The Case for Climate Optimism: A Response

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In response to Yossi Sheffi's article, "The Real Inconvenient Truth," Mayers and Koomey argue for the use of a variety of urgent measures to address climate change, rather than focusing primarily on long-term development and dependency on carbon capture and storage. Citing the now competitive cost of renewable power and the success of several countries in enacting programs that address climate change, they urge the need for optimism.

We would like to respond to Yossi Sheffi's article, "The Real Inconvenient Truth," which pessimistically suggests that most current efforts to reduce carbon emissions will be unsuccessful and will involve too much "sacrifice and deprivation" for consumers to stomach. Sheffi's article argues that nuclear power expansion could have played an important role if campaigning environmental activists had not acted as "their own enemies." In the short term Sheffi recommends that, ideally, companies should focus on developing ecotechnology (including renewables and energy efficiency measures) but suggests that the effectiveness of such technologies will be limited by consumer willingness to pay. Sheffi argues that the solution is a longer term "moon shot" investment in the capture and storage of carbon from fossil fuel power generation, industrial processes, and the atmosphere itself (direct air capture). This perspective is not particularly new; it's fairly common amongst sceptics of current climate action.[1]

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Fortunately, for those who look beyond anecdotal examples, there is reason for greater optimism. Although carbon capture and nuclear power are both important in tackling climate change, ultimately, they can only produce part of the necessary reduction in emissions, and expanding renewable energy is cheaper, hands down. The United Nations has identified a number of additional means of reducing emissions and meeting climate targets.[2] These measures can all be achieved without bringing misery to consumers:

- Expand renewable energy e.g. wind, solar, and biofuels
- Electrify end use of energy e.g. transport, heating
- Improve energy and fuel efficiency e.g. transport, industry, buildings
- Incentivise use of low carbon products and services e.g. public transport
- Increase efficiency of using materials with high carbon impact e.g. cement, iron, and steel
- Phase out energy production from coal
- Link energy access to emission reductions for 3.5 billion 'energy poor' people
- Prevent clear-felling of forests
- Reforest and grow plantations on unforested lands
- Adopt soil conservation practices in farming

These are undoubtedly big tasks to organise on a global scale and will require international financial investments. But they will not cause economic development to grind to a halt. According to estimates from the Intergovernmental Panel on Climate Change (IPCC), taking steps to address climate change would reduce annual global economic growth by only a tenth of a percent, roughly (about 0.04%-0.14% per year).[3] This expense would be considerably less than the substantial and incalculable economic damages of a 3°C warming scenario.[4] The current COVID-19 crisis provides a stark example of how an uncontrolled global crisis can play out, with the global economy predicted to actually shrink (-3% GDP growth) in 2020.[5] By contrast, these proposed steps will create employment opportunities and marketable innovations while reducing smog and pollution. Although these benefits are difficult to estimate precisely, they are expected to help counterbalance mitigation costs and support alternative economic growth.

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Renewable Power

The improved economic outlook for renewables is particularly encouraging and is only getting better. Over the last decade the cost per unit of renewable energy has fallen rapidly as we have gained experience and learned from new innovations (see figure below). Generating and storing electricity from wind and solar power installations is now cost-competitive with power generation from fossil fuels.[6] If we take an only slightly optimistic view, at the current trajectory of adoption, renewables have the technical and economic potential to deliver a substantial chunk of the reductions needed.[7] Targeted use of natural gas also plays an important role, because it is highly efficient, relatively inexpensive, and responds quickly to demand. It is therefore an excellent counterbalance to the variability of renewable power generation.

Carbon Capture and Storage

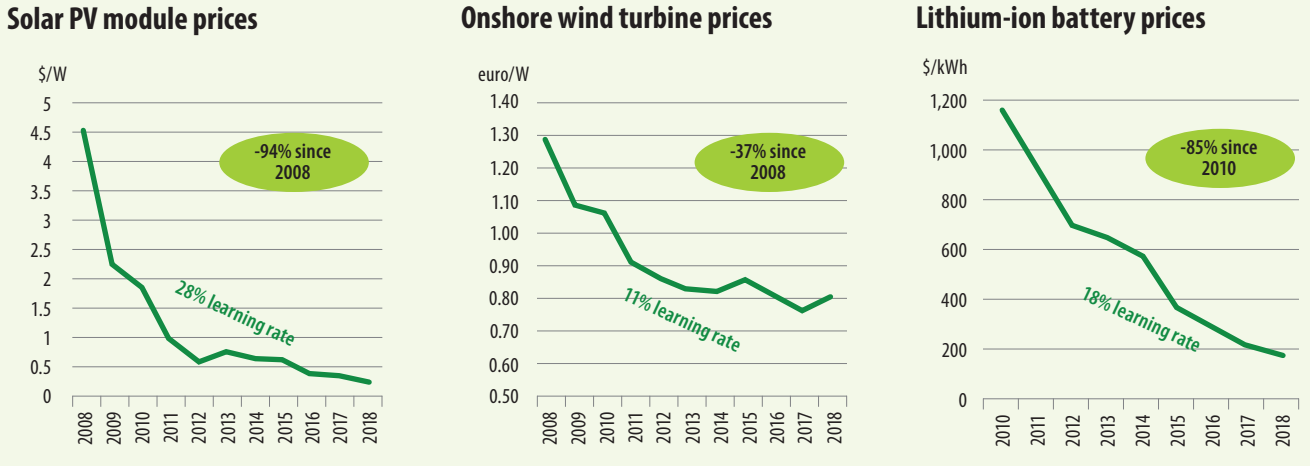
The various technologies for capturing and storing carbon dioxide are still in their infancy and are comparatively expensive. Their widespread development and adoption would substantially increase the cost of fossil fuel fired energy generation, and with it the cost of energy to consumers:

- Carbon capture from coal-powered electricity generation: In 2019, building new coal plants with carbon capture and storage cost about $152 per MWh. Installing new commercial solar and onshore wind generation cost only $32-42 and $28-54 per MWh respectively.[8]
- Direct carbon capture from air: Coal plant chimney gases can have CO_2 concentrations of around 15 percent.[9] In contrast, CO_2 is present in the atmosphere only at a trace levels (around 0.04 percent by volume),[10] which makes it difficult and expensive to extract directly from air. The extraction alone can cost up to $1,000 per ton of CO2 captured *before* the additional costs of storage![11] To put this price in context: even by a recent optimistic estimate,[12] meeting 2030 global emissions reduction targets through direct capture would incur costs equivalent to as much as 4 percent of the worldwide economic output before storage. It would also consume the equivalent of a quarter of the global electricity supply.[13] These demands make the widespread adoption of carbon capture almost inconceivable.
- Carbon capture from bio-energy fuels: Carbon capture from biofuels (not specifically mentioned in Sheffi's article) could remove CO_2 from the atmosphere more economically than direct air capture. Plants capture carbon, which is burned to produce energy, and the resulting CO_2 is then captured and stored. In theory, this approach could reduce emissions by up to 22.5 Gt of CO_2 equivalent[14] (out of 33 Gt of total energy-related emissions in 2019) .[15] It would also, however, require the conversion of 80 percent of cropland and would push the planet's limits for freshwater use, soil health, and biodiversity. Consumers would also see a substantial increase in energy costs because biofuels are persistently more expensive than gas and diesel.[16] Meanwhile the additional costs of carbon capture are estimated at $30-280 per ton.[17]

Nuclear Power Generation:

Admittedly, it is relatively cheap to generate electricity with existing nuclear reactors (around $29 per MWh).[18] Shutting down those reactors would certainly slow progress towards emissions reduction targets. The main barrier to nuclear expansion, however, is the rising cost of new reactors, not a minority of environmental naysaying campaigners and NIMBYists. Reactor costs have increased by 20 percent over the last decade, largely because of industry specific expenses like the need for better safety measures. The cost of electricity from new nuclear installations is therefore much higher than that of electricity from new wind and solar facilities (at $118-192 per MWh).[8] Furthermore, the International Energy Agency (IEA) estimates that doubling nuclear energy output globally would produce only one seventh of the carbon emission reductions needed.[19] Nuclear fusion, rather than fission, might theoretically do better, but it does not present a foreseeable solution anytime soon.[20]

Figure 1: Transitions driven by technology



Bloomberg's Energy and Mobility Transitions.

Carbon capture is not a magic bullet that can solve climate change by itself; we must acknowledge the interdependency of our paths towards a solution.

Sheffi's article presents a relatively pessimistic view of our current efforts to reduce carbon emissions, even going so far as to label them "pretend sustainability." It advocates the long-term research and development of carbon capture and storage as the solution. If, as Dr. Sheffi suggests, emissions continue to rise despite our best efforts, then carbon capture will not be able to run on renewable power and will, itself, generate additional snowballing emissions that must be captured. In this eventuality, the costs of halting climate change would escalate to truly untenable proportions. Carbon capture is not a magic bullet that can solve climate change by itself; we must acknowledge the interdependency of our paths towards a solution. Sheffi's article also misses a very important point: we can't wait for an expensive long-term gamble on carbon capture and storage - we need urgent action in the short term. Let us consider the impact of climate change on living standards if we *don't* take sufficient action over the next few years. This impact is proportional to the overall accumulation of CO_2 in the atmosphere. If we are to avoid an escalation of the type of crises prevalent all over the world in recent years, substantial reductions in carbon emissions are needed soon (50 percent over the next decade to keep warming from rising more than 1.5 or 2C from pre-industrial levels).[21] It is not only a minority of passionate environmental activists that recognise this need. Blackrock, a company managing $6.47 trillion in assets (as of March 31st, 2020),[22] decided to remove from its portfolio all companies generating more than a quarter of their revenue from thermal coal production, and to push for the removal of CEOs who fail to act on climate risks.[23]

The book "*Cold Cash, Cool Climate: Science-based Advice for Ecological Entrepreneurs*" is a useful reference for anyone looking to navigate this field and plot a serious course to tackle climate change.[24] We can and are redesigning systems. We can improve both products and services, like electric vehicles or intelligent heating / cooling systems, while simultaneously lowering emissions. These improvements are not one-off reductions, as Dr. Sheffi's article suggests, but will continue to keep emissions low for years to come. Meanwhile, innovation is opening new markets while new knowledge is reducing the cost of adopting new emerging technologies at scale. Addressing climate change does require urgent commitment and action by governments, industry, and *individuals* (as highlighted at the recent United Nations Climate summits in New York and Madrid in 2019). We do need to move our discussions beyond 'sustainability theatre,' as Dr. Sheffi rightly points out, and it's true that current commitment and action fall short. But none of this means that our actions have been or will be entirely futile. For example, the failure of any regulation to hold individuals or companies to account, like the emissions scandals in the automotive sector, does not justify inaction. Instead, it underlines the need for more effective government policy and enforcement. Regulators have certainly not been idle in this regard. In the case of VW, executives have resigned and been charged with criminal offences, fines and car rework costs have run into several billions of dollars, and VW share prices fell by more than a third as the news broke in September 2015.[25]

Encouragingly, entire countries have enacted successful efforts and, in so doing, provided leadership on how to proceed. For example, the latest third quarter figures from 2019 show that renewable energy accounted for 38.9 percent of the UK's electricity supply and that the percentage supplied by coal was in single digits.[26] Costa Rica has been recognised as UN Champion of the Earth for its ambitious commitments to the Paris Climate Agreement. Ninety-eight percent of its energy is renewable, and its forest cover has been restored to 53 percent of its land area after decades of intense deforestation.[27] These achievements prove that there is a way, where there is political will. We consider that good enough reason for optimism over pessimism, for action over inaction. Let us then proceed on the basis of both empirical evidence and scientific expertise. Academic research gives us vital insights with which to better inform and educate governments, industry, and society on the path ahead.

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Endnotes

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