Effective Energy Altruism

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CHAPTER OVERVIEW INCLUDED FOR GENERAL MESSAGES START ON PAGE 2

BACKGROUND: An Effective Altruist Perspective
In this optional background, we introduce EA as a perspective and briefly discuss some implications of a rationalist approach to the topic of energy and climate change.

SECTION I: Climate Change, Effective Altruism and Clean Energy Abundance
In Section I, we will review the cause prioritization of climate change within EA, critique dominant framings of the problem and suggest an alternative approach.

SECTION II: A reframing: Lkow-Carbon Energy Supply as a cause/strategy that addresses climate change, air pollution and energy poverty simultaneously
In Section II, we will argue that “low-carbon energy abundance” is a plausible candidate for such a reframing, introducing the issues of air pollution and energy poverty more fully to show their relationship to clean energy abundance.

SECTION III: The state and trajectory of low-carbon energy supply
In Section III, we discuss the current status and plausible trajectories of the energy system illustrating that, despite some cause for optimism, achieving global low-carbon energy abundance is far from a solved problem. We also highlight opposition to ‘technology tribalism’ as an attractive opportunity for EAs.

SECTION IV: Impatient Optimism: Accelerating low-carbon energy innovation as a tractable EA strategy.
Section IV makes the case that low-carbon energy innovation is an attractive candidate to focus on when seeking to facilitate clean energy abundance; with energy innovation being both comparatively neglected and -- in expectation -- highly effective.

SECTION V: Effective Energy Altruism
This concluding section will explore what we can do as Effective Altruists to make a positive impact on this issue, to become Effective Energy Altruists.

I: EFFECTIVE ALTRUISM, CLIMATE CHANGE, AND CLEAN ENERGY ABUNDANCE - *Key Messages*

THE (NON-)NEGLECTEDNESS OF CLIMATE CHANGE

- **1) '*Important but not neglected*' might be true but is not well-substantiated yet:** While the statement that climate change is important but not neglected is part of the 'canonical' treatments of climate change in EA the empirical content of this claim is not solidly established. Different EA-treatments cite different sources to identify global spending on climate change: DGB cites research budgets to come to this conclusion, GWWC-CC cites 391 billion using a figure from the Climate Policy Initiative, whereas 80k provides a rough estimate of 100-1000 USD billion / year (reducing the estimate to 10-100 USD billion as most spending is considered ineffective).

- **2) Considerable variance in the estimates justify the same conclusion:** This is obviously a wide range (between 10 billion effective and almost 400 billion when only considering effective estimates or between 100-1000 billion otherwise) across estimates all used to justify the *same conclusion* of non-neglectedness. Whether the estimate is closer to 10 billion effectively spent or 1 trillion ineffectively spent should matter for the relative neglectedness.

- **3) None of these estimates is a good estimate of climate-mitigation spending:** All of these estimates are either very partial (GWCC-CC relying on CPI) or very imprecise (80k) or both (DGB).

- **4) This is not surprising because estimating climate mitigation spending is hard:** To properly identify climate mitigation spending one would need a counterfactual world where climate mitigation is never a motivation. In the absence of this, a global carbon market would provide a good approximation of what is being spent on keeping emissions within a given limit. We have neither of those and no clear strategy of estimating climate mitigation spending. After all, we are living in a world economy where almost all economic decisions involve decisions about emitting greenhouse gases and only few of those decisions are made paying an explicit price for emissions.

SCOPE AND IMPORTANCE

- **5) EA-treatments of climate change often differentiate between moderate and catastrophic climate change as distinct causes:** Doing this then leads to noticing the comparatively higher importance of catastrophic scenarios and the neglectedness of geo-engineering research. Yet, treating these climate change realizations as distinct implies an understanding of climate sensitivity and an ability to quickly affect warming levels (if catastrophic realization is anticipated) that we might not have.

