Centre for Economic Performance

Innovation, growth and the transition to net-zero emissions

– *what policies are needed?*

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Drawing on article with Nicholas Stern in Research Policy (Freeman centenary special issue), a series of reports on sustainable growth with CEP/GRI colleagues & Economy 2030 Inquiry work

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LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

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ECONOMY 2030

UKRI Economic and Social Research Council

Decisive decade: net zero, pre-existing fragilities, Covid recovery

Climate change

- IPCC (2018, 2021) highlights immense dangers of warming beyond 1.5°C
  - Time is running out if we are to take effective action keep warming below 1.5°C
  - Pre-COP26 on course for 2.7°C (UNEP, 2021); recent IEA analysis - if COP26 pledges are enforced, < 2°C could be achieved.
  - But this relies on **implementation**, and 1.5 must still be the target to avoid catastrophic and irreversible damage

Decade pre-Covid

- Rising emissions and destruction of biodiversity
- Falling investment rates; slowing growth and stagnant productivity in many countries – productivity puzzle particularly acute in the UK
- Challenges around social cohesion and populism, faltering of internationalism

Covid

- Tragic human costs and loss of life; severe economic impacts across countries and widening of pre-existing inequalities; debt stress severe
- Underlined the dangers, weaknesses and fragilities that have been building in the world economy

A new approach to growth is urgently required

- **Sustainable, inclusive and resilient growth, driven by "clean" investment and innovation**

5 - 10 years		Investment in sustainable infrastructure and other assets can boost shorter-run demand and growth, sharpen supply and efficiency, reduce waste and pollution, promote sustainable development and reduce poverty.
~ 10 years		Spur innovation, creativity and growth in the medium term, unleash new waves of innovation and discovery.
~ 20 years		Low-carbon is the only feasible longer-run growth on offer; high-carbon growth self destructs.

  - By 2030, low-carbon technologies and business models could be competitive in sectors representing > 70% global emissions (today 25%; mainly power, transport) (SYSTEMIQ, 2020)
- Requires substantial investment across types of capital, but can generate high returns
- Change will be felt by citizens and consumers: in homes, work, transport, lifestyle choices
  - In UK, CCC estimates that 60% of remaining decarbonisation to 2035 involves behaviour change (vs 13% over 2009-2019)
- Momentum in policy and across citizens, consumers, businesses, investors

Series of market failures point to collection of policies

- Some specific to the environment, others relate to innovation, enhanced for “clean”

Greenhouse gases externality	• Taxes so that firms internalise the cost of carbon, cap and trade, regulation
R&D externality	• Tax incentives, public support for R&D Evidence that knowledge spillovers greater for “clean” technologies
Capital market imperfections	• Support for investments in risky early stage technologies Evidence that clean tech been seen as more risky than alternatives
Networks	• Investment in infrastructure, coordination, planning, system design
Information frictions	• Raising awareness, informing choices of consumers, businesses, investors, workers
Co-benefits	• Valuing ecosystems, biodiversity, health impacts

- Some markets are absent, investor expectations and credible pathways become crucial
  - e.g. regulated phase out of high-carbon technologies when answer not yet known

