Climate

A selection of charts and data visualisations from *The Little Book of Data* on the climate crisis and potential solutions
Mercury rising
Record high temperatures in Europe

- Italy: 2021
  - 48.8°C
  - Bulgaria
  - Romania
  - Albania
  - Croatia
  - Greece
  - Spain
  - Portugal
  - Turkey
  - Croatia
  - Austria
  - Germany
  - Luxembourg

- France: 2019
  - 46°C
  - Poland
  - Sweden
  - Lithuania
  - Latvia
  - Estonia
  - Finland
  - Denmark
  - Norway
  - Switzerland

- UK: 2022
  - 40.3°C
  - Ireland
  - Iceland
Climate change is leading to more frequent and extreme heatwaves across Europe: 19 countries have hit record high temperatures over the last decade, and ten since 2019.
One phenomenon contributing to higher temperatures is the formation of heat domes, which occur when heat is trapped by a layer of atmospheric high pressure. The heat dome that formed over Canada and the US in 2021 sent northerly temperatures in excess of 40°C over 100 times.
Swelltering in heat domes
Human impacts as high pressure traps heat

Canada, 2021
Small number, big impact
Why 0.5°C makes a world of difference

What difference might a 0.5-degree increase in average global temperatures make? How hard should we strive to cap the increase? These are questions for everyone. Contributors to the IPCC have grappled with them and concluded a small headline difference might change things a lot. In the frame: the resilience of food supply chains on land and sea.

Ecosphere impacts

1.5°C
- Humans exposed to extreme heat: 14%
- Tropical maize harvest: 3%
- Coral reef decline: 70-90%

2°C
- Humans exposed to extreme heat: 37%
- Tropical maize harvest: 7%
- Coral reef decline: 99%
A temperature increase of 0.5°C is expected to diminish species range, with the greatest negative impact in the insect world. Insects support the base of the food chain and play an important role as pollinators. “No insects equals no food equals no people,” notes Dino Martins, entomologist at the Mpala Research Centre in Kenya.

Decline in species range

- **Insects**
  - 1.5°C: 6%
  - 2°C: 18%

- **Plants**
  - 1.5°C: 8%
  - 2°C: 16%

- **Vertebrates**
  - 1.5°C: 4%
  - 2°C: 8%
Who are the giant polluters?
Contemplating scale and emissions trajectory

The visualisation shows data on total annual and per capita CO₂ emissions in 20 different countries, ranked by total population in 2019. Countries are ordered along the horizontal axis by total population and along the vertical axis by total GDP. National per capita emissions range from 0 (minimum CO₂ emissions) to 20+ (high per capita CO₂ emissions).

Emissions by country, ranked by population and per capita, 2000-2019
Each line represents one year with the length highlighting CO₂ emissions per capita in tonnes.

Country: Emissions in 2000 5 - 13
2000
2005
2010
2019
2019
2015

Country

Peak of CO₂ emissions within range
Area represents total annual CO₂ emissions in tonnes in 2019
Per capita emissions in 2000 were lower than in 2019
Per capita emissions in 2000 were higher than in 2019

China
2.60 - 7.10

US
21.29 - 16.06

India
0.93 - 1.91

Russia
10.05 - 11.51

Mexico
4.00 - 3.44

Brazil
1.85 - 2.21

Indonesia
1.26 - 2.28

Nigeria
0.64 - 0.70

Bangladesh
0.21 - 0.63

Pakistan
0.74 - 1.15

Emissions in 2000 were lower than in 2019
Emissions in 2000 were higher than in 2019

Population in thousands:
127,575
144,373
163,046
200,963
211,049
216,565
270,625
328,239
1,366,417
1,397,715
# Acts of God or consequences of man?

Extent of protection from extreme climate events

<table>
<thead>
<tr>
<th>Event</th>
<th>Insured and total damages, 2000-2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storms</td>
<td>1,300</td>
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<tr>
<td>Floods</td>
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<td>Droughts</td>
<td>119</td>
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<td>Wildfires</td>
<td>94.3</td>
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<tr>
<td>Heat waves</td>
<td>13.4</td>
</tr>
<tr>
<td>Cold waves</td>
<td>31.3</td>
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</tbody>
</table>

US$ billions
Insured and total damages, 2000-2022

- Droughts: 119
- Floods: 610
- Wildfires: 94.3
- Heat waves: 13.4
- Cold waves: 31.3

Total damages: 13.4

Climate 79
With extreme climate impacts and vulnerabilities from energy dependency building, one obvious response is to accelerate the transition, which is what Europe intends with REPowerEU. This multi-billion euros investment scheme intends to make Europe independent from Russian fossil fuels before 2030. In this context, the scale of fossil-fuel subsidies is worth a closer look.
Accelerating the energy transition
Funnelling investment with geopolitical considerations in mind

REPowerEU strategic investment target, 2027-2030 (€bn)
The world of work is changing
Assessing the nature of green and brown jobs

Identifying task differences in the UK, 2019
What could the energy transition mean for the job market? There will be growth in some sectors and contraction in others, but employment in many industries will not fit neatly into a binary ‘green or brown’ classification. Instead, it might be helpful to think about how the nature of work could change.
Rethinking the carbon cycle
Sustainable building materials could trap carbon

Bio-based construction materials could trap carbon and replenish the land carbon pool. Researchers are also exploring ways to use captured CO$_2$ as an ingredient in concrete: CO$_2$ can be added in the form of aggregates or injected during mixing.
Bio-based and CO₂-infused construction materials

