2018 Future Energy Scenarios

Costing webinar

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Welcome

Hosts:

- Marcus Stewart – Senior Manager Energy Analysis
- Neil Rowley – Gas Markets Development Manager
- Shibo Liu – Whole Systems Analyst
- Roop Phull – Webinar Support

Housekeeping:

- Remain on mute in Webex to minimise any background noise
- Do not switch your camera on
- Ensure your computer's audio is on to hear us
- Send your questions and report any issues via the 'Chat' box function

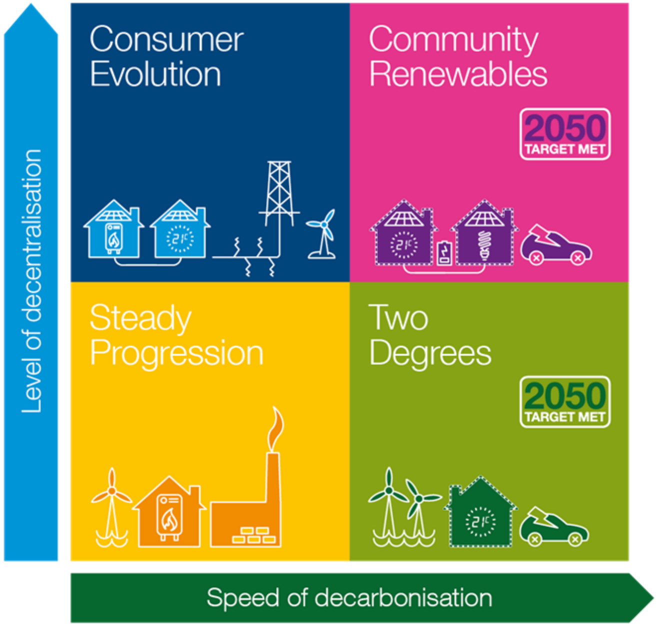
Agenda

- Project background detail
- Key conclusions
- Costs: whole energy system, power, road transport, heating sector and industrial & commercial
- Questions and answer

Costing FES 2018 scenarios

What we set out to do:

The purpose of the work is to cost the 2018 FES scenarios to understand the relative costs of the different scenarios. This is in order to elicit additional insight on the analysis and identify areas of opportunity and challenge.

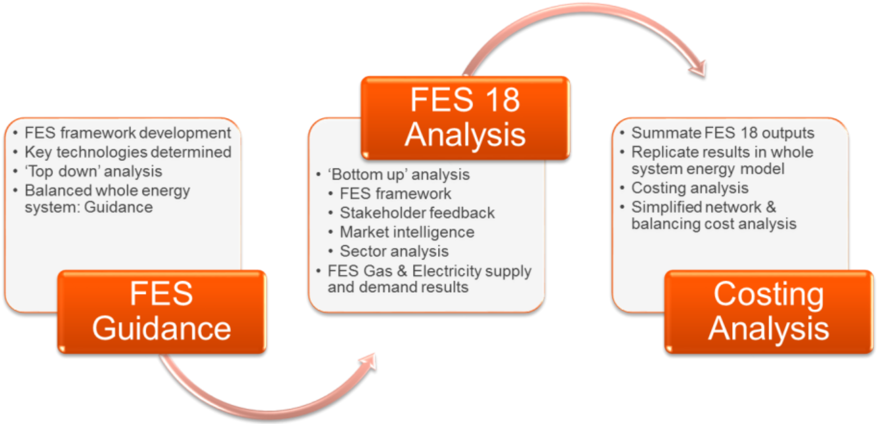


Macro assumptions

	Today	2050
Population	64.5m	70.5m
Houses	27m	31.5m
GDP growth	1.8%	0.9 – 2%

Modelling approach – replication of FES in UKTM

1. FES 18 scenarios are replicated in the UKTM whole system optimiser Model. This approach is developed with University College London and utilises industry benchmarked cost assumptions.
2. Includes assets related to the consumption and production of energy for electricity, heat, transport and industry.
3. Considers upstream, midstream and downstream costs. For the midstream we have used simplified network modelling.
4. Costs are undiscounted.
5. Asset costs are annuitized over the life of the asset to give levelised costs.



Key conclusions

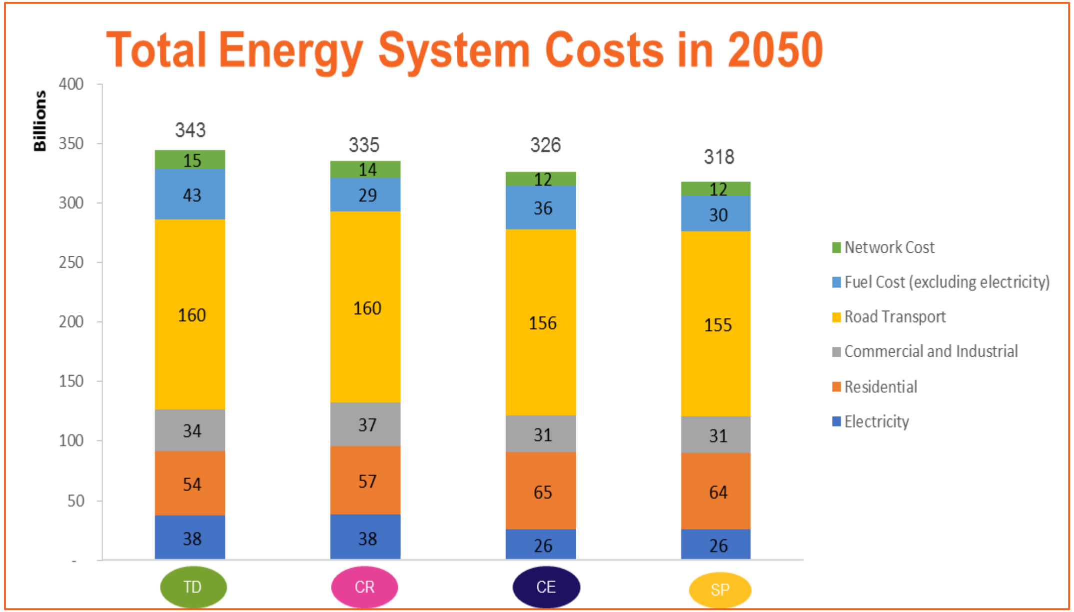
1. Small cost difference between the highest and lowest cost scenarios. The falling cost of low carbon technology now means costs are less of a barrier to reducing our emissions but still more expensive.
2. Very small difference between Two Degrees & Community Renewables. No clear cost distinction between these pathways considering the error margin. However, Two Degrees does decarbonise energy sector further than Community Renewables.
3. Power generation sector higher cost in low carbon scenarios reflecting greater capacity build to accommodate electrification of transport and some heat.
4. Road transport costs in 2050 are similar in all scenarios reflecting the growth and relative consistency of electric vehicle Two Degrees & Community Renewables.
5. Heating costs are higher in the lower carbon scenarios due to more expensive appliances, insulation and building costs or more expensive fuels.

As costs are similar it is fair to compare the four scenarios against each other when considering the plausibility of the different scenarios.

Total Energy System Cost in 2050

Small (8%) cost difference between the highest and lowest cost scenarios. The falling cost of low carbon technology now means costs are less of a barrier to reducing our emissions but still more expensive.

The difference between TD & CR is around 2% in 2050: No clear cost distinction between these pathways considering the error margin. However, TD does decarbonise energy sector further than CR.



67	79	267	262	Emissions (MTCO[2] Eq)
165*	165*	388*	383*	*incl Agriculture, Aviation & Shipping

Total energy system costs range from **£318bn** to **£343bn** in 2050. Road transport dominates costs, followed by residential, power generation, industrial & commercial and fuel costs. Networks & balancing costs continue to be a small cost factor.

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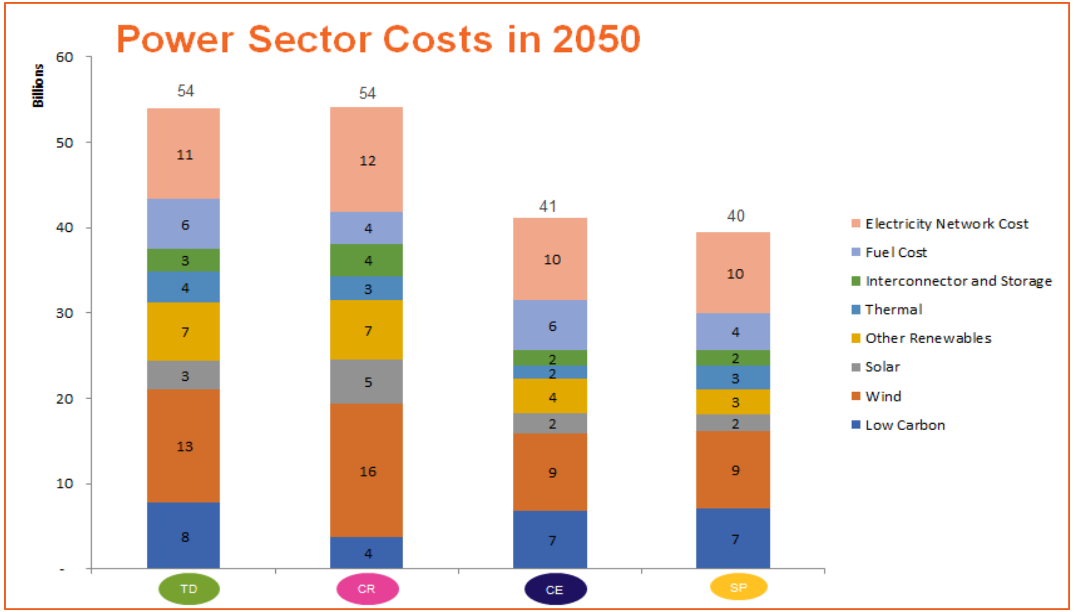
Power Supply Sector

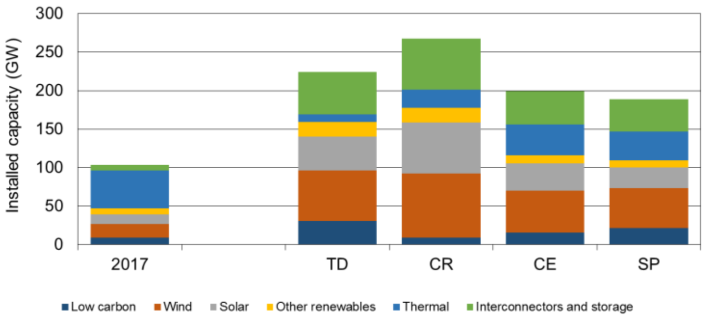
Power generation sector higher cost in low carbon scenarios reflecting greater capacity build to accommodate electrification of transport and some heat.



9	14	29	22	Emissions (MTCO² Eq)

TD has greater fuel cost whereas CR has greater capital costs due to the greater level of capacity. However TD decarbonises power sector further.

Power Generation Capacity in 2050



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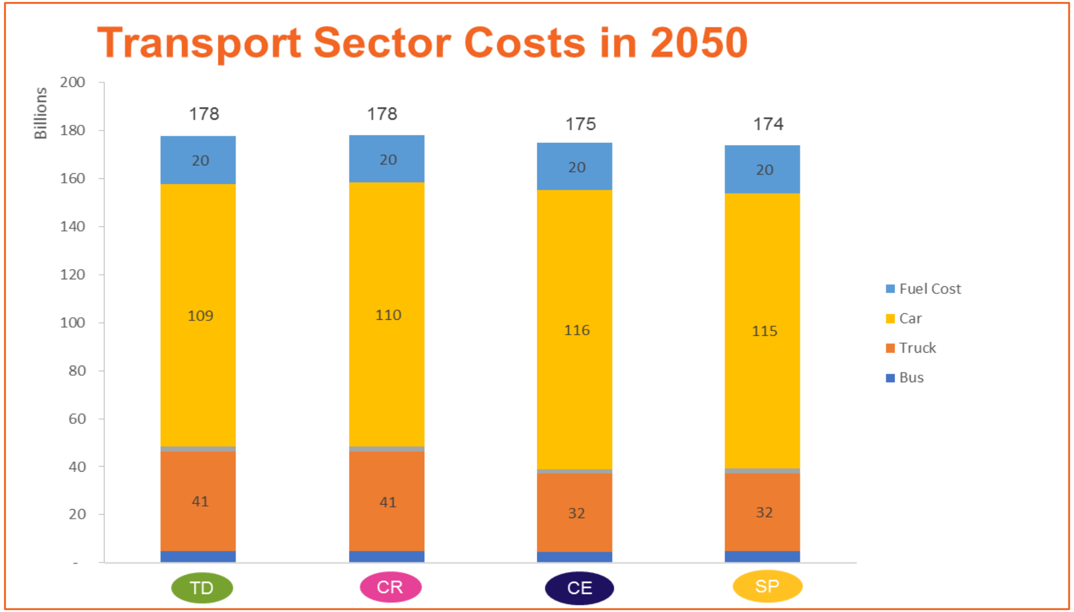
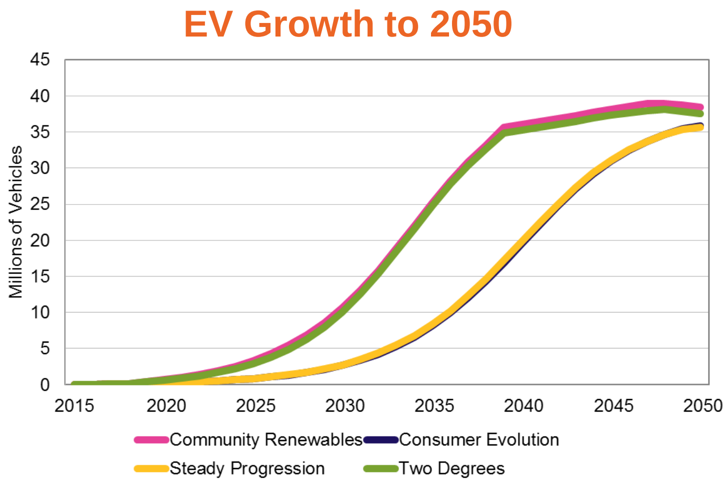
Road Transport Sector

Road transport costs in 2050 are similar in all scenarios reflecting the growth and relative consistency of Electric Vehicles penetration. Decarbonising the commercial vehicle fleet increases costs and therefore impacts TD & CR



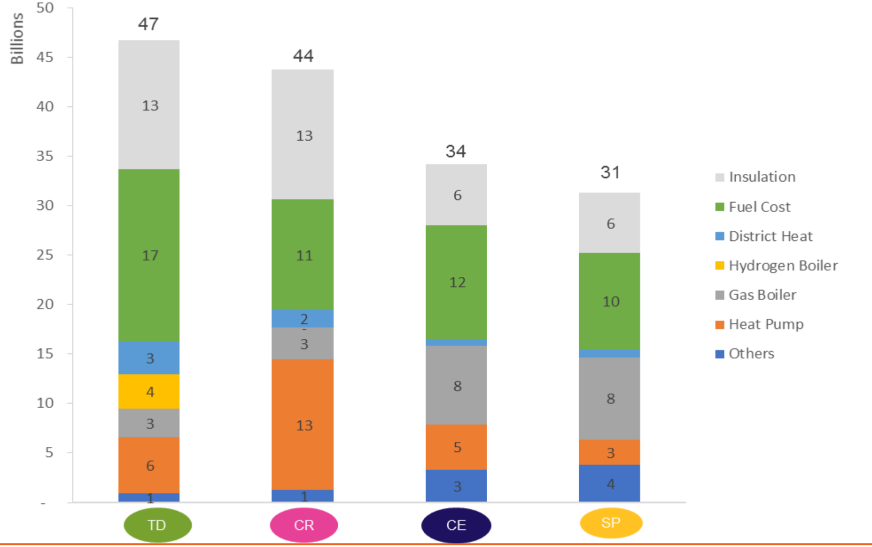
0.2 0.2 29 29 Emissions ($MTCO^2$ Eq)



Domestic Heating Sector

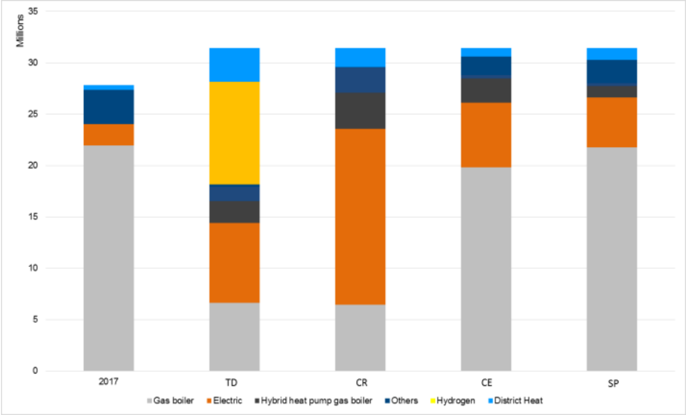
Heating costs are higher in the lower carbon scenarios due to more expensive appliances, insulation and building costs or more expensive fuels. TD has a higher Opex cost whereas CR has higher Capex costs.

Residential Sector Costs in 2050



13	14	51	57	Emissions ($MTCO^2$ Eq)

Residential Heating Appliances in 2050



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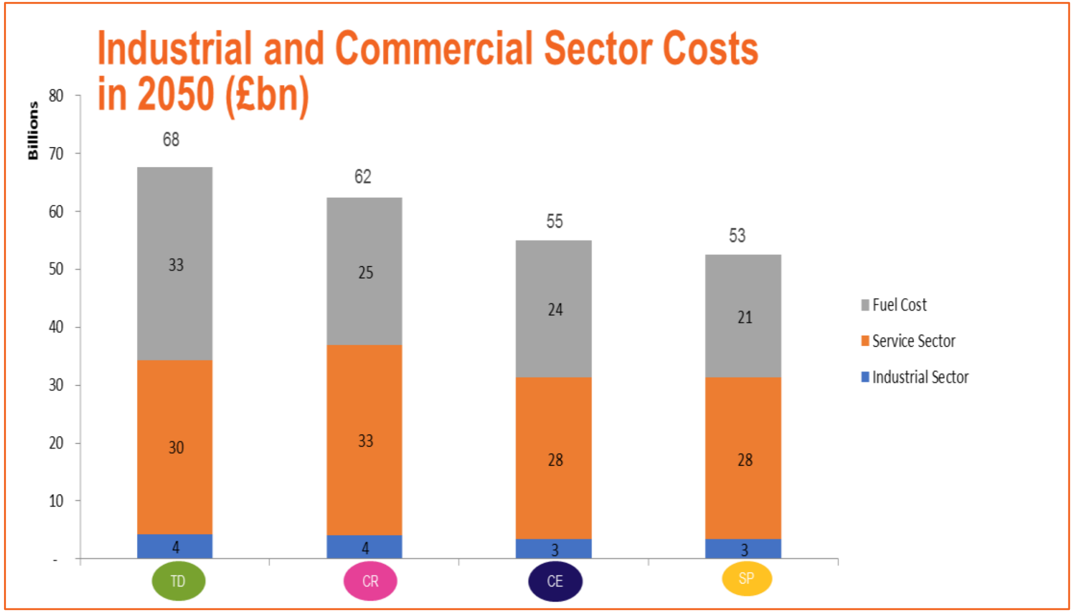
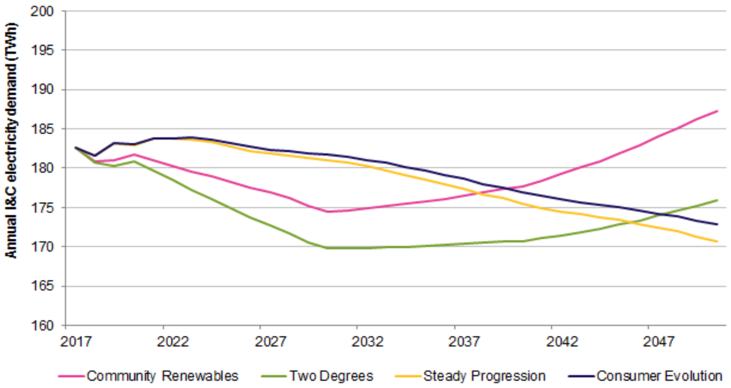
Industrial and Commercial Sector

I&C Capex costs are highest in CR driven by the greater need to electrify demand. The Opex costs are highest in TD caused by the higher electricity price per unit and the impact of H2 production. TD decarbonises this sector further than CR due to Carbon Capture & Storage.



45	51	157	154	Emissions ($MTCO^2$ Eq)

I&C Electricity demand to 2050



Recap - Key conclusions

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Thank you

Thank you for your attention.

To contact us after the webinar, please email FES@nationalgrid.com

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Key assumptions across the scenarios

		CR	TD	SP	CE
	2017	2050	2050	2050	2050
Gas annual demand (incl exports) TWh	933	333	673	739	717
Gas peak demand GWh/d	5,522	2,047	2,992	4,817	4,147
Electricity (underlying) annual demand TWh	319	464	396	413	417
Electricity (underlying) peak demand GW	59.4	82.7	78.5	86.5	86.7
EVs numbers (Cars)	91k	31.7m	30.7m	33.1m	33.4m
Heat pumps number (million)	0.04	19.13	8.96	3.41	6.15
Total installed generation capacity	103.1 GW	267.7 GW	224.4GW	189.2 GW	199.6 GW
% decentralised generation capacity	27%	65%	44%	37%	56%
Nuclear	9.2 GW	9 GW	18.5 GW	15.2 GW	15.6 GW
Electricity interconnector capacity	3.6 GW	16.5 GW	19.8 GW	15.1 GW	9.8 GW
Total electricity storage capacity	2.9 GW	29.0 GW	17.3 GW	11.8 GW	15.9 GW
Offshore wind (capacity)	6.1 GW	32.5 GW	43.4 GW	35.0 GW	21.0 GW
Onshore wind (capacity)	11.5 GW	50.8 GW	22.4 GW	16.4 GW	33.5 GW
Gas TX (CCGT + CHPs)	31.0 GW	10.5 GW	2.0 GW	29.7 GW	24.1 GW
CCUS capacity	0.0 GW	0.0 GW	12.1 GW	6.7 GW	0.0 GW
Total installed decentralised capacity.	28.2 GW	173 GW	98.8 GW	70.9 GW	112.4 GW
Carbon intensity of power generation, annual average (g of CO2 per KWh)*	266 gCO2/KWh	32.2 gCO2/KWh	19.8 gCO2/KWh	51.8 gCO2/KWh	71.6 gCO2/KWh

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