# Twin Transitions:
# Policy Innovations for a Sustainable Digital Future

*Towards Sustainable Digital Futures Symposium*
*14-15 May 2025*

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iDODDLE
The Impacts of Digitalised Daily Life on Climate Change

Environmental *Change* Institute
eci
UNIVERSITY OF OXFORD

erc European Research Council
Consolidator Grant #101003083

# Two imbalanced tales of digital and climate

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AI for Good Global Summit

*Identifying innovative AI applications to solve global challenges*

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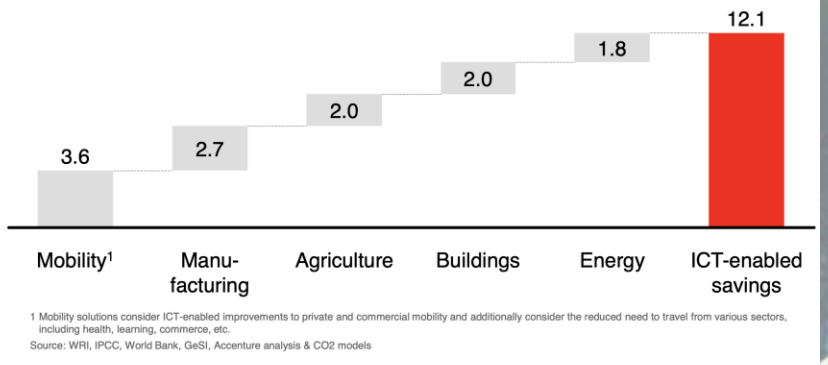
## Digital and Climate

Scaling digital solutions for low carbon, circular and sustainable industries.

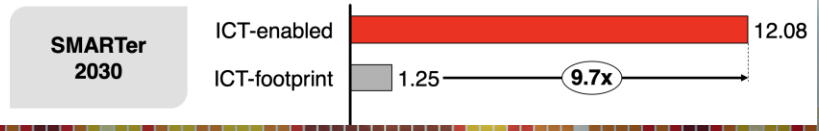
Figure 1: $CO_{2e}$ abatement potential by sector (2030)




1 Mobility solutions consider ICT-enabled improvements to private and commercial mobility and additionally consider the reduced need to travel from various sectors, including health, learning, commerce, etc.

Source: WRI, IPCC, World Bank, GeSI, Accenture analysis & CO2 models

Figure 2: ICT benefits factor in 2020 and 2030 (Gt $CO_{2e}$)




GeSI GLOBAL e-SUSTAINABILITY INITIATIVE

Adobe Stock | #566920520

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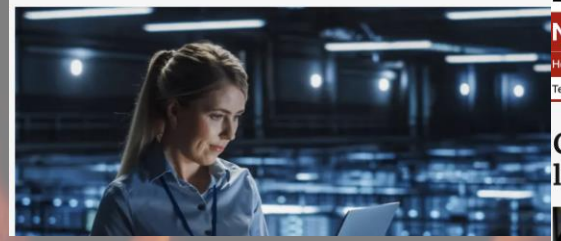
## Electricity grids creak as AI demands soar



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Technology

## Concern UK's AI ambitions could lead to water shortages

[1]

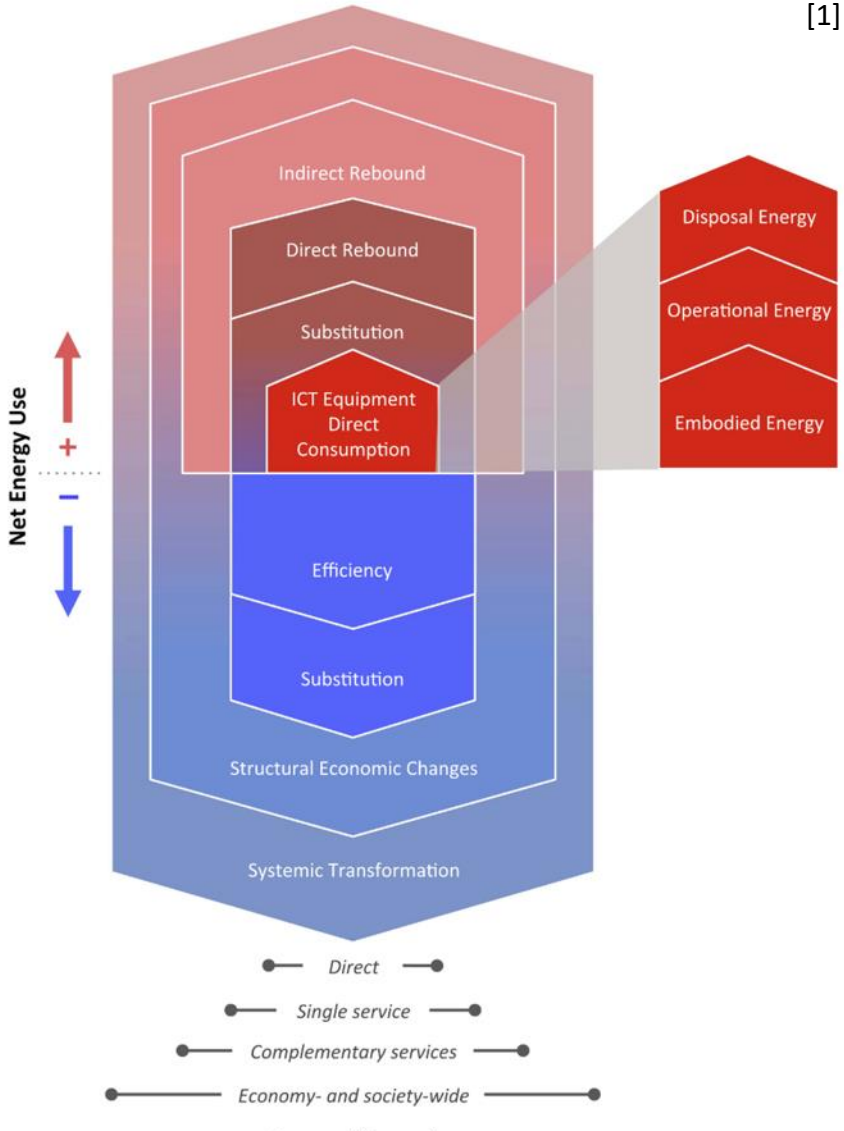
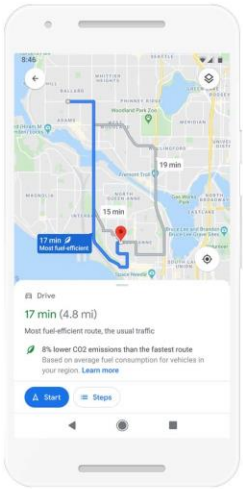



**Figure 2.** Taxonomy of ICT energy effects. Red effects increase energy use, blue effects decrease energy use, and shading intensity decreases as effect scope increases. (Effect magnitudes are only illustrative and not to scale.)