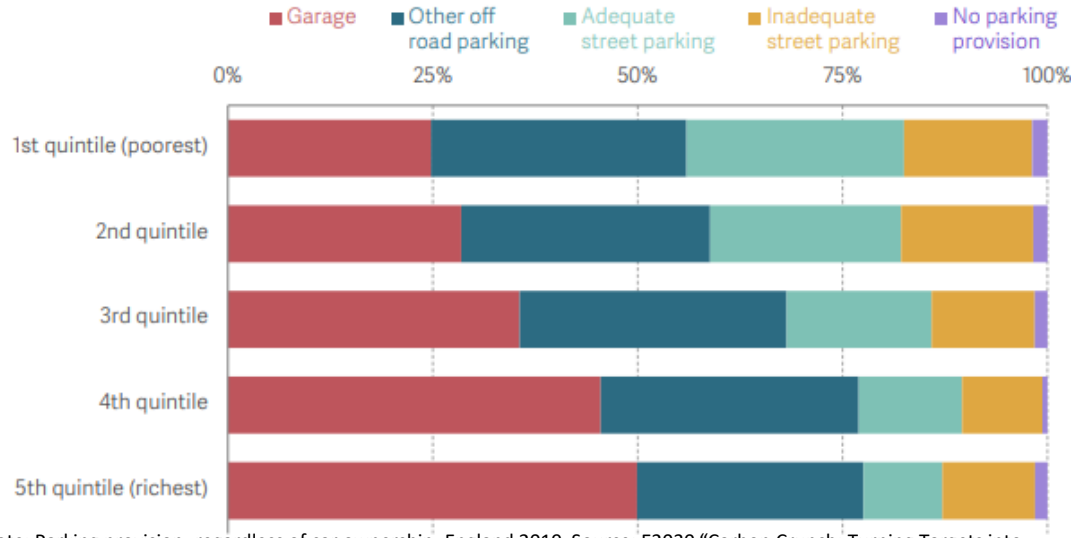
Path dependencies and “creative destruction” with a purpose

- Need to accelerate a process of creative destruction, with a purpose and at pace
- **To shift quickly to clean innovation, need coordinated policies, incentives and institutions** due to path dependencies in production, deployment and diffusion of new technologies
- Concept captured in literature on **environment and directed technical change** (Acemoglu et al., 2012), which implies:
  - Without policy, market forces favour the “dirty” sector
  - Sound policy consists of both carbon taxes and other levers such as subsidies to clean R&D
  - Once clean technologies have gained sufficient productivity advantage and are able to benefit from their own patterns of path dependence, policy incentives are no longer required
  - Delay is costly: it implies a longer transition phase with slow growth
- The importance of pro-environmental attitudes (Aghion et al., 2021)
  - Consumer values influence the direction of innovation, and more so in competitive markets and magnitudes appear to be large
  - Maintaining support requires active management of the “disruption”

Public attitudes, change and a new economic strategy

- Preferences of consumers, workers, investors, voters are key to achieving net-zero and realising sustainable growth opportunities
- Pro-environmental attitudes rising, but need to convert to action
  - Prices, disruption, free-riding, information, infrastructure, distributional aspects…

Access to low-cost home EV charging by income quintiles



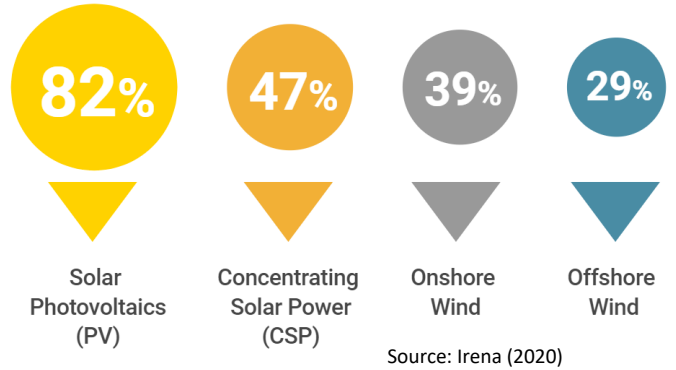
Note: Parking provision, regardless of car ownership, England 2019. Source: E2030 "Carbon Crunch: Turning Targets into Delivery" report, data from Dept of Levelling up, housing and communities, English Housing Survey Live tables

- Economy 2030 Inquiry: next stage in UK's journey to net zero…
  - Involves more visible **change** (transport, homes, diet, jobs)
  - Requires fair management of **costs** and sharing of benefits
  - Needs an update to our economic strategy to reflect the changed **context**
- Needs creative, directional and participatory approaches to policy making to ensure a system-wide view, improving understanding, and gaining buy-in from citizens and consumers
- Building evidence to help shape this

