A new perspective on decarbonising the global energy system

Summary for policymakers

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A new perspective on decarbonising the global energy system

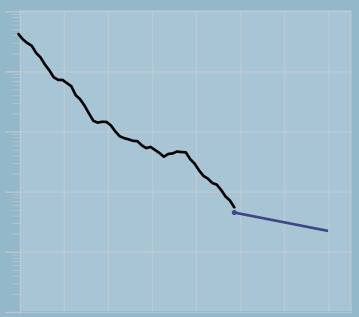
A novel approach to energy systems modelling – accounting transparently for the real-world, historical cost trends of renewable energy technologies – indicates that the decarbonisation of the global energy system:

- Is likely to be cheaper than commonly assumed
- May not require any declines in economic growth
- Can be achieved without large investments in unproven and potentially expensive technologies

The problem

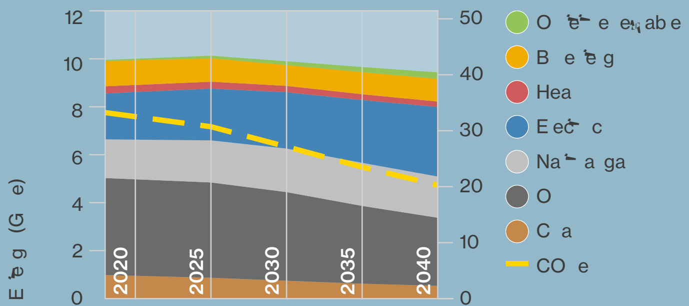
Existing energy system models have consistently underestimated the cost reductions and growth potential of key renewable and energy storage technologies.

Average global solar photovoltaic costs



(IEA World Energy Outlook 2001-2020, Nemet 2006, and IRENA 2020)

Global final energy mix



Sustainable Development Scenario

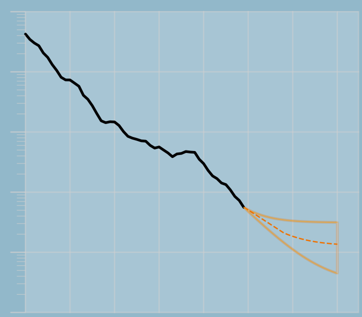
The IEA's Sustainable Development Scenario (IEA World Energy Outlook 2019):

- 3.4% p.a. economic growth
- Requires expensive large-scale carbon capture & storage (CCS)
- Keeps coal through CCS retrofits
- Some electrification benefits
- Electricity prices unlikely to fall
- Emissions are less aligned with Paris goals

Our response

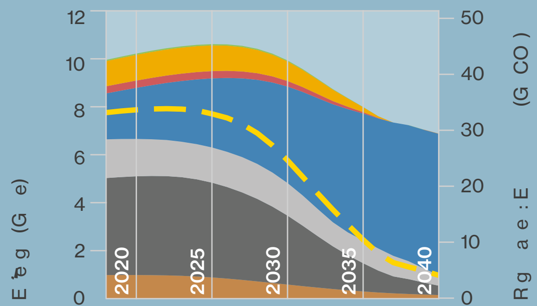
Our energy systems model is built on observed trends in the relationship between the rate of deployment and the cost of energy technologies such as **solar**, **wind**, **batteries** and **hydrogen**.

Average global solar photovoltaic costs



(Based on Way et al. 2020)

Global final energy mix



Decisive Transition scenario

Our Decisive Transition scenario:

- 2% p.a. useful energy growth (>3.4% p.a. economic growth)
- No expensive large-scale CCS required
- Rapid phase-out of all fossil fuels
- Large eﬃciency gains from electrification
- Electricity prices are *very likely* to fall
- Emissions are more aligned with Paris goals

Unlike most other ambitious scenarios, the Decisive Transition scenario does not rely on underdeveloped technologies, such as carbon capture and storage (CCS) and Bioenergy with CCS (BECCS). This raises questions about whether we should continue channelling investment towards technologies like CCS and nuclear fusion for energy provision. Neither may mix particularly well with renewables and will detract investment away from driving down costs in renewables and storage technologies.

It is still vital that we counter institutional and social barriers to a Decisive Transition, that financial stability is maintained, that gender and social equality is maintained or improved, and that job losses in the fossil fuel industries are addressed. The IEA has shown the potential for renewables to provide far more jobs than other energy-related investments (IEA, 2020), but these jobs may not be created in the areas where coal mines are being closed. Industrial strategies will therefore need to be developed to counter such transition risks. Efforts to maintain or improve gender and social equality should be prioritised now to avoid perpetuating existing gender inequalities (Pearl-Martinez & Stephens, 2016). Social equity concerns also go well beyond the implications for coal miners and include communities tied to coal-fired power stations and communities linked to oil extraction and refinement (Carley & Konisky, 2020). Countries with high reliance on coal-fired energy will also require international support in establishing grid balancing, storage, and efficient power markets to enable higher renewable penetration.

Transition risks are real and likely, given how rapidly technological trends are moving, but it must be remembered that, unlike physical climate risks, stranded assets are only a one-off cost. If we do not end climate change, the more frequent and damaging extreme hurricanes, floods, droughts, and wildfires are likely to cause far greater economic costs that will be constant, long-term, and potentially permanent. Our estimates show the costs of climate damages up to the end of the century from a Stalled Tellcnld

This feature allows these storage technologies to also “ride” down experience curves of their own, reaching far higher deployment levels than are commonly anticipated. In doing so, the model demonstrates that it is economically feasible to create a carbon-neutral

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