# **Indirect** environmental impacts from digitalisation are much larger in scope and magnitude!

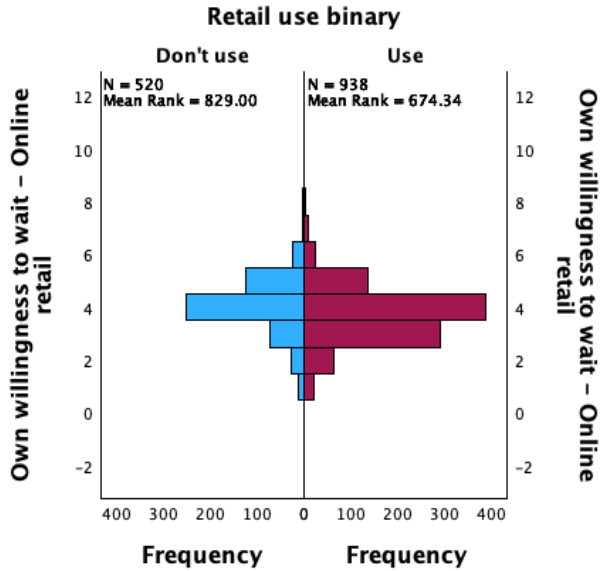

Substitution[2]

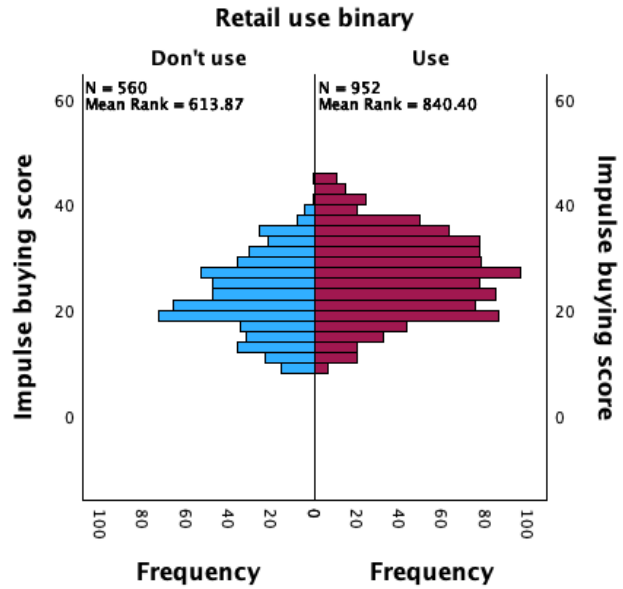



Efficiency

Rebound[3] & Induction[4]

# Example: on-demand retail

# Policies tend to be techno-optimist, while tackling digitalisation's risks for climate is limited to data centre efficiency + power source