Rapid technological change, and opportunities

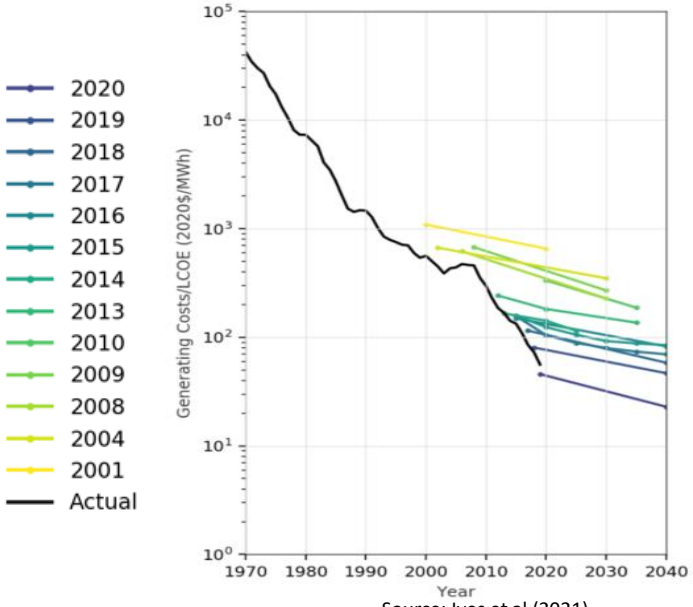
- Evidence of increasing returns to scale in the discovery and production of clean technologies (Ekins and Zenghelis, 2021)
- Capital costs for renewables continue to fall faster than those for conventional technologies, and faster than expected
  - Solar and wind cheapest forms of new power generation in countries representing over 70 per cent of global GDP (SYSTEMIQ, 2020)
  - Similar happening now with batteries
- Occurred despite fairly weak policies – potential for faster change – and associated growth opportunities
- *But how can specific countries or regions determine which types of technology, goods or services to support as part of industrial/innovation policy?*

Decline in renewables costs (2010-2019)



Source: Irena (2020)

Average global solar PV costs

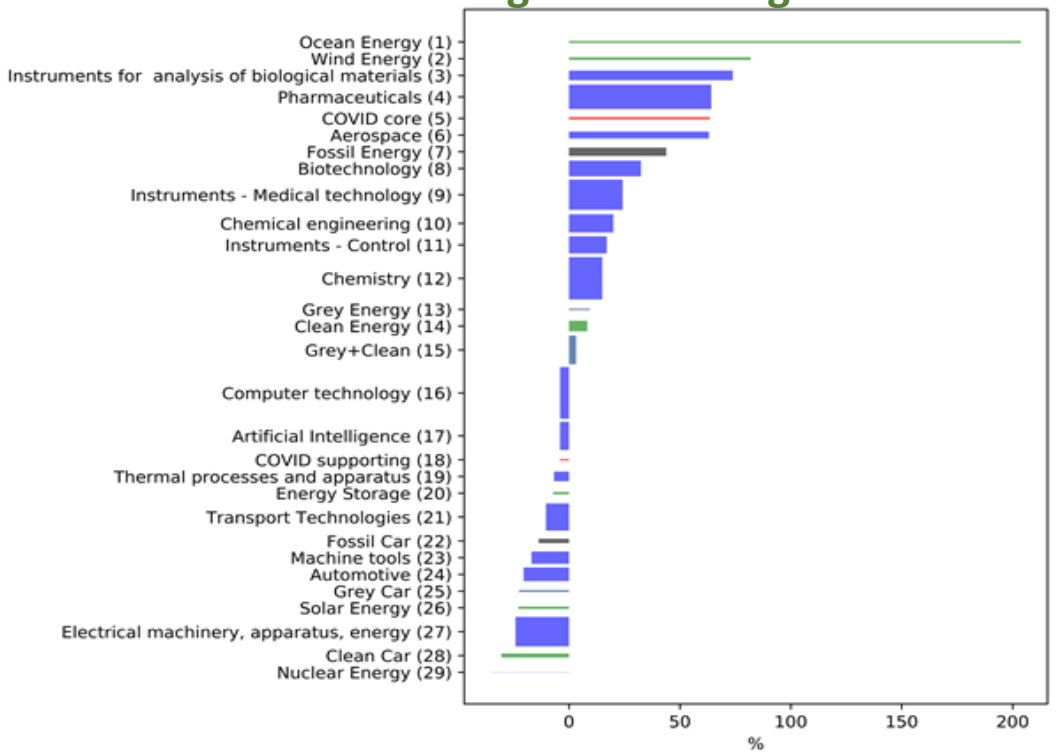


Source: Ives et al (2021)

