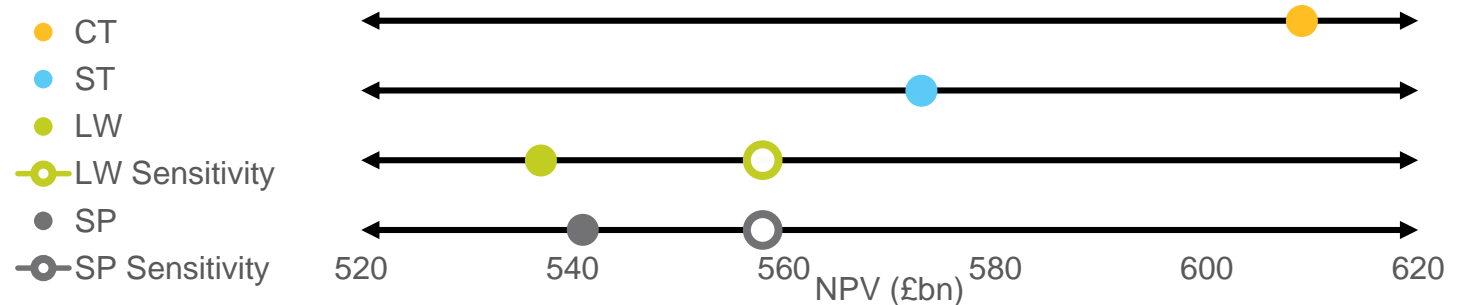
Leading the Way has the lowest electricity generation costs

The production of negative emissions from BECCS offsets some costs in this sector in the net zero scenarios

Undiscounted accumulative electricity generation cost (£bn)



Electricity sector net present value costs per scenario – sensitivity is central carbon price

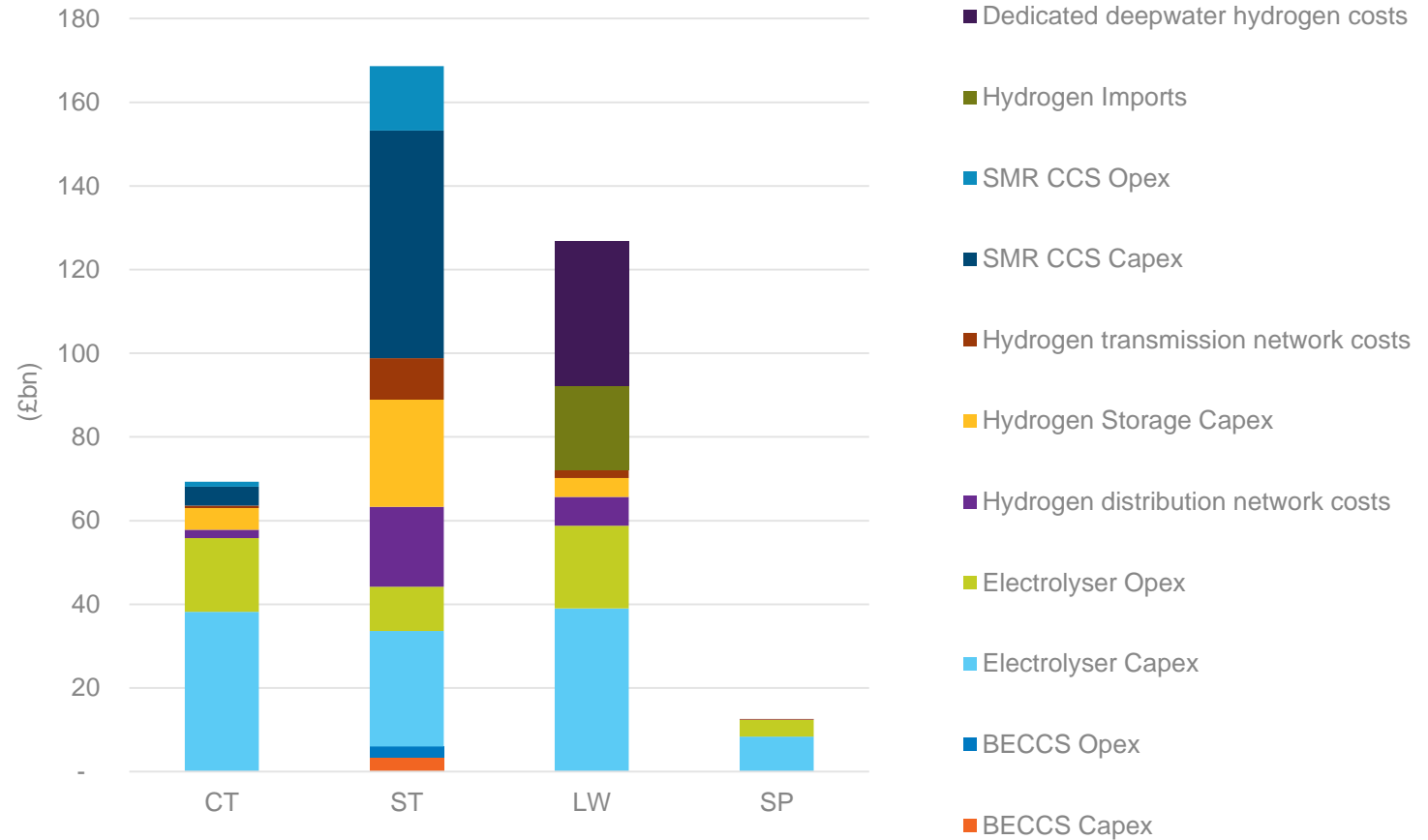


# Hydrogen

Hydrogen costs per scenario correlate with levels of hydrogen demand

Hydrogen network costs do not contribute significantly to costs for the sector overall

Undiscounted accumulative hydrogen costs (£bn)



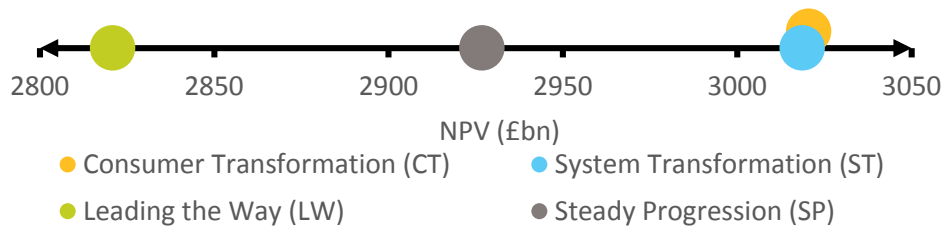


# Conclusion

This piece of work supports the key messages from our FES 2020 report, showing that the key messages in June not only were technologically sound but are also economically sound. The overall cost is broadly similar across the scenarios, indicating that the technology choices within our scenarios do not vary the outturn cost significantly.

From the analysis we see:

- The overall cost is broadly similar across the scenarios
- Costs are kept lower when consumers are engaged, energy efficiency is pursued, and we have negative emissions in the energy sector
- The biggest individual sectors with potential cost saving are transport and heat.



Leading the Way	£2,821bn
Steady Progression	£2,927bn
System Transformation	£3,019bn
Consumer Transformation	£3,020bn

# Questions and answers

[www.slido.com](https://www.slido.com)

Slido code: #FES2020costing



# Close and thank you

FES 2021 and Bridging the Gap engagement

[www.nationalgrideso.com/future-energy/future-energy-scenarios](http://www.nationalgrideso.com/future-energy/future-energy-scenarios)

FES@nationalgrideso.com