NEWS ANNOUNCEMENT | 15 March 2024 | Directorate-General for Energy | 2 min read

## Commission adopts EU-wide scheme for rating sustainability of data centres

European Commission

# Policies on ICT infrastructure alone are not enough!
# We need a…

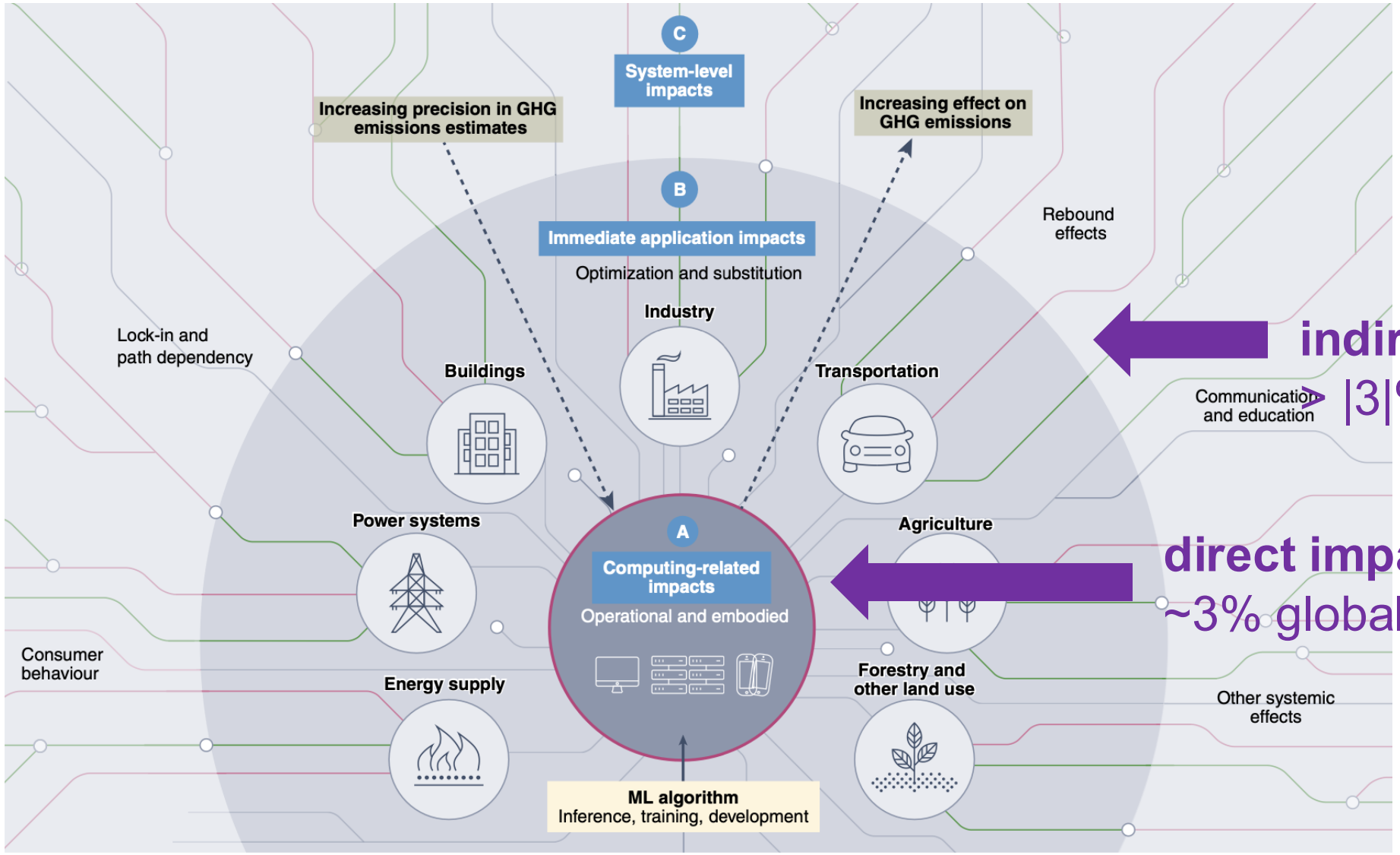

"A fundamental redirection of the purpose of digital technologies towards a deep sustainability transformation."[5]

## Digital Green Deal[6]


**Fig. 1.** Three aims to ensure policy coherence between sustainability and digital policies.

But challenging in many ways…

# Indirect environmental impacts are **diffused**



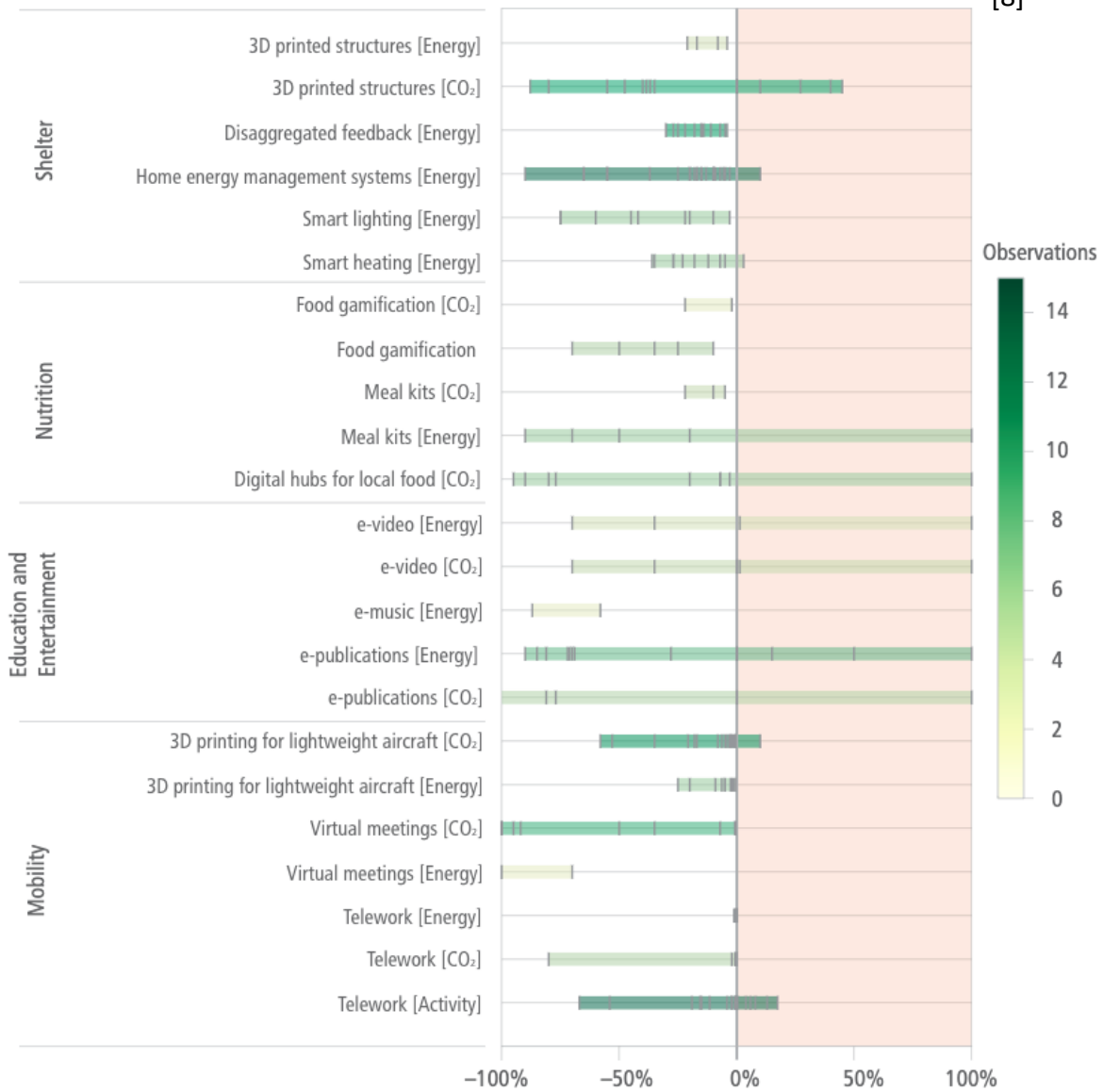

**indirect impacts**
> |3|% global $CO_2$

**direct impacts**
~3% global $CO_2$

Example:
AI's environmental impact[7]

# Indirect environmental impacts are **uncertain**

[8]