Informing UK industrial and innovation policy using patents

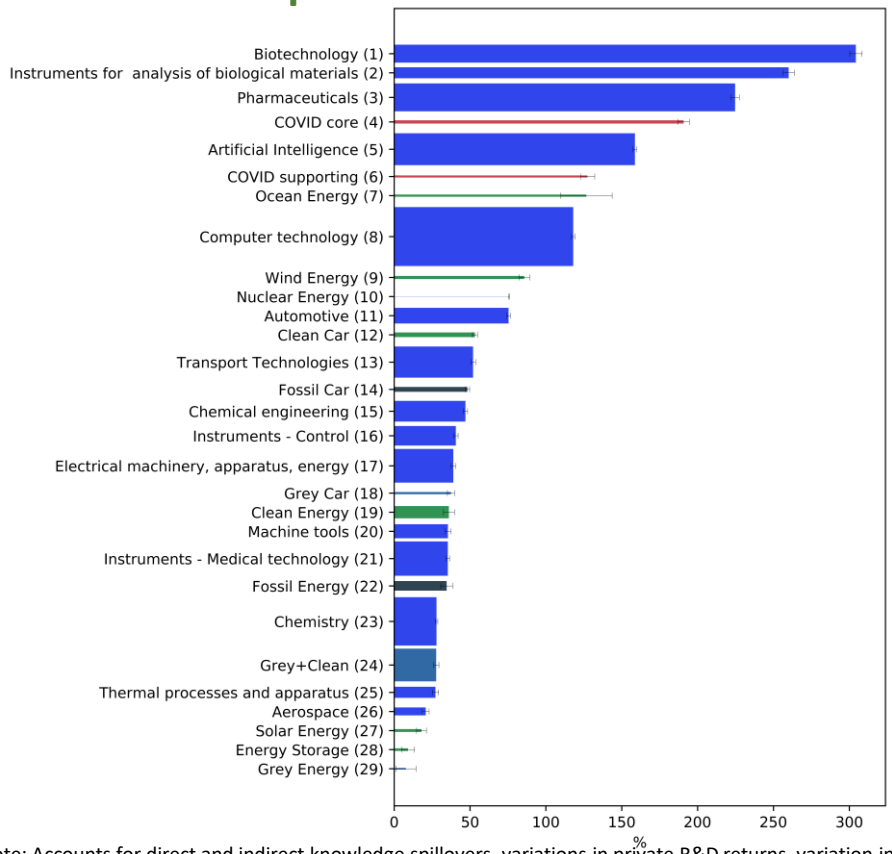
- Analysis of patents to identify where UK has comparative advantage, and where economic returns (accounting for spillovers) are high

UK "revealed technological advantage" vs ROW



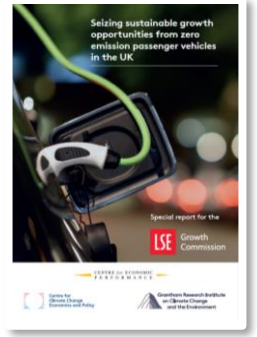
Note: Covid-related includes Covid "core" and Covid "supporting". Source: Martin et al. (2020)