- Glulam
- Bamboo
- Cross-laminated timber
- Concrete

Carbon pool formation
Carbon pool depletion
Carbon pool replenishment

2020
Carbon pool replenishment
2050

Mineral-based construction materials
- Masonry
- Concrete
- Cross-laminated timber

Bio-based and CO₂-infused construction materials
- Glulam
- Bamboo
- Cross-laminated timber
- Concrete
<table>
<thead>
<tr>
<th>Case</th>
<th>Gas boilers</th>
<th>Electric boilers</th>
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<tr>
<td>1</td>
<td>100</td>
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<td>2</td>
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<td>10</td>
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</table>

**Annual costs (£)**

**CO2 emissions (tonnes)**

**Energy-efficient home with gas boiler, EV, solar panels and battery**

**Energy-efficient home with electric boiler, heat pump, EV, solar panels and smart battery**

**Baseline case: no energy-efficiency improvements and old gas boiler**

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WWF-UK and ScottishPower’s *Better Homes, Cooler Planet* report shows how low-carbon technologies could reduce energy bills and carbon emissions. The report considered the effect of installing a range of technologies at the household level and estimated the impact on annual energy bills through running-costs modelling, as well as the carbon savings.
Making positive changes to decarbonise
Emissions savings from different technology combinations

Baseline case: no energy-efficiency improvements and old gas boiler

Energy-efficient home with gas boiler, EV, solar panels and battery

Energy-efficient home with electric boiler, heat pump, EV, solar panels and smart battery
Appendix
Sources and notes


72-73  **Sweetering in heat domes** Aviva Investors, September 2022.

74-75  **Small number, big impact** Kelly Levin, ‘Half a degree and a world apart: The difference in climate impacts between 1.5°C and 2°C of warming’, World Resources Institute, October 7, 2018.

76-77  **Who are the giant polluters?** Travis Tester, ‘CO₂ emissions of the top 20 most populous countries’, August 3, 2021. Visual inspiration from Federica Fragapane.


80-81  **Accelerating the energy transition** 'Financing REPowerEU', European Commission, May 17, 2022; Kate Abnett, ‘Fossil fuel subsidies to face tighter EU scrutiny’, Reuters, January 31, 2022.

82-83  **The world of work is changing** Molly Broome, et al., ‘Net zero jobs: The impact of the transition to net zero on the UK labour market’, The Resolution Foundation, June 2022. Note: The measures of task intensity are standardised across all SOC 2010 four-digit level occupations. Green jobs refer to ‘core green task’ jobs and brown jobs refer to ‘brown changer’ jobs (occupations particularly prevalent in emissions-intense sectors).


86-87  **Making positive changes to decarbonise** 'Better homes, cooler planet: How low-carbon technologies can reduce bills and increase house value', WWF-UK and ScottishPower, July 20, 2022. Note: The cases in this chart involve different combinations of five low-carbon technologies (LCTs) – heat pumps, electric vehicle chargers, solar panels, battery storage, and energy efficiency upgrades. Case 1 represents a house with an old gas boiler and no LCTs, while Case 17 contains all five technologies, with policy costs moved from electricity bills. The running cost figures are derived from modelling which assessed the impact that low carbon technologies have on annual home energy bills, by combining datasets that calculate the energy demands of different house types with information about the characteristics of different technologies. Bill levels used to calculate running cost savings assume that the householder is on a Standard Variable Tariff set at the level of the Default Tariff Cap for the period beginning April 2022, and which was in place at the time of publication. Updates to the price cap level may impact the estimates. The detail on the technology specific assumptions is available in the full report.

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Heat and hot water fuel</th>
<th>LCTs installed and energy efficiency standard</th>
<th>Upfront cost (£)</th>
<th>Energy costs (exc. vehicle fuel costs) (£/yr)</th>
<th>Energy costs saved (£/yr)</th>
<th>Energy costs (inc. vehicle fuel costs) (£/yr)</th>
<th>Residual CO₂ emissions (lifetime TCO₂)</th>
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<tbody>
<tr>
<td>Case 1</td>
<td>Gas</td>
<td>Baseline case (no EE improvement) + old gas boiler</td>
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<td>2,118</td>
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<td>2,816</td>
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<td>Case 2</td>
<td>Gas</td>
<td>Baseline case (no EE improvement) + modern gas boiler</td>
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<tr>
<td>Case no.</td>
<td>Heat and hot water fuel</td>
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<td>Energy costs saved (£/yr)</td>
<td>Energy costs (inc. vehicle fuel costs) (£/yr)</td>
<td>Residual CO₂ emissions (lifetime TCO₂)</td>
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<td>Case 3</td>
<td>Gas</td>
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<td>Case 8</td>
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<td>Case 9</td>
<td>Gas</td>
<td>EE4 + electric vehicle + solar panels + battery</td>
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<td>1,660</td>
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<td>Case 10</td>
<td>Electricity</td>
<td>EE4 + heat pump</td>
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<td>Case 11</td>
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<td>Case 13</td>
<td>Electricity</td>
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<td>Case 16</td>
<td>Electricity</td>
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<tr>
<td>Case 17</td>
<td>Electricity</td>
<td>EE4 + heat pump + electric vehicle + solar panels + smart battery (policy costs moved)</td>
<td>30,713</td>
<td>383</td>
<td>1,735</td>
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</tbody>
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