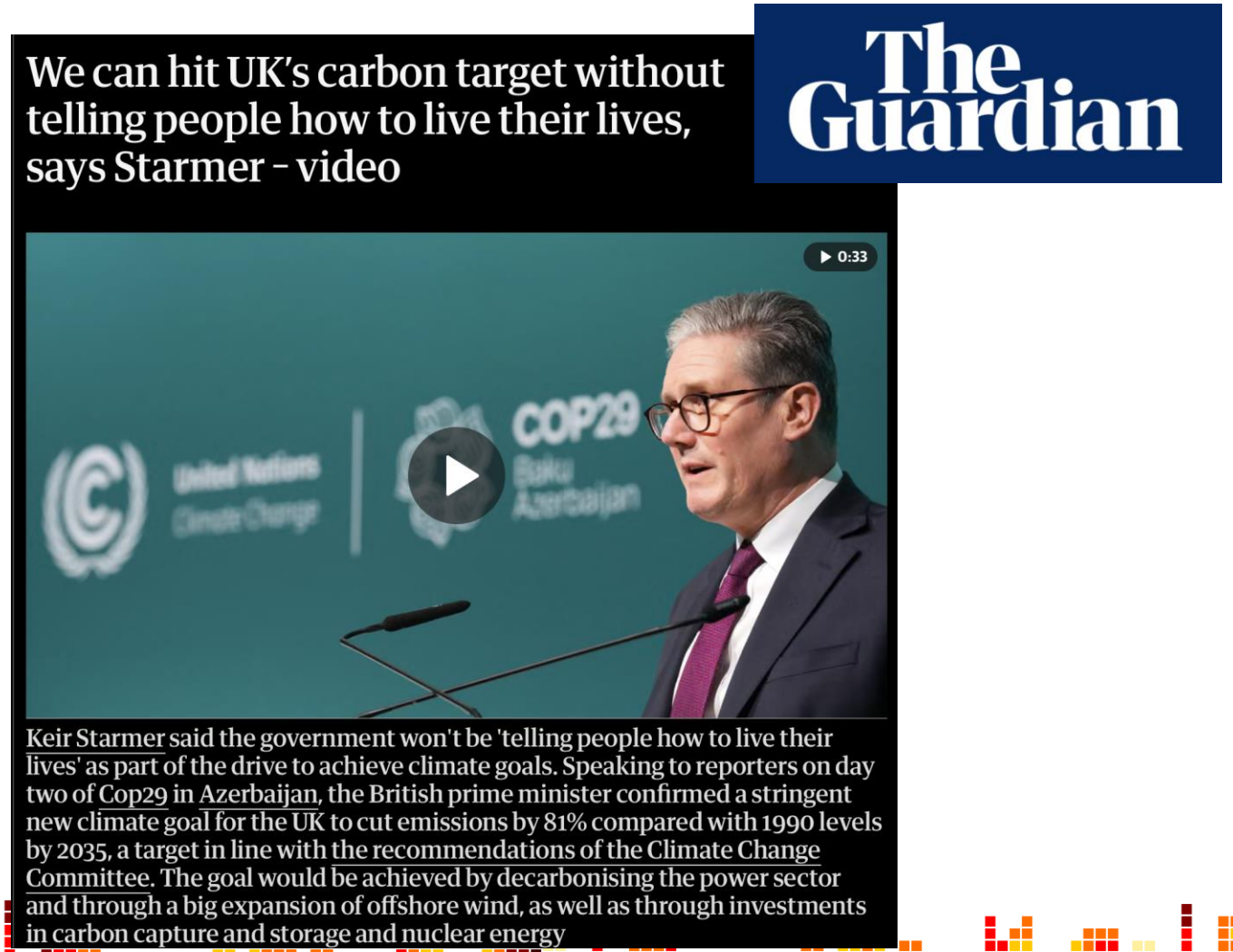

[9]

**Table 3. Quantitative estimates of digitalisation's indirect impacts on energy or carbon**

| Activity categories | Digital application | Impact ranges (ΔEnergy or ΔCarbon) | Sources |
|---|---|---|---|
| Entertainment, media | E-publications | ΔE -90% to +3000% | 1 |
| | E-news | ΔE -1400% to +550% | |
| | E-music | ΔE -87% to +235% | |
| Work | Teleworking | ΔE -15% to -0.01% | 2 |
| Travel | Ride-hailing | ΔE +41% to +90% | 3 |
| | Shared ride-hailing | ΔC -62% to -12.6% | 4 |
| | Mobility-as-a-Service | ΔE -50% to +20% | 5 |
| | | ΔC -50% to +20% | |
| | Autonomous vehicles | ΔE -45% to +60% | 6 |
| | | ΔC -94% to +48% | |
| Retail | E-retail | ΔC -94% to +140% | 7 |
| | P2P goods | ΔC -89% to +55% | 8 |
| Managing home | Home energy management systems | ΔEimp -91% to +9.1% | 9 |
| | | ΔC -79% | |
| | Smart heating (residential) | ΔE -36% to +2% | 10 |
| | Smart cooling (residential) | ΔE -7.7% to -7.6% | |
| | Smart lighting | ΔE -73.2% to -13.4% | 11 |
| | Smart home appliances and Internet of Things | ΔE -10% to -2.63% | 12 |

Note: ΔE = % change in energy use; ΔC = % change in CO2 or CO2e; ΔEimp = % change in energy imported from the grid.
Sources are available in Appendix 2.

# Addressing indirect environmental impacts requires **behavioural change**



The Guardian

## We can hit UK's carbon target without telling people how to live their lives, says Starmer – video



Keir Starmer said the government won't be 'telling people how to live their lives' as part of the drive to achieve climate goals. Speaking to reporters on day two of Cop29 in Azerbaijan, the British prime minister confirmed a stringent new climate goal for the UK to cut emissions by 81% compared with 1990 levels by 2035, a target in line with the recommendations of the Climate Change Committee. The goal would be achieved by decarbonising the power sector and through a big expansion of offshore wind, as well as through investments in carbon capture and storage and nuclear energy

# Policy Landscape

**International Frameworks/Principles**

- Global Digital Compact
- OECD AI Principles
- EU Ethics Guidelines for Trustworthy AI