UK returns to public R&D investments



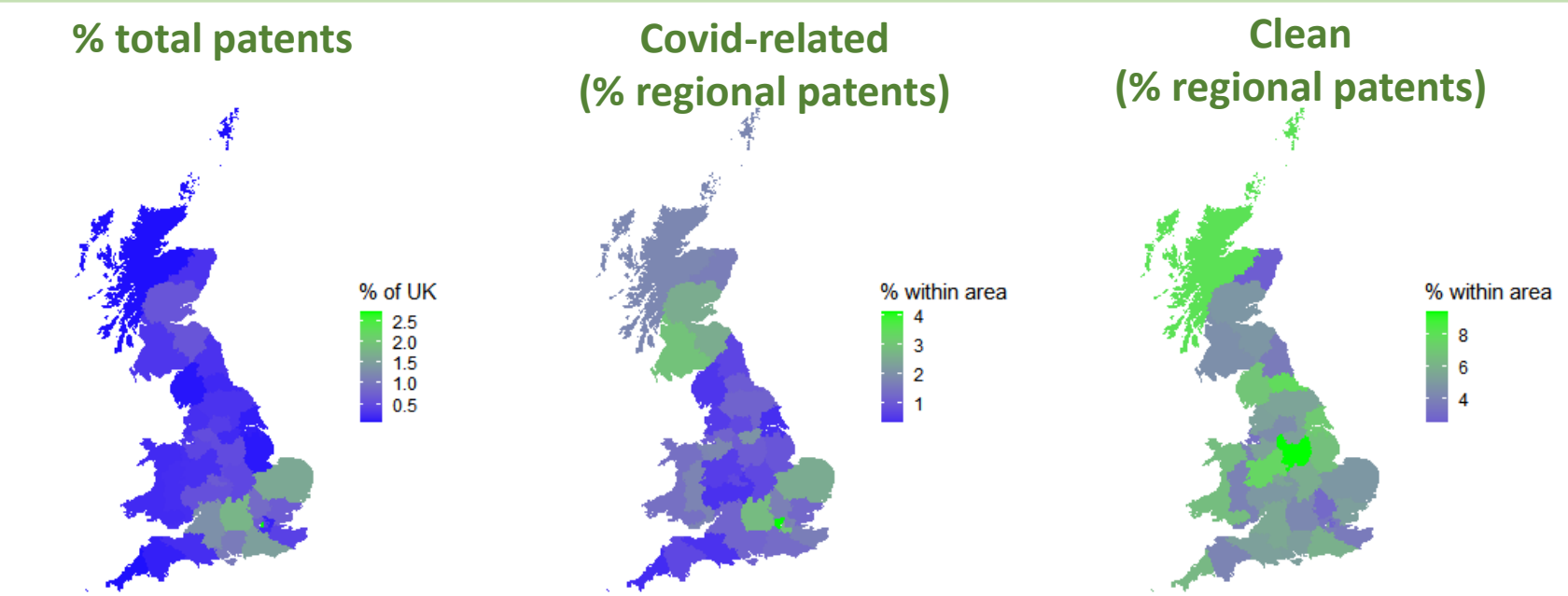
Note: Accounts for direct and indirect knowledge spillovers, variations in private R&D returns, variation in R&D costs and differences in the responsiveness to subsidies between different technology areas.

"Deep Dives"



Innovation and place

- Patenting in clean technologies appears to be relatively spread across the country (vs all technologies, or “Covid-related” ones)



Note: Covid-related includes Covid “core” and Covid “supporting”. The analysis covers the period 2004–14.
Source: Martin et al. (2020)

- We argue that there is a **“triple win”:** support for clean tech can help mitigate climate change, promote economic growth and contribute to “levelling up”

Policy levers and engagement, the five capitals

- **Many at national level**: carbon pricing, regulation and standards, procurement, R&D subsidies, major infrastructure decisions, national growth and skills policies

Infrastructure / physical	Knowledge / innovation	Human	Natural	Social
• Sustainable investments and planning in local transport • Energy efficiency in buildings: retrofits, new developments	• Support for emerging tech / coordination of larger projects • Strengthening linkages between stakeholders (e.g. universities and industry)	• Upskilling / re-skilling via education and on-the-job training – supply and demand for skills • Health, wellbeing, productivity	• Ecosystems creation, preservation and restoration • Land restoration, trees and water management and curbing pollution	• Developing and communicating a vision that can gain local support • Participatory decision-making • Sharing gains, addressing displacements

- But **local/regional level** is key to implementing climate action, across all areas:

Conclusions

- “Sustainability can be achieved by reorienting growth, rather than slowing or stopping it” Chris Freeman and coauthors, 1973
- Coordinated government policy (consistent, long term, credible) and building support from consumers/civil society crucial for the required private sector investment in clean technologies that can then benefit from its own path dependencies
- **Need to act at scale and pace:** policy action and real time research required, updating policies and approaches as new findings emerge or circumstances change

Thank you!