This data set presents the underlying data used to produce the results for the UKERC working paper:

Sensitivity Analysis of Net Zero Pathways for UK Industry

Which can be accessed from the below link or from the UKERC Publications section of the Energy Data Centre:

https://ukerc.ac.uk/publications/sensitivity-nzip/

This paper presents a sensitivity analysis of net zero pathways for UK industry. The characteristics of the resulting pathways are dependent on the modelling assumption used. Element Energy, the Climate Change Committee (CCC) and the Department for Business, Energy, and Industrial Strategy (BEIS) have undertaken some sensitivity analysis to explore how changes in key assumptions affect the results. However, given the importance of the Net-Zero Industry Pathways (N-ZIP) model in informing policy on industrial decarbonisation, in this working paper we undertake further analysis to explore how the model results are affected by changing a wider range of inputs than previously studied.

Before making the sensitivity analysis / changes to the N-ZIP model assumptions, we have replicated the results of the '**Balanced Scenario'** presented in the 6th Carbon Budget Report by the Climate Change Committee (CCC) to serve as a benchmark for comparison with our scenarios. Thus, we always compare with the 'Balanced' scenario in our considered scenarios. The 'Balanced' scenario prioritises low-regret measures and implements a balanced mix of decarbonisation technologies in the long-term. The results of the 'Balanced Scenario' are presented in section 2 of the working paper. The data used to plot these results are given first in directory

`1-CCC_default_Balanced_Scenario_data`

in file `1-CCC_default_Balanced_Scenario_data.xlsx`.

This excel files contains four sheets as follows:

- **Sheet 1: emissions pathway,** which contains the following columns

Column A: the time period of the model from 2017 till 2050.
Column B: the baseline emissions in (MtCO2e) in those years.
Column C: the baseline emissions in (MtCO2e) after applying Resource Efficiency and Energy Efficiency (REEE) measures in the model.
Column D: The total amount of directly abated emissions (i.e., after applying the decarbonisation technologies to industrial processes) for all years in (MtCO2e).
Column E: the remaining emissions in all years in (MtCO2e).
Columns I, K, M, O, Q, S: the amount of emissions per year that are decarbonised using electric, blue hydrogen, green hydrogen, CCS, BECSS+ bio diesel and any other technologies respectively in (MtCO2e).
Columns: J, L, N, P, R, T: the baseline of the total emissions after applying electric, blue hydrogen, green hydrogen, CCS, BECSS+ bio diesel and any other technologies respectively in (MtCO2e).

- **Sheet 2: Emissions-sector-years,** which contains the followings:

For certain years (2025, 2030, 2040 and 2050), the emissions abated by electrical, hydrogen and BECCS technologies are presented for all industrial sectors. So in Column A: Emissions abated by Electricity in (MtCO2e) with the corresponding industrial sector in Column B and

So on. These are all clearly marked in the data as well to easily visualise them. Please note that there are sectors info are duplicated because the data given is at the *site-process level.* So, this needs to be aggregated to reach the *sector* level as in the results presented in the working paper.

- **Sheet 3: Net cost (total abatement measure cost, minus baseline cost)** , which contains the certain years in Column A (2020 – 2050 in five years steps) and column B contains the annualised Net Cost in £bn for that year.
- **Sheet 4: fuel use**, contains fuel use data for the industrial sector in GWh/year for electricity, gas, petroleum, solid fuel, hydrogen and primary bioenergy in all years from 2020 till 2050.

The changes / scenarios considered are divided into 8 groups in directories named as follows:

1. **2-Resource_Efficiency_scenarios**: there are four sub-scenarios in this section in which the level of resource efficiency has been changed to 0%, 20%, 50% and 150% in the N-ZIP model. Thus, there are four xlsx excel files named `Resource_Efficiency_nnnpc.xlsx` where nnn is the resource efficiency percentage corresponding to the scenarios. The results of those scenarios are in section 4.1 of the working paper. For each of the excel files, there are 4 sub-sheets as explained above.

2. **3-Discount_rate_scenarios**: the discount rate parameter has been changed to 0.01%, 3% and 15% to examine the changes on the Net Present Value calculation in NZIP. Thus, there are three xlsx excel sheets given in files named `Discount_rate_nnnpc.xlsx` where nnn is the discount rate percentage. The results of those scenarios are in section 4.2 of the working paper.

3. **4-Carbon_price_scenarios**: the carbon price (i.e., the assumed cost of emitting a tonne of CO_2) is included within the NPV calculations and so has a key role in the selection of abatement options within the N-ZIP model. This has been changed 8 times so there are £28/tCO_2, £46/tCO_2, £96/tCO_2, £146/tCO_2, £196/tCO_2, £246/tCO_2, £446/tCO_2, and £546/tCO_2 scenarios. Therefore, there are 8 separate excel files named `Carbon_price_nnn.xlsx` where nnn is the carbon price, one file per scenario, and each file contains the same 4 sheets described above.

4. **5-Carbon_capture_and_storage_scenarios**: we increased the costs associated with Transport and Storage of CO_2 such that it was a minimum of either £40/tCO_2 or £200/tCO_2. Thus, there are 2 files corresponding to these scenarios named `CCS_TS_Cost_nnn.xlsx` where nnn is the cost of transport and storage of CO_2.

5. **6-Energy_costs_scenarios**: We considered the effect of changing the relative costs of fuel of different options. First, we examined the effect of changing the price of energy vectors (including electricity, biomass. coal, gas, and oil but excluding hydrogen). There are three scenarios in this section: double the original (balanced scenario) fuel costs, half, or quadruple the costs. Therefore, there are 3 excel files named

Energy_cost_double.xlsx, Energy_cost_half.xlsx, Energy_cost_quad.xlsx. Each file contains the same 4 sheets previously described in detail.

6. **7-Hydrogen_availability_scenarios**: We considered the effect of varying the price or availability of hydrogen on the model's outputs. There are 3 scenarios: "Expensive H2" scenario, "Expensive H2 and CCS T and S" scenario (T and S is transport and storage), and "Expensive H2 in two clusters" scenario. There are 3 excel files, one for each scenario, called Hydrogen_availability_expensive_H2_and_CCSTandS.xlsx, Hydrogen_availability_expensive.xlsx, and Hydrogen_availability_Hydrogen_restricted_two_clusters.xlsx.

7. **8-Other_model_constraints_scenarios:** Here, we examined the effect of relaxing several modelled constraints on the emissions pathways to 2050. One excel file is provided Other_model_constraints_comparison.xlsx which contains one sheet. In this sheet, *Column A*: the time period of the model from 2017 till 2050.
Column B: the baseline emissions in (MtCO2e) in those years.
Column C: the baseline emissions in (MtCO2e) after applying Resource Efficiency and Energy Efficiency (REEE) measures in the model.
Column D, E, F, G, H, I: the remaining emissions in all years in (MtCO2e) for the 'no biomass constraint', ' no hydrogen constraints', 'no CCS constraints', no Supply Chain constraints' and 'double SC constraints' scenarios respectively.

8. **9-Heat_Decarbonisation**: here, we focus on the abatement of GHG emissions associated with the provision of heat, as this is a key issue for industry. This includes processes that use both high- and low-temperature heat. So there are 2 files: one called Heat_Decarbonisation_high_temperature_processess.xlsx for high temperature which contains two sheets (one for the default balanced scenario and the other when the carbon capture transport and storage cost was varied to £200/tonne). Similarly, for the low temperature heat file, Heat_Decarbonisation_low_temperature_processess.xlsx, there are two sheets (one for the default balanced scenario and the other when the carbon capture transport and storage cost was varied to £200/tonne)

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