**National Frameworks/Strategies**

- UK AI's Regulatory Principles
- Germany Digital Strategy

**Regulations/Laws/Policies**

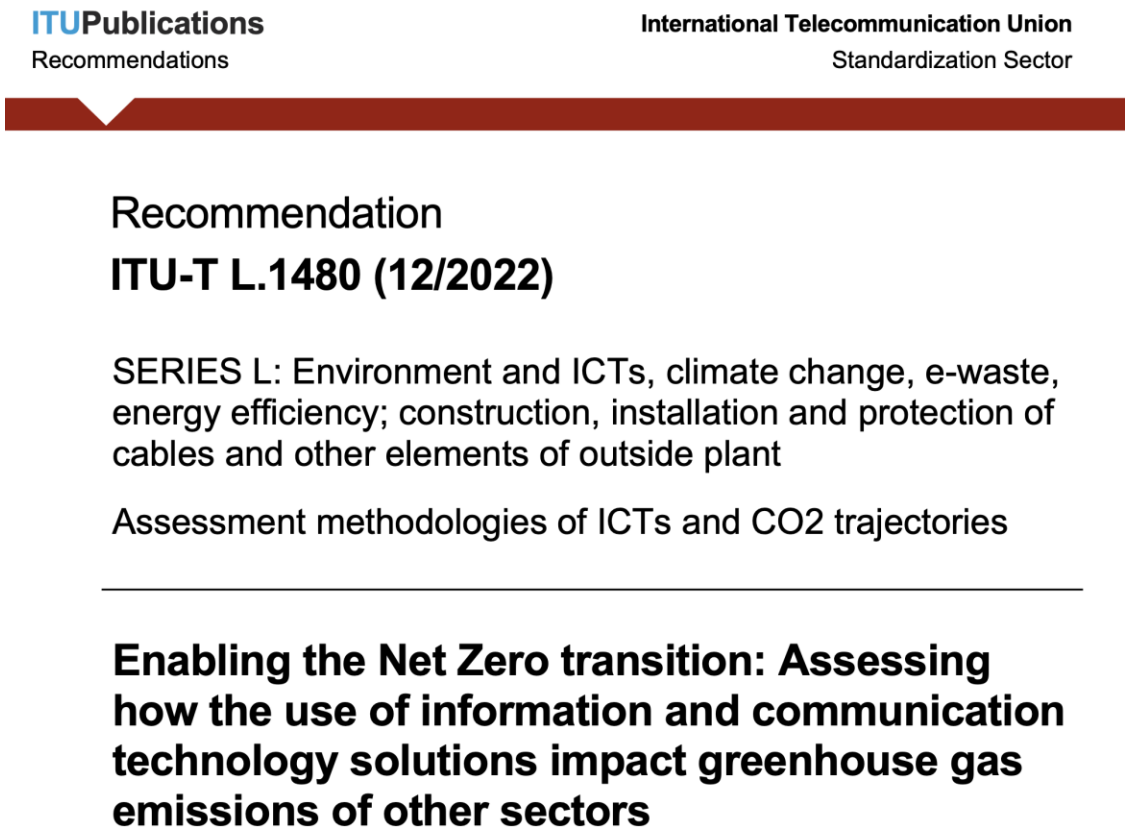
- EU AI Act
- EU DSA/DMA
- UK AI Growth Zones

**Table 3 | Ethical principles identified in existing AI guidelines** [10]

| Ethical principle | Number of documents | Included codes |
|---|---|---|
| Transparency | 73/84 | Transparency, explainability, explicability, understandability, interpretability, communication, disclosure, showing |
| Justice and fairness | 68/84 | Justice, fairness, consistency, inclusion, equality, equity, (non-) bias, (non-)discrimination, diversity, plurality, accessibility, reversibility, remedy, redress, challenge, access and distribution |
| Non-maleficence | 60/84 | Non-maleficence, security, safety, harm, protection, precaution, prevention, integrity (bodily or mental), non-subversion |
| Responsibility | 60/84 | Responsibility, accountability, liability, acting with integrity |
| Privacy | 47/84 | Privacy, personal or private information |
| Beneficence | 41/84 | Benefits, beneficence, well-being, peace, social good, common good |
| Freedom and autonomy | 34/84 | Freedom, autonomy, consent, choice, self-determination, liberty, empowerment |
| Trust | 28/84 | Trust |
| Sustainability | 14/84 | Sustainability, environment (nature), energy, resources (energy) |
| Dignity | 13/84 | Dignity |
| Solidarity | 6/84 | Solidarity, social security, cohesion |

# 1. Measurement & reporting of **direct + indirect impacts**

Quantitative estimates + qualitative mechanisms



ITUPublications
Recommendations

International Telecommunication Union
Standardization Sector

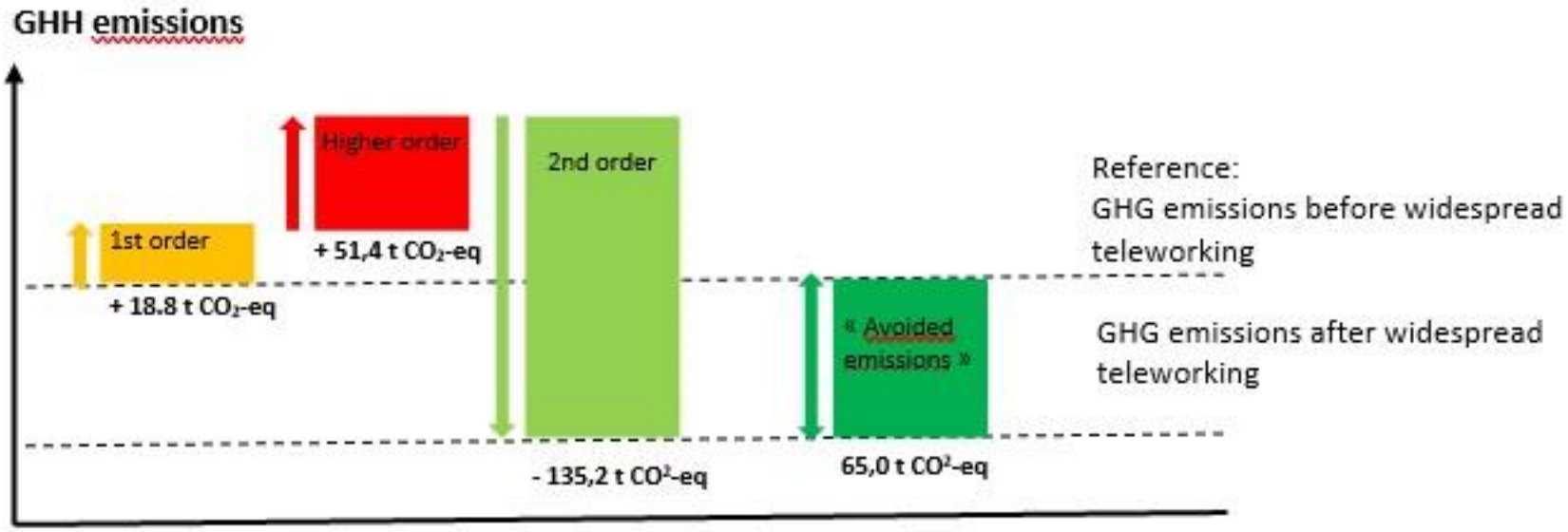
Recommendation
**ITU-T L.1480 (12/2022)**