- **6) 'Cause areas' aren't things lying around in the world, they are arbitrary slicings of reality constructed in political processes:** For such a vast issue as climate change, there are myriad (partial) solutions that not only address climate change but also have a large set of other intended and unintended consequences across a range of beings and domains. As such, taken a high-level conceptualization of a problem as "climate change" as given (and noting its non-neglectedness) risks over-looking attractive strategies addressing multiple causes (e.g. spreading veganism as an animal welfare and climate strategy). More fundamentally, when causes do not exist in any non-arbitrary sense, taking socially defined causes and assigning attributes such as importance, neglectedness, tractability to them is problematic because it limits 'finding' attractive strategies in pre-defined salient problem definitions which are arbitrary with regards to things we care about.

RATIONALE OF THIS PAPER

- **7) Provide a reframing around the cause of clean energy abundance as a more constructive treatment:** Against this backdrop, it is the goal of this paper to provide a reframing of the issue in an EA-context and to identify strategies worthy of further exploration as highly effective.

II: A REFRAMING: LOW-CARBON ENERGY SUPPLY AS A CAUSE AREA

THREE PROBLEMS

- **1) Climate change presents a significant risk:** Particularly in its catastrophic form enabled through high climate sensitivity and / or continued unabated emissions, climate change presents a significant risk to human civilization as well as many animals. Through knock-on effects it could also affect the overall existential risk profile or affect the overall trajectory of human civilization.

- **2) Energy poverty is a vast problem:** Often overlooked in Western energy discourse focused on climate change, energy poverty is a vast problem. Almost 3 billion – about 4 of 10 humans – rely on biomass to cook, about 1 billion have no access to electricity at all. These two statistics are just the tip of the iceberg with many more people having far too little energy for the basics of modern living standards, let alone a prosperous life.

- **3) Negative health consequences of energy production:** Over six million die prematurely from combustion of fossil fuels and biomass alone, with other significant health consequences related to mining, to other generation / production technologies and with the manufacturing of energy infrastructure.

- **4) Dominant moral concerns:** While there are other issues in the energy / climate nexus, it appears to us that the above three are dominant moral concerns from an EA-perspective defining the desirability of different solutions and outcomes. Other concerns, such as energy security for specific nations, the realization of decentralized energy production or the avoidance of specific risks at the avoidance of others [technology-specific risks (while thereby increasing others)] appear to be a of a lesser magnitude from a perspective focused on maximally improving the situation of as many beings as possible.

IMPLICATIONS

- **5) Enabling clean energy is much more important than "just" solving climate change:** This follows directly from 1-3.

- **6) It is ethically desirable to advance solutions that help solve all of the three problems rather than trading them off against each other:** Solutions exist that address one -- for example, unabated fossil fuel build-out (energy poverty) -- or two -- for example, constraining energy access (climate change, health consequences) -- of the three problems. However, given the significant scale of all of the three problems (and a lacking ability to quantify their relative importance) solutions that address all three of these appear much more desirable.

- **7) Apart from ethical desirability, the robustness of solutions recognizing all three problems is likely much higher:** With energy poverty affecting large shares of humanity, climate and public health policy not robust to increasing energy demand is likely to fail. Similarly, unabated fossil fuel development risks 'stranded assets' from increased stringency of pollution-control and climate policy.

- **8) A focus on such solutions suggests a focus on enabling decarbonization of energy supply:** While energy efficiency (less energy per unit), decreased energy intensity (lower share of energy-intensive economy) and lower GDP (degrowth) can significantly reduce global energy demand, they cannot create a world without energy consumption. Yet, almost all emission scenarios compatible with ambitious climate policy either require zero net emissions or even net negative emissions before the end of the century. Thus, even when energy intensity decreases and efficiency improves, it is very unlikely that climate stabilization will be achievable without massive progress in decarbonizing energy supply. In other words, while other approaches are helpful, decarbonizing energy is essential in solving the public health and climate concerns of energy production.

III: STATE AND TRAJECTORY OF LOW-CARBON ENERGY SUPPLY - *Key Messages*

THE PROBLEM

- **1) Ambition reality gap:** There is a large difference between the globally proclaimed goal – limiting warming to 2°C and, if possible, to less and closer to 1.5°C – and the reality of national commitments, with an even larger gap to what countries are actually doing. The range of warming under current policies is estimated at 3.6°C by 2100, with a range from 2.6°C to 4.9°C depending on climate sensitivity.

- **2) Energy poverty is a vast problem:** When it comes to energy poverty, the situation is similarly precarious: Almost 3 billion – about 4 of 10 humans – rely on biomass to cook, about 1 billion have no access to electricity at all. These two statistics are just the tip of the iceberg with many more people having far too little energy for the basics of modern living standards, let alone a prosperous life.

- **3) Unprecedented speed and scale of global energy transformation needed:** Together, the expectation of and hope for increased energy access and the expected need to drastically and quickly reduce emissions require an upscaling of low-carbon energy and a phase-out of high-carbon energy at a pace that is unprecedented on a global scale.

PROGRESS THUS FAR

- **4) Limited progress:** Progress in the past has been mixed at best. Rates of decarbonization now are where they were in the 1990s, even the share of low-carbon electricity has barely increased globally.

- **5) Decarbonization progress concentrated in the power sector:** Where progress in decarbonizing energy has been made, it is most often focused on the power sector. Other uses and forms of energy, in transport, heating / cooling, and industrial uses tends to be seen as harder to decarbonize. Solutions in these sectors are often less obvious and considerably more niché than well-established methods of producing low-carbon power with hydro dams, nuclear fission, various variable renewables, etc.

- **6) GDP-growth vs. energy intensity declines as main determinants to date:** GDP-growth vs. energy intensity declines have been the dominant drivers of de/re-carbonization trends over the past quarter-century. Reduction in carbon intensity of energy in is becoming a stronger contributor, driven by fuel switching within fossil fuels (coal > gas) and low-carbon additions.

IMPLICATIONS

- **7) Emissions rise, not on trajectory:** Rather than declining, emissions increased again in 2017. The climate challenge becomes *more* daunting every year.

- **8) No time to waste on energy tribalism:** In this situation, narrowing the set of options one considers acceptable based on tribalism – idealizing solutions preferred for socio-cultural reasons while demonizing others – is *extremely counterproductive,* yet prevalent.

- **9) Need to increase the toolbox:** Expanding the toolbox to enable deep decarbonization appears extremely important, in any case it is difficult to argue that the current trajectory and available solutions are sufficient.

IV: IMPATIENT OPTIMISM: ACCELERATING CLEAN ENERGY INNOVATION - *Key Messages*

THE PROBLEM

- **1) Energy innovation is severely neglected:** Compared to the (a) vastness of the challenge, (b) to other sectors or challenges, (c) to other climate policy approaches and to other (d) time-periods, the current energy innovation effort is surprisingly and severely neglected.

- **2) This neglect is not random, but rather appears as an equilibrium supported by a variety of factors:** Among those factors are the commodity character of energy, oligopolistic market structures with long investment-horizons, the prevalence of interest groups seeking subsidies for deployment of existing technologies and a discursive context where a focus on publicly driven innovation can be misused as a delay-tactic or seen as unnecessary due to distorted views on spontaneously emerging innovation driven solely by private entrepreneurship.

- **3) Innovation neglect across geographies:** With the possible exception of China, this neglect appears consistently present across major economies.

INCREASED INNOVATION EFFORT AS A SOLUTION

- **4) Review of systematic studies:** Inherent to innovation, a single effort might always fail (or succeed), But this is not informative for the question on whether an increased broad innovation effort is an effective strategy. Hence, our review on effectiveness focuses on systematic studies covering many cases or general arguments / mechanisms.

- **5) High effectiveness of additional innovation effort at the margin:** Reviewing multiple lines of evidence, we find strong arguments for expecting additional innovation effort to be very effective at bringing about new technologies expanding the clean energy portfolio.

- **6) Across the innovation chain / policies / technologies:** We present evidence for this effectiveness from studies covering different stages of the innovation process and, relatedly, different innovation policies. We also discuss literature arguing that it is hard to foresee where technological innovation will be most successful, justifying a broad innovation approach.

- **7) Declining marginal effectiveness of learning-by-doing (LBD) & non-substitutability of learning-by-(re)search:** We review evidence that also demonstrates that an increