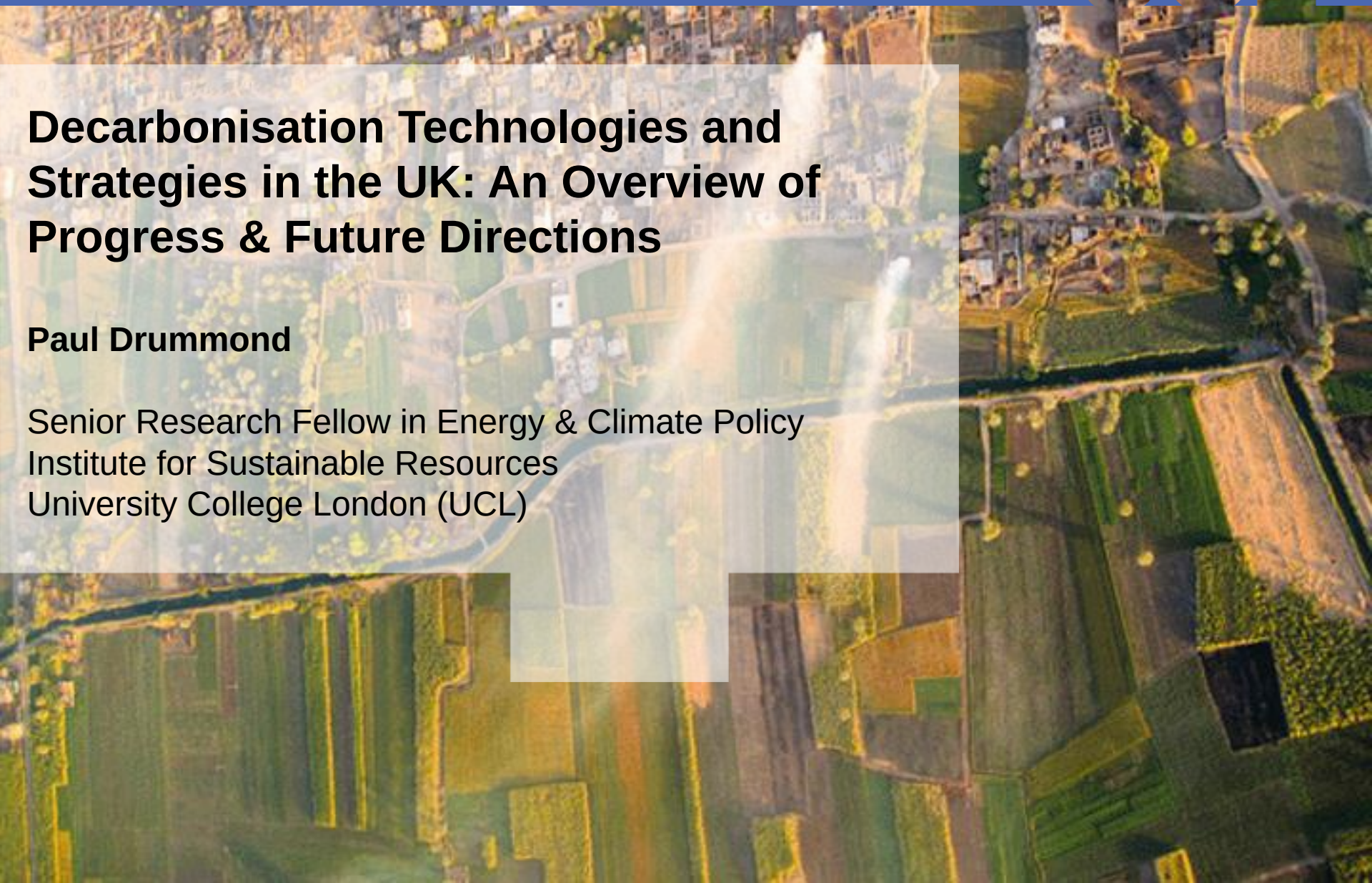

Decarbonisation Technologies and Strategies in the UK: An Overview of Progress & Future Directions

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UK Policy Context & Emissions Development

EU '20-20-20' targets (2010)

- 3/5 targets of the 'Europe 2020' strategy for 'smart, sustainable, inclusive growth'
  - **Reduce GHG emissions by 20%** by 2020 (from 1990 levels) – ***UK = 26%***
  - **Increase share of renewables** in final energy consumption to **20%** by 2020 - ***UK = 15%***
  - **Increase energy efficiency by 20%** by 2020 (compared to projected baseline) - ***18% = UK***
  - Implemented through a range of EU Directives and Regulation, and Member State action
  - EU overall on track – UK on track for GHGs (40% below 1990 in 2018), behind on renewables & energy efficiency

EU 2030 Climate & Energy Framework (2014)

- Increase in EU level targets to:
  - Reduce GHG emissions by **40%** by 2030 (below 1990 levels)
  - Increase share of renewables in final energy consumption to **32%** by 2030
  - Increase energy efficiency by **32.5%** by 2030 (compared to projected baseline)

2050 long-term strategy (2018)

- Agreed to achieve **net-zero emissions by 2050**, with plans to enshrine this in European law in 2020

UK Policy Context & Emissions Development

UK Climate Change Act (2008)

- Set an overarching goal of **reducing GHG emissions** by **80% by 2050** (below 1990)
- Delivered through five-yearly '**carbon budgets**' - legal limits on total GHG emissions (currently legislated to 2032)
- Independent '**Committee on Climate Change**' (CCC) created to track progress, advise on future carbon budgets, and recommend policy measures (annual report to Parliament)
- In 2019, overall target was **revised to net-zero** emissions by 2050 (recommended by CCC)

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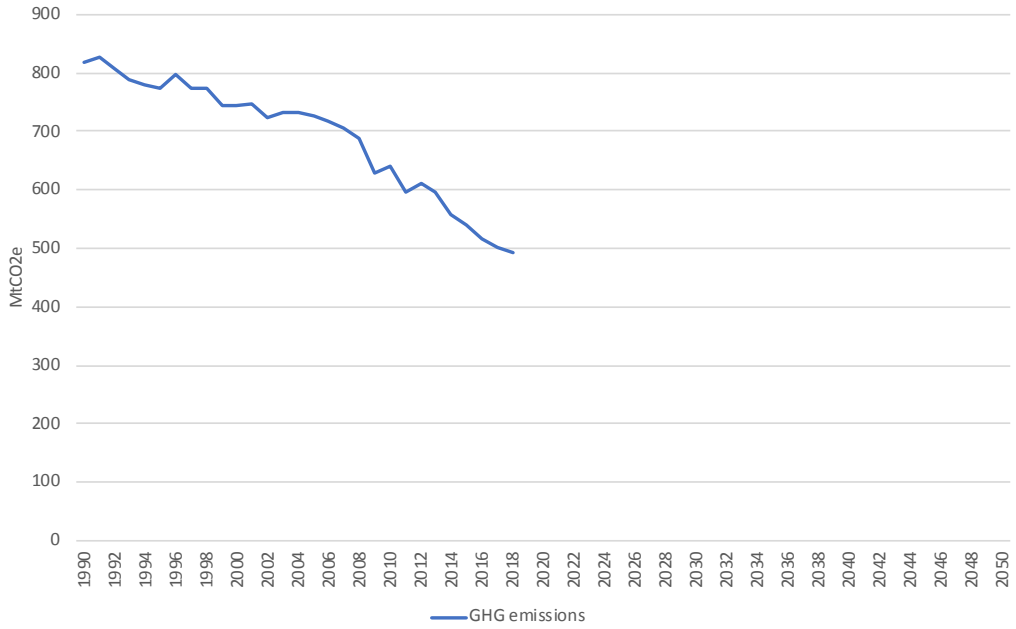

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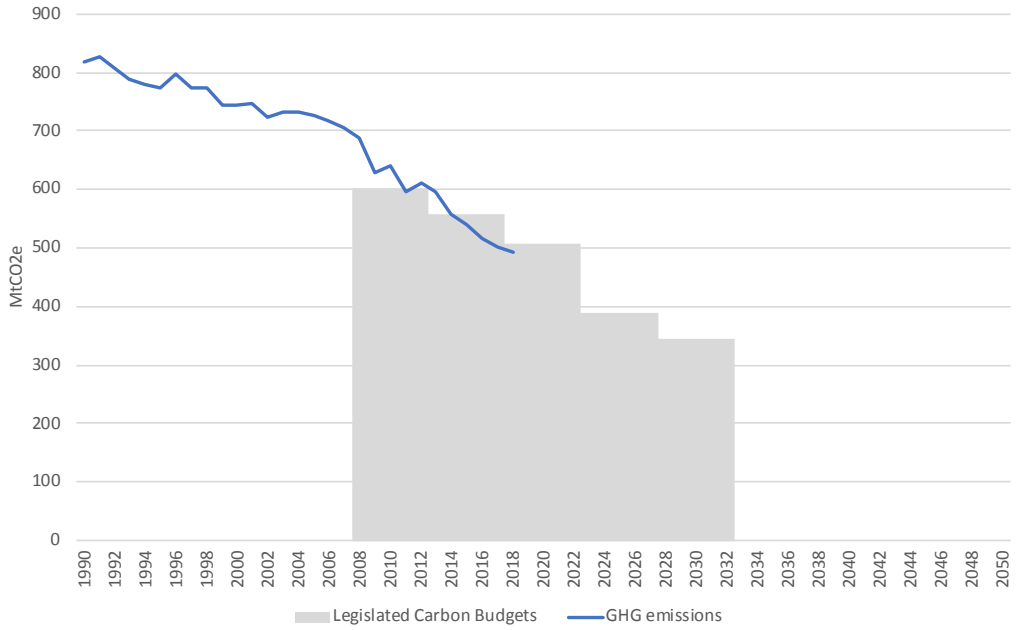

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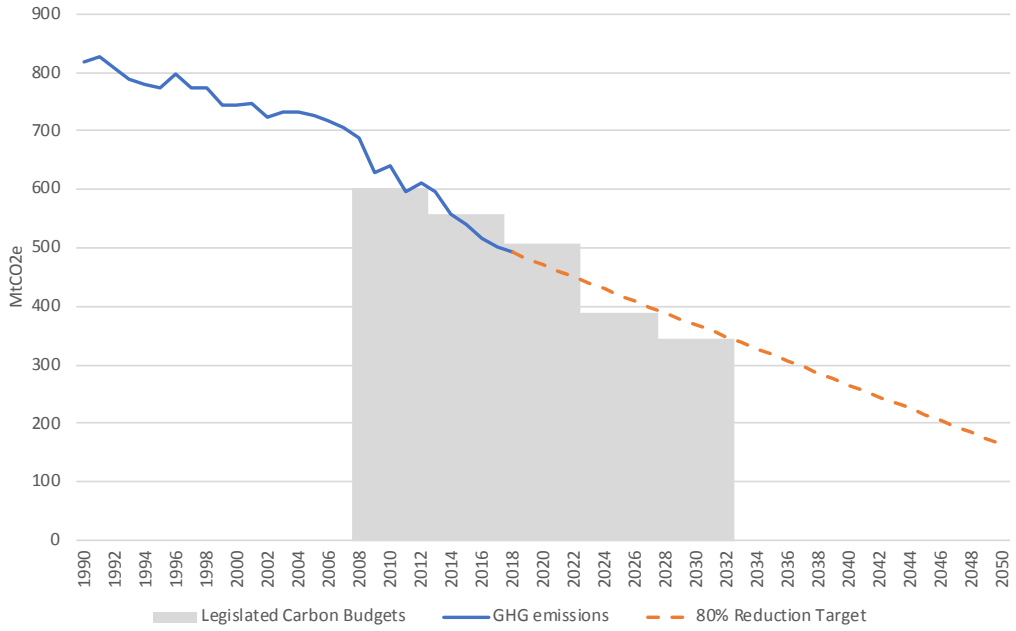

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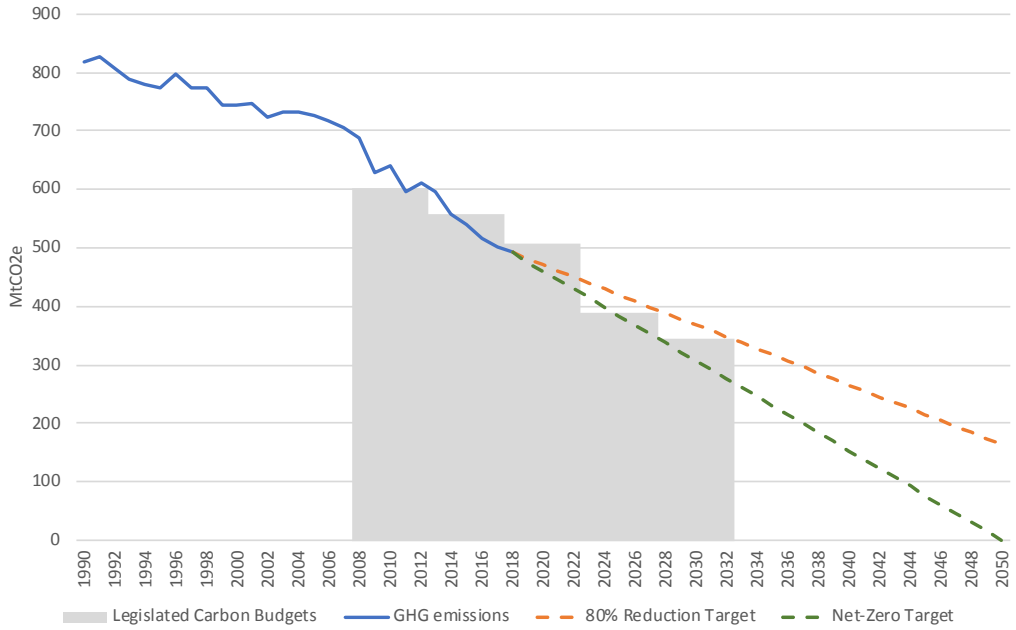
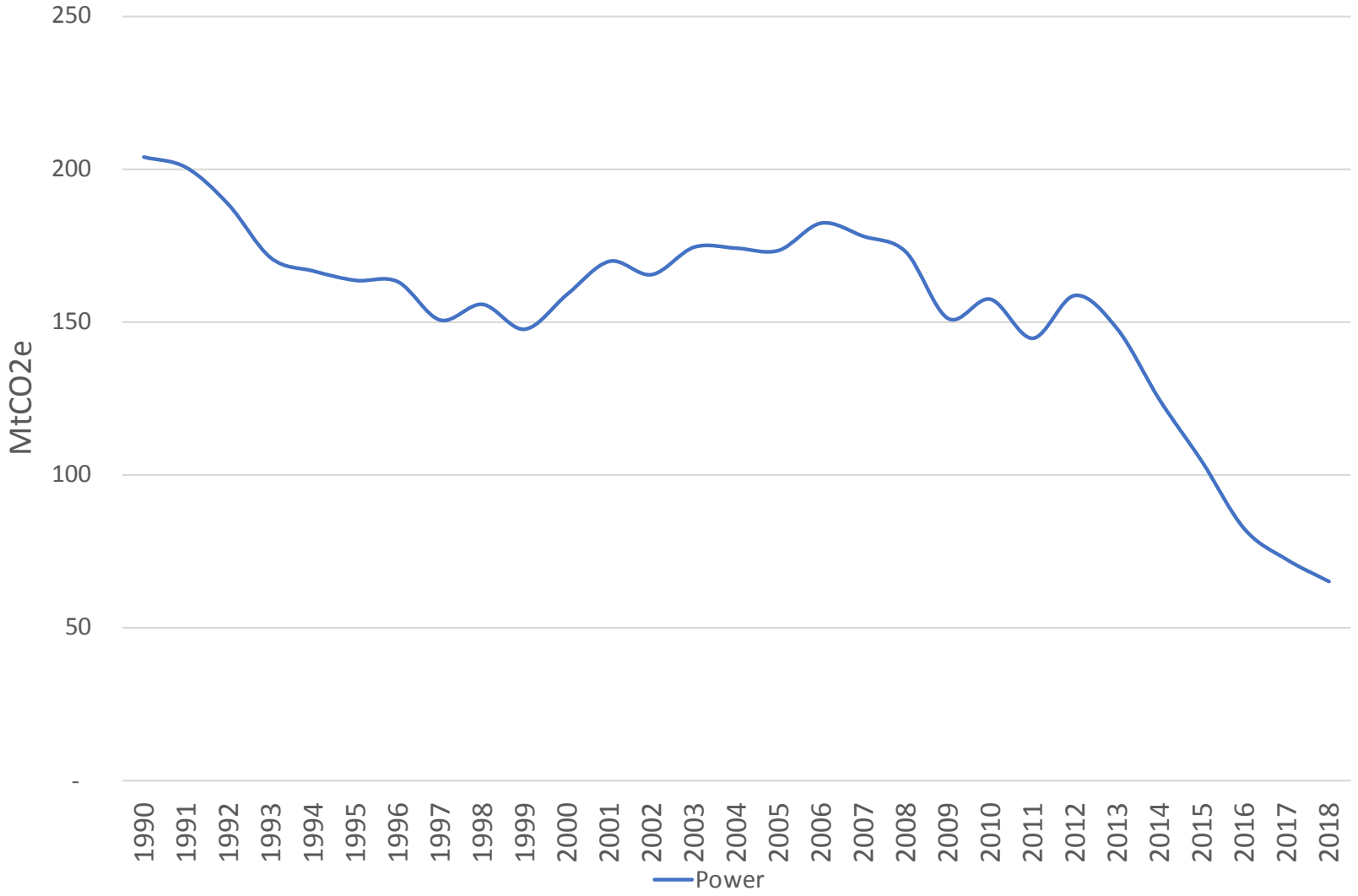
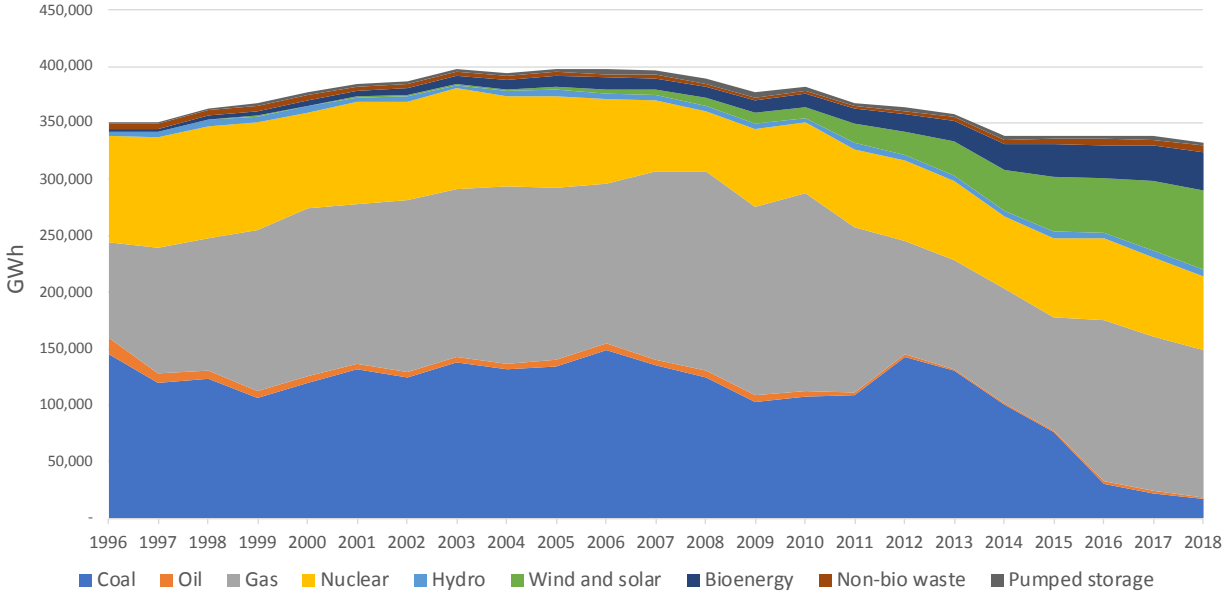


UK Emissions Development - Power



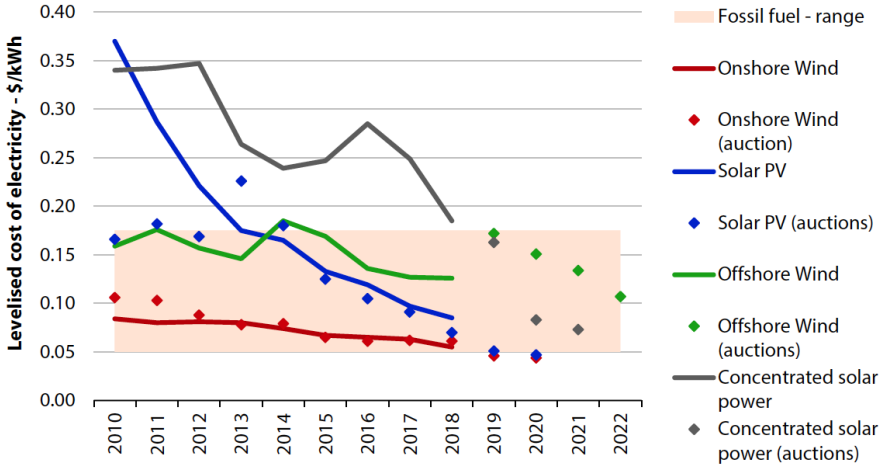
Sector Development: Power



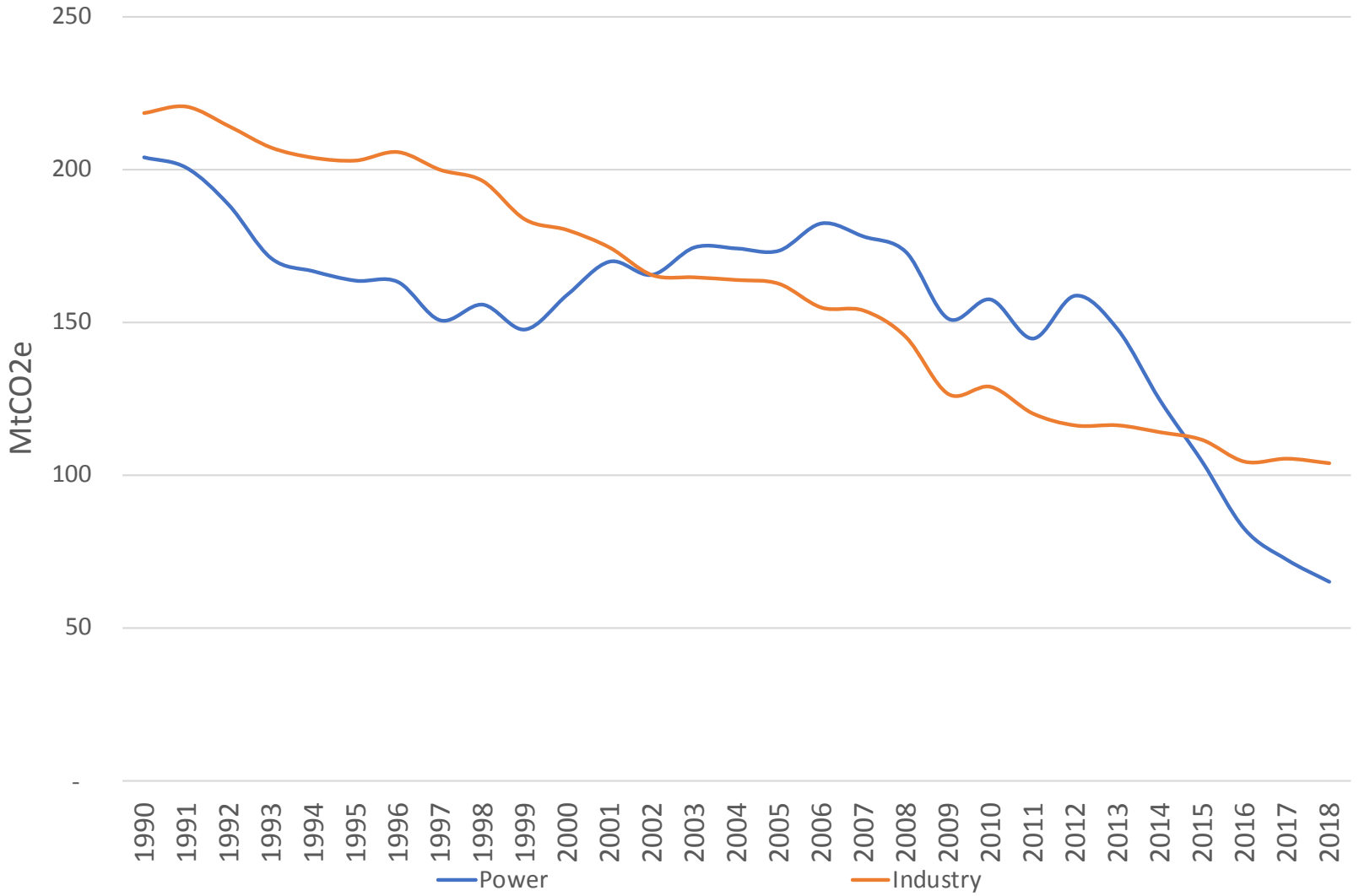
- Rapid growth in **wind and solar** (in particular – **20% generation** in 2018, with renewables overall ~35%), driven by (successive) subsidy mechanisms
- Supported by EU ETS and (unilateral Carbon Price Floor) removing coal (**40%** in 2012 to **5%** in 2018).

- **80% renewables** target by **2030 –** 30% from offshore wind alone
- Costs have come down rapidly globally & in UK:
  - New offshore wind = **$50/MWh** (delivery 2024-2026)
  - New solar PV = **~$65/MWh**
  - New onshore wind – estimated at **$60/MWh**
- UK wholesale electricity price = **~$65/MWh** (average since 2010) – medium term, renewables can **reduce** electricity bills (as legacy subsidy costs reduce)

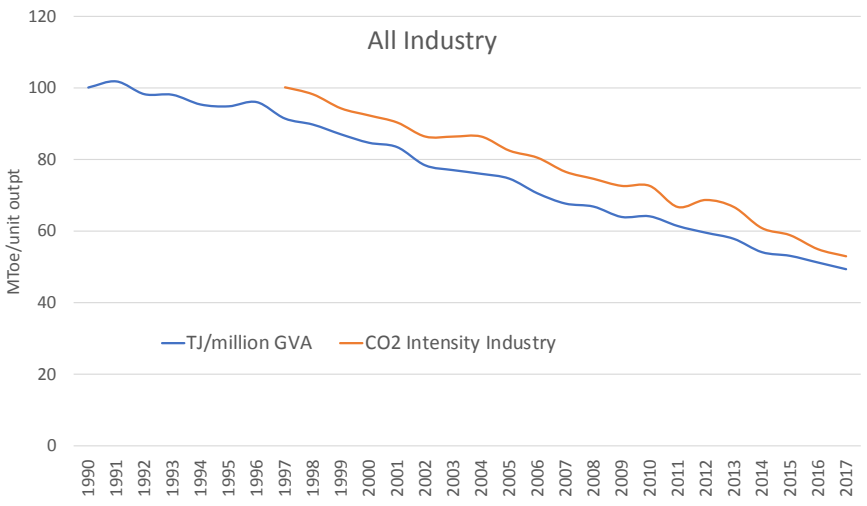
Global LCOE Trends

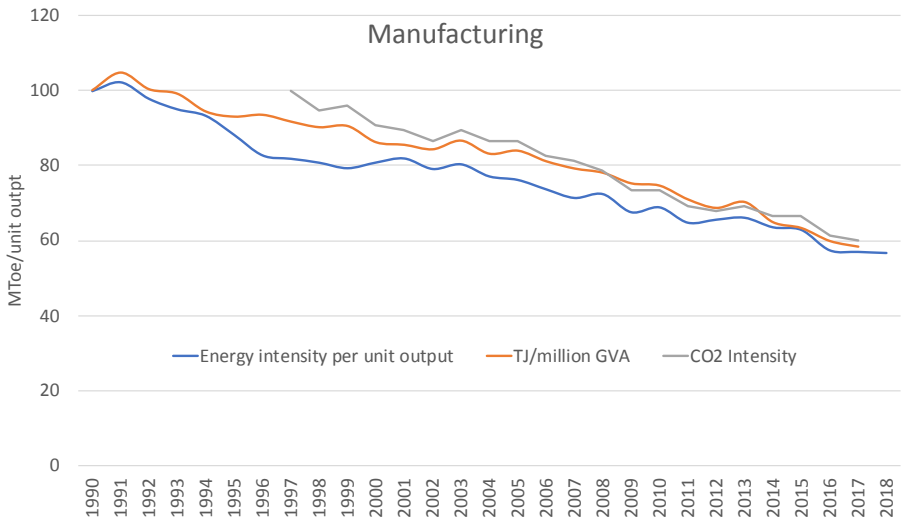


UK Emissions Development - Industry



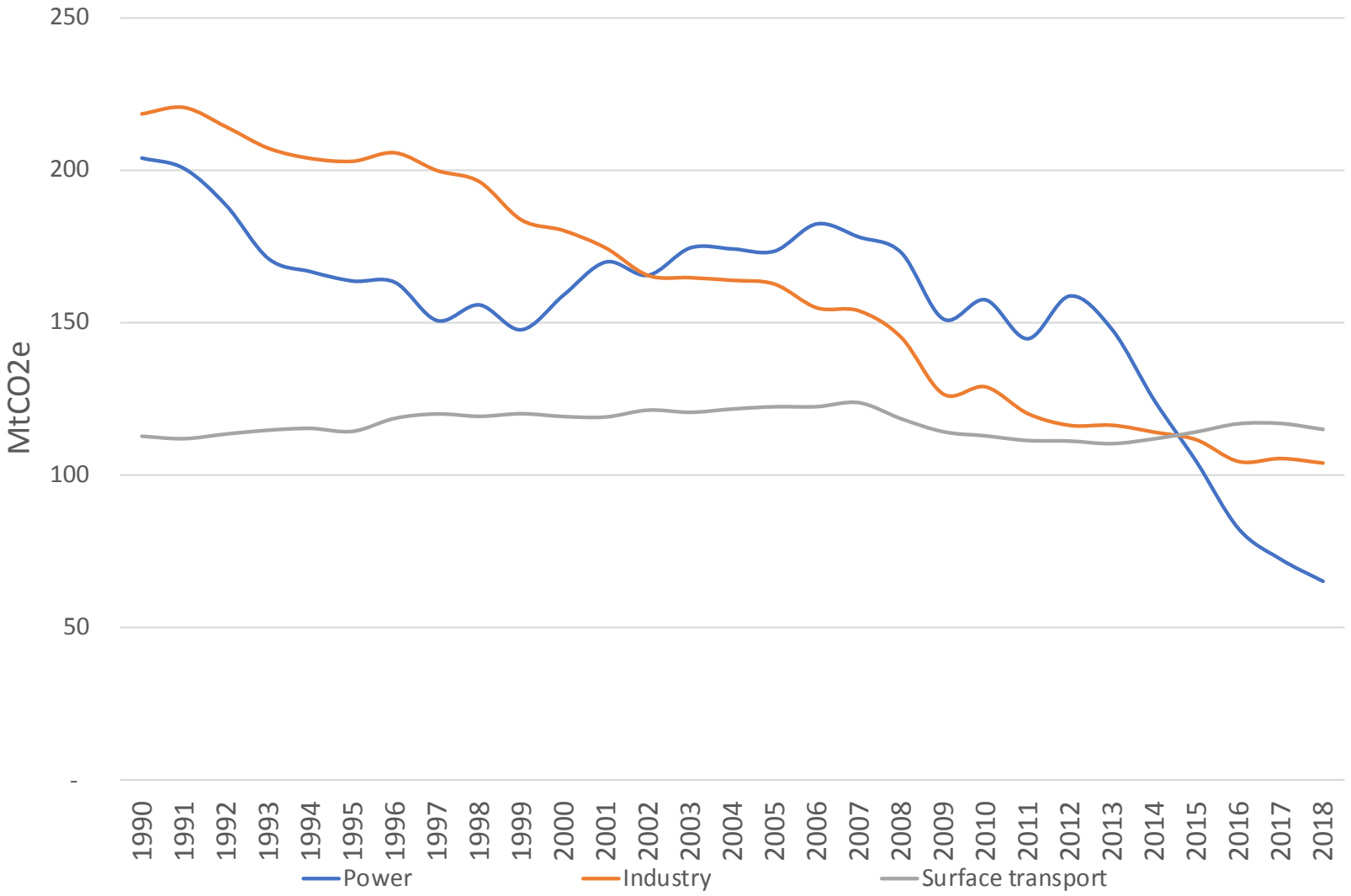
Sector Development: Industry



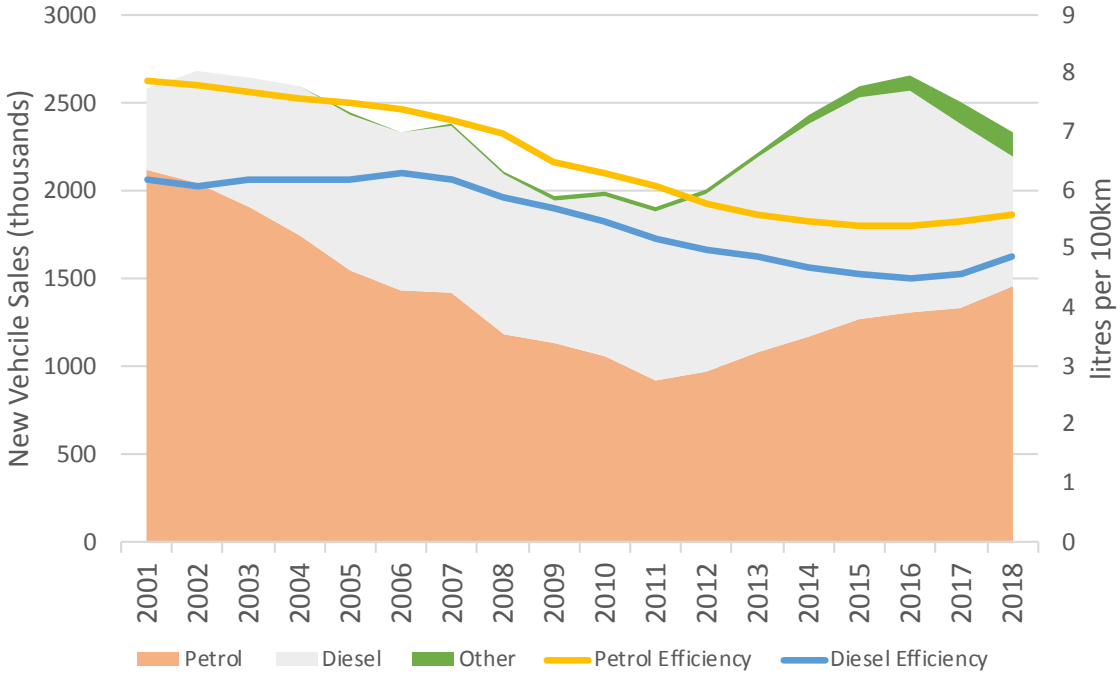


- Reduction in energy & CO_2 intensity partly a result of a **shift to a knowledge & service-based economy** (but manufacturing output remained stable)
- Manufacturing energy & CO_2 intensity **also reduced substantially**
- **Various policy** – e.g. EU ETS, Climate Change Levy & Climate Change Agreements, Energy Saving Opportunity Scheme (Article 8 of EU's Energy Efficiency Directive), and 'Best Available Technology' permit requirements (EU Industrial Emissions Directive)
- **ISO 50001** Energy Management System certification may be used to satisfy both EED & IED – UK has 7% of all global certifications
- **No evidence of carbon leakage** (in part due to exemptions/discounts/compensations, particularly for industries/firms most exposed to international competition)

UK Emissions Development - Transport



Sector Development: Transport

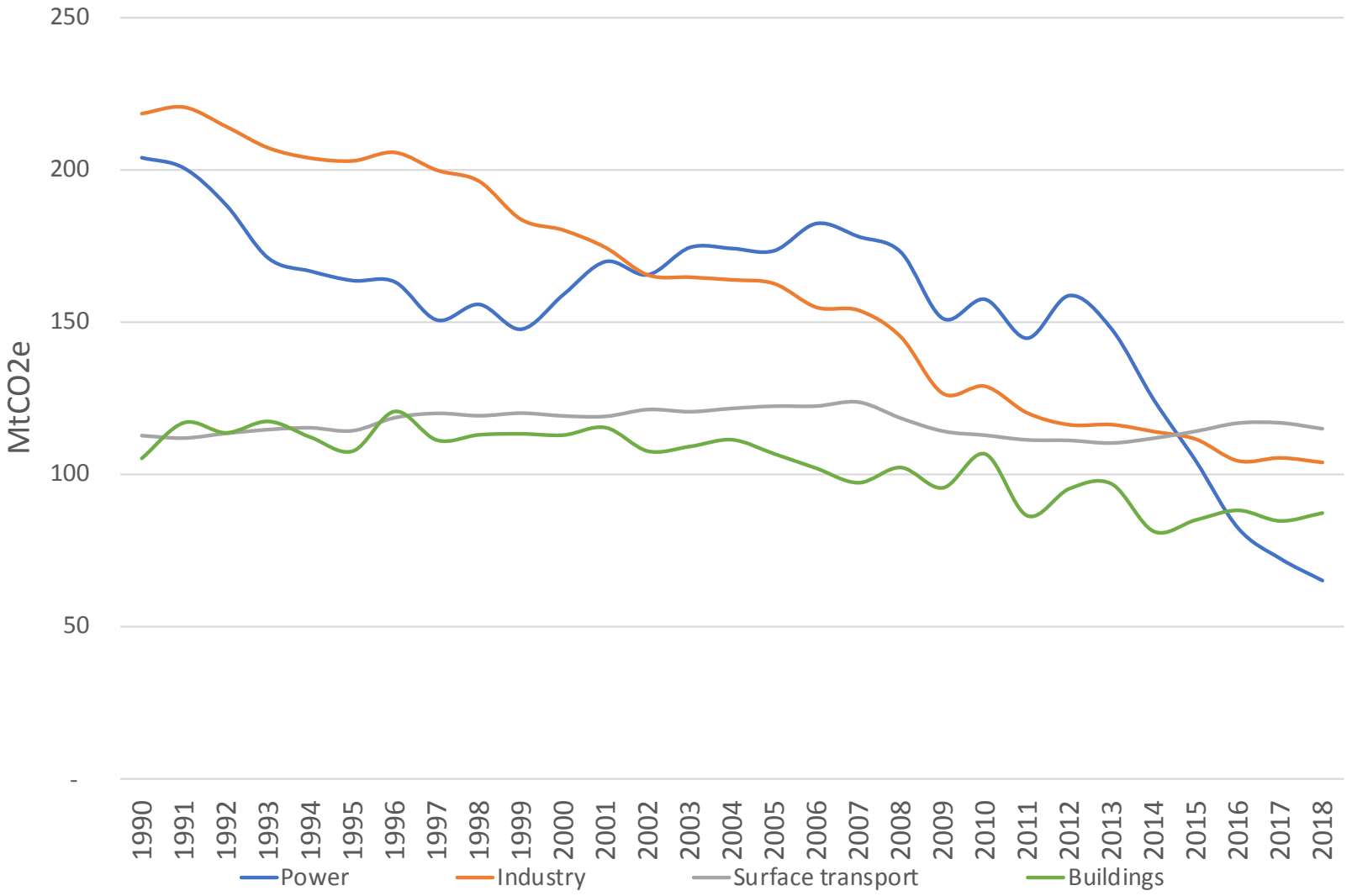


2001 to 2018:

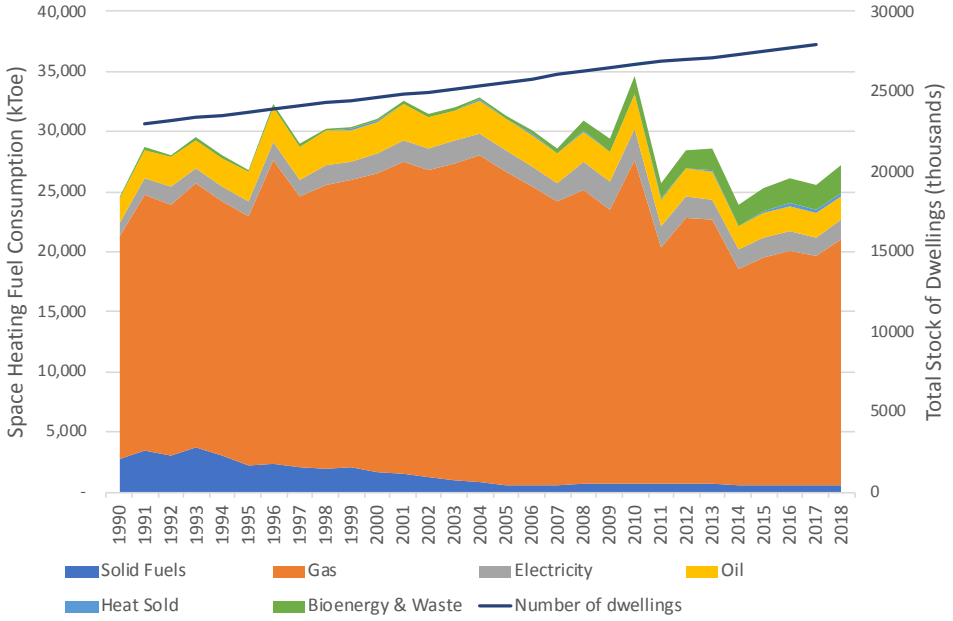
- Efficiency increased **30%** (petrol) & **20%** (diesel)
- **Diesel** increased from 18% to 31% of sales
- '**Other**' – 0.1% to 6.2% - average **29% YOY growth**
- **But**: Private car used increased 22% 1990 - 2018 (78% of all motorised land travel demand)

- Electric cars generally now have **lower Total Cost of Ownership** over the lifetime of the vehicle, due to rapidly reducing battery costs (89% between 2010 and 2019).
- Range of policies at **EU-level** (CO_2 regulations, 'EURO' standards, labelling) and **UK-level** (vehicle tax, fuel duty, purchase subsidies, local zonal pricing) – also **ban on new non-zero-emission cars by 2035.** Key driver = tackling **air pollution** in cities, and:
- **UK's 'Industrial Strategy'** (2016) – policies & investment to place UK at forefront of zero-emission vehicle technology, development and manufacture.

UK Emissions Development - Buildings



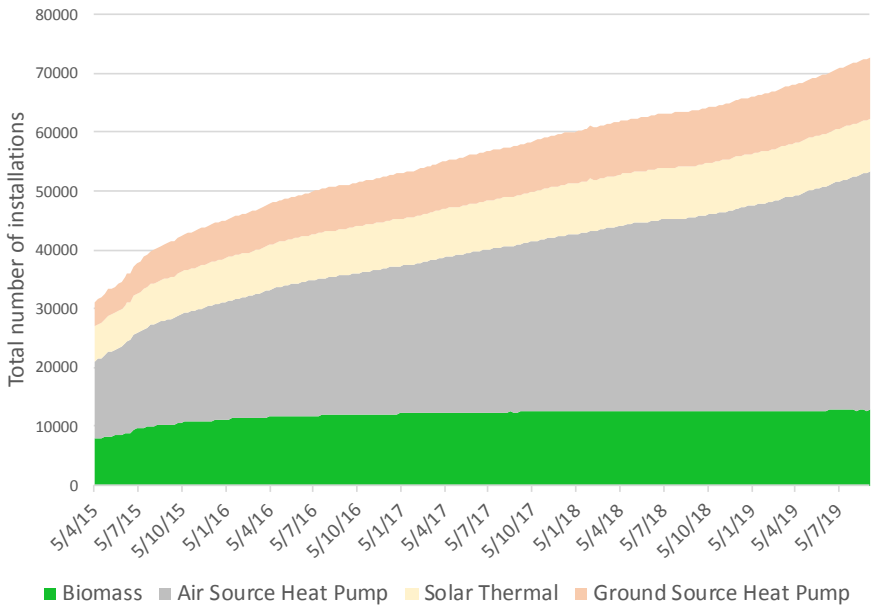
Sector Development: Buildings



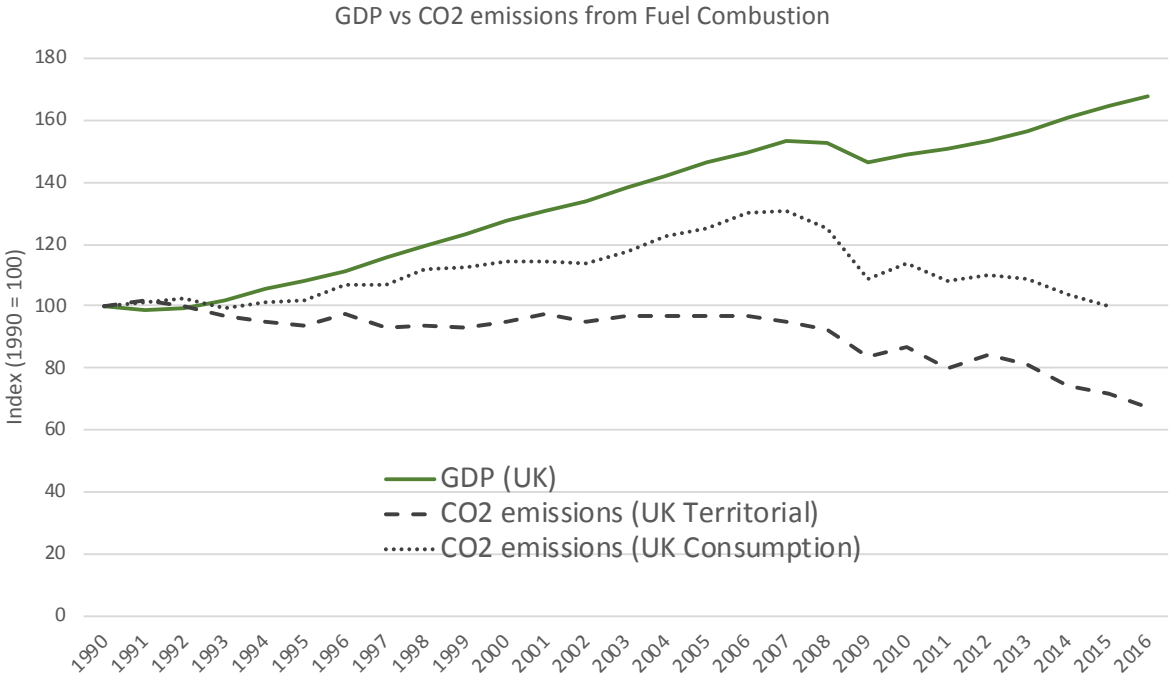
1990 to 2018:

- **Gas & oil** stable (~75%,10%) coal replaced by **biomass** (~8%), electricity also increasing
- **Increasing** dwellings, **reducing** demand – **increasing efficiency** of buildings & heating technologies
- Strong **policy drivers (from EU)** – mainly Renewable Energy, Energy Performance of Buildings, and Eco-Design Directives

- **'Future Homes Standard'** – no new homes using gas from 2025 (2024 in Scotland)
  - *…and **much higher building** efficiency standards (reducing total demand)*
  - *Parallel phase out of **RHI***
- Likely massive uptake of **heat pumps** (new homes) (maybe with DH) possibly **hydrogen** for existing homes
  - *Possibly **full phase-out** of gas by 2050*



Overarching Costs, Benefits & Motivations



CC estimates net-zero to cost **1-2% of GDP** annually by 2050, but excludes:

- Value of **avoided climate damages**
- Value of **health** (and other environmental) **co-benefits** (*0.1-0.6% GDP gain estimated by 2030*)
- **Economic opportunities**

- Low-carbon & renewable energy sector in UK **worth £44.5bn in 2017** (209k employees) – 6.8% growth from 2016 (x4 wider economic growth)
- **No 'silver bullet'** - range of (technological & behavioural) solutions required
- **Strong motivations are**: innovate to capture opportunities in developing technologies and markets; improved productivity; energy security; improve public health; reduce inequalities
- …reflected through **strong representation** in Government's '**Industrial Strategy'**
- **Strong** (and increasing) **public support** for action, for reasons above

Thank You!

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