SERIES L: Environment and ICTs, climate change, e-waste, energy efficiency; construction, installation and protection of cables and other elements of outside plant

Assessment methodologies of ICTs and CO2 trajectories

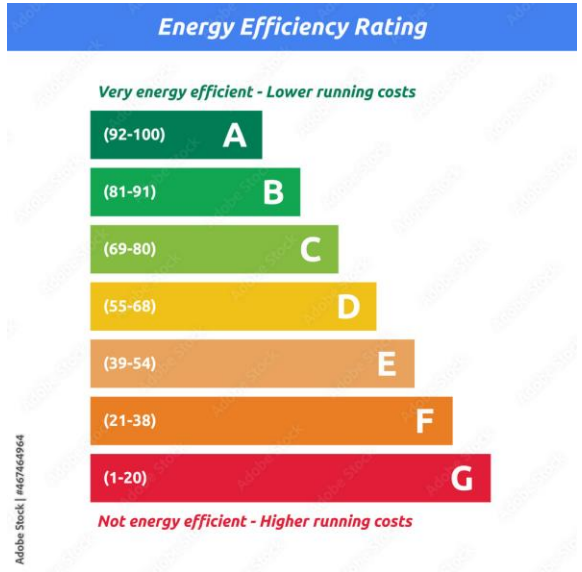
**Enabling the Net Zero transition: Assessing how the use of information and communication technology solutions impact greenhouse gas emissions of other sectors**

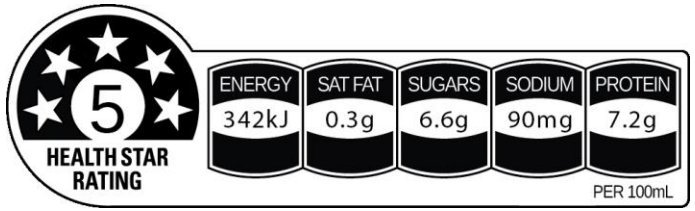
# Case study: Orange Atalante site in Rennes[11]



# 2. Informational instruments

From



To

Spaces | AIEnergyScore / Leaderboard | like 58 | Running | App | Files | Commu

Submission Portal | Label Generator | FAQ | Documentation | Download Data | Community

# AI Energy Score

There's a **61,848.0x** difference between the highest and lowest energy use in this leaderboard.

Text Generation | Image Generation | Text Classification | Image Classification | Image Captioning | Summarization | ...

Select Model Class: A (Single Consumer GPU) <20B parameters

Sort: Low to High

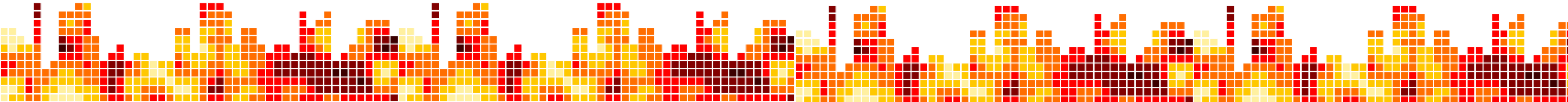
There's a **21.9x** difference between the highest and lowest energy use in this class.

| Model | Provider | GPU Energy (Wh) | Score |
|---|---|---|---|
| distilgpt2 | distilbert | 1.31 | ★★★★★ |
| opt-125m | facebook | 1.94 | ★★★★★ |
| gpt2 | openai-community | 2.15 | ★★★★★ |
| openai-gpt | openai-community | 2.70 | ★★★★★ |
| gpt2-medium | openai-community | 3.96 | ★★★★★ |
| OLMo-1B-hf | allenai | 5.59 | ★★★★★ |
| gpt2-large | openai-community | 6.12 | ★★★★★ |
| phi-1_5 | microsoft | 6.29 | ★★★★★ |

## The (un)sustainability of Big Tech companies [5]

If all digital companies follow the insufficient climate ambition of these influential IT companies, the sector will not play its part in preventing dangerous global warming beyond 1.5 °C.

| Company | Rating | Climate Pledge (What's there / What's missing) |
|---|---|---|
| Alphabet | C | Achieve net zero emissions and use 100% carbon-free energy by 2030. / No concrete targets to reduce indirect emissions outside the organisation's energy consumption. |
| Meta | C | Reach net zero by 2030 by reducing its emissions and supporting carbon removal projects. / No concrete targets to reduce indirect emissions outside the organisation's energy consumption. |
| amazon | D | Reach net zero by 2040 and use 100% renewable energy for operations by 2025. / No credible and publicly available plan to reduce its emissions. |
| NETFLIX | C | Reach net zero by 2022, reduce internal and energy emissions by 45% by 2030, and encourage suppliers to set reduction targets by 2025. / No concrete targets to reduce indirect emissions. |
| ebay | C | Reduce direct emissions by 90% and indirect emissions by 20% by 2030. / No net zero pledge. |
| Microsoft | B | Become carbon negative by 2030, by investing in carbon removal projects and reducing overall emissions by over 50%. / Indirect emissions other than the organisation's energy consumption still increased in 2021. |
| Spotify | C | Reach net zero by 2030, by reducing overall emissions and offsetting the rest. / No concrete and transparent reduction targets for all indirect emissions. |



# 3. Market regulation

EU's Unfair Commercial Practices Directive (UCPD)

Status: EU law

addressing

- Hyper-nudging
- Recommender algorithm
- Agentic AI
- Dark patterns (e.g., video auto-play, infinite scrolling, unstoppable notifications, etc.)



Search Engine Land

Search Engine Land » PPC » Google is testing ads in third-party AI chatbot conversations

Google is testing ads in third-party AI chatbot conversations

Google is bringing ads into AI chatbot conversations, creating a new frontier for advertisers beyond traditional search.

Anu Adegbola on May 1, 2025 at 1:13 pm | Reading time: 2 minutes

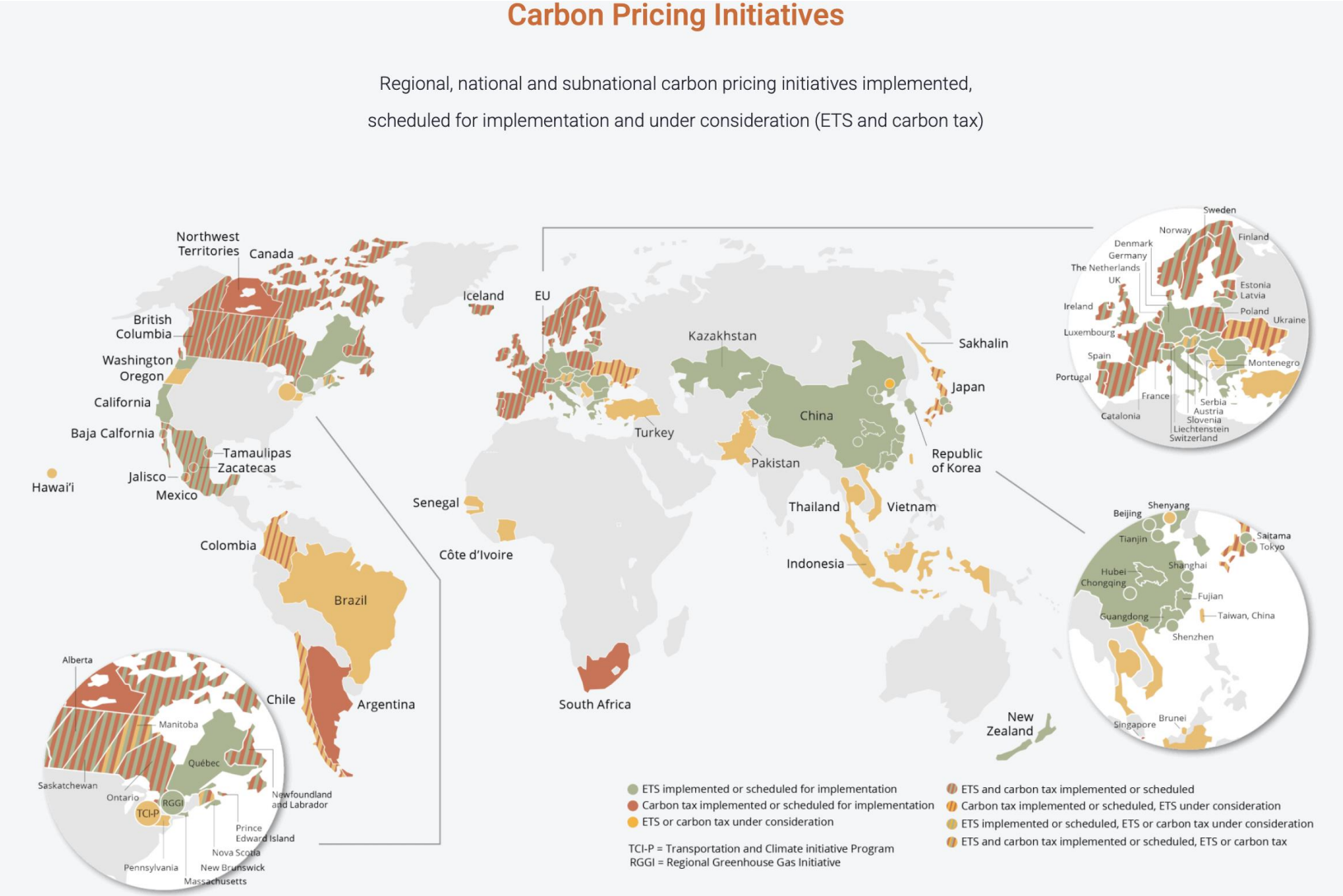
# 4. Consumer protection

Consumer protection against false environmental claims



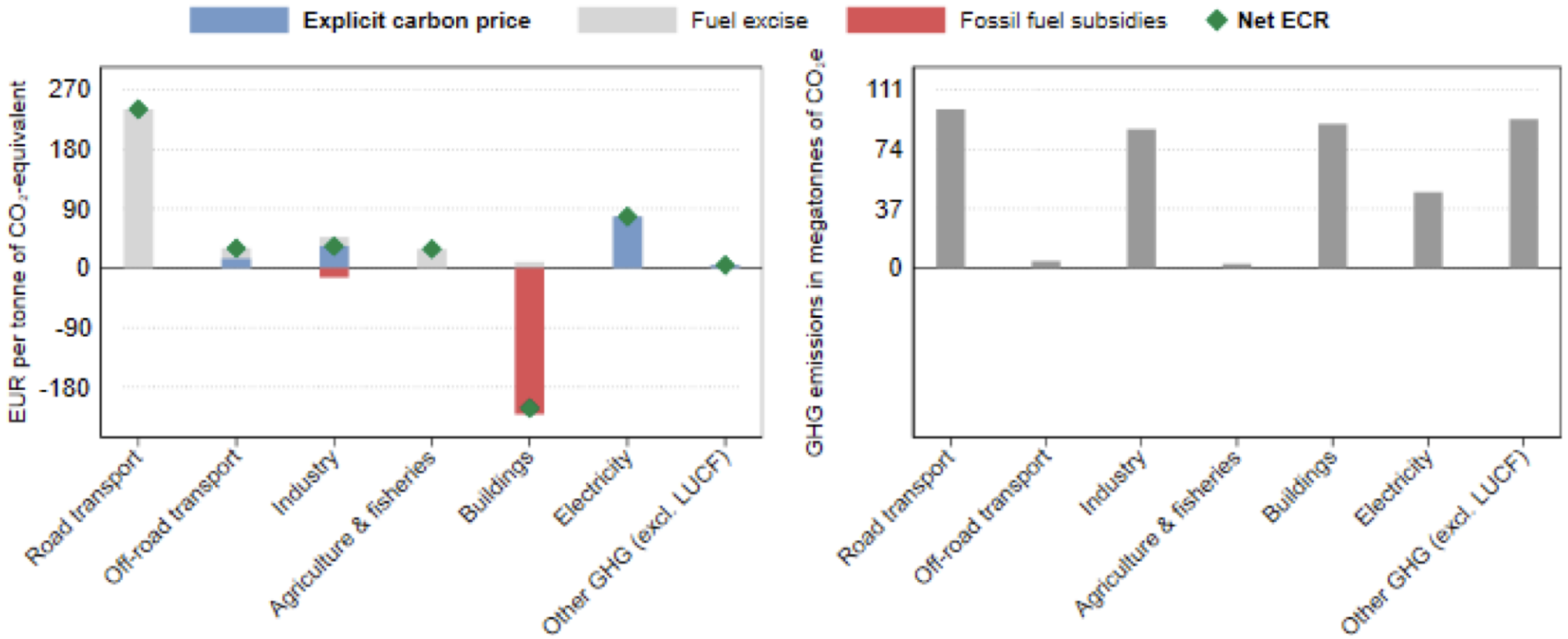
Data protection laws

# 5. Financial instruments



**Average effective carbon prices (left panel) and GHG emissions (right panel) by sector, 2023 estimates** [12]

Net Effective Carbon Rates are highest in the road transport sector, which accounts for 23.4% of the country's total GHG emissions. The Net ECR is on average negative in the buildings sector. The buildings sector accounts for 21.2% of GHG emissions.



# 6. Sectoral policies


Oxfordshire County Council electric car club pilot scheme
Credit: Dr Hannah Budnitz

GOV.UK

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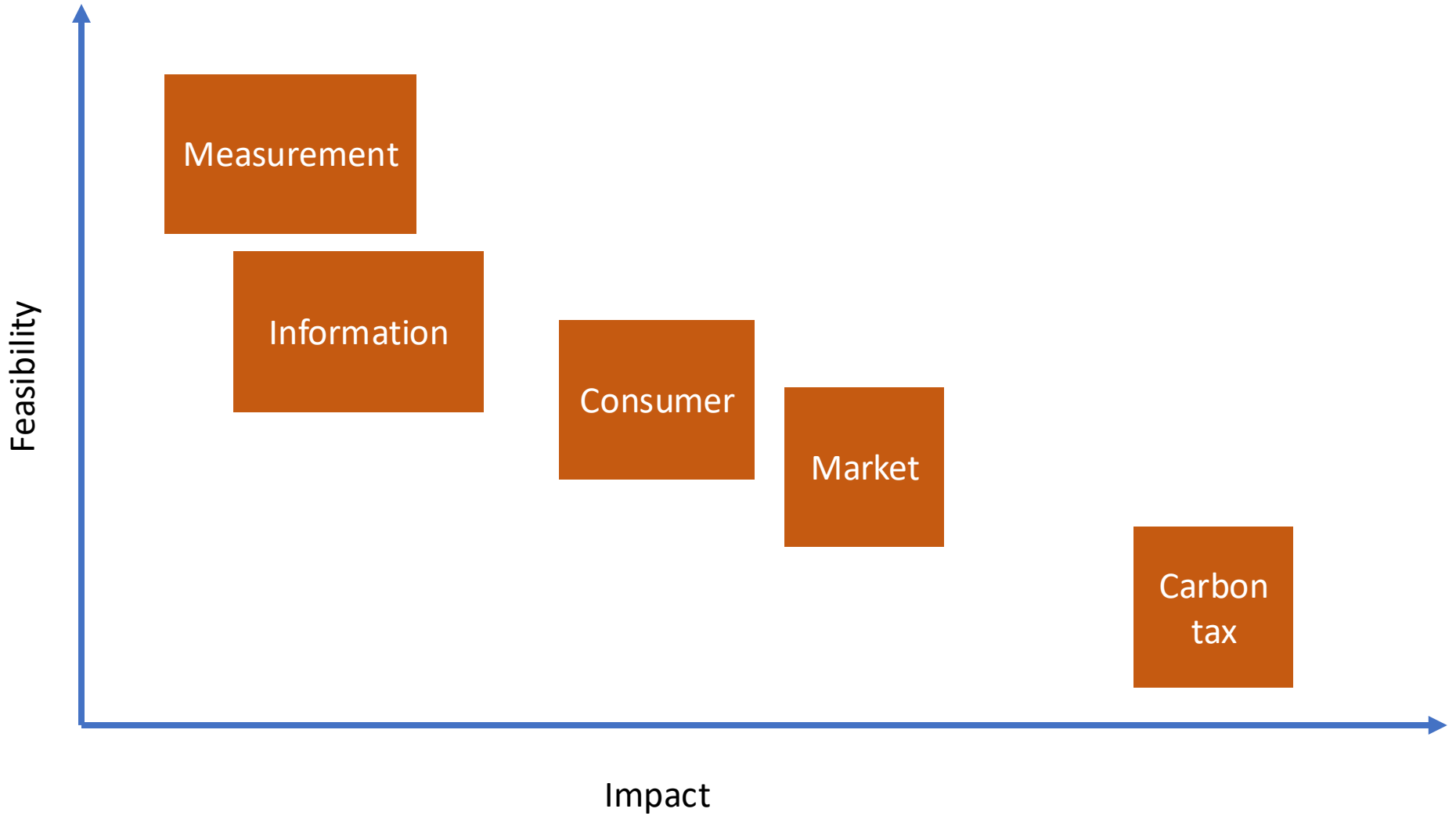
Press release

**Millions of shoppers to be protected by new Buy-Now, Pay-Later rules**

New rules will give millions of Buy-Now, Pay-Later users key protections offered by other forms of credit.


Measurement
Information
Consumer
Market
Carbon tax
Feasibility
Impact

# Conclusion & further questions

1. A digital reset will require proactive, coordinated, and comprehensive digital, environmental, and sectoral policies
2. Range of policy options from soft-touch to command-control
3. Feasibility amidst geopolitical competition on digital economy?
4. Capacity for enforcement?

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# Thank you for listening

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Environmental *Change* Institute

European Research Council
Consolidator Grant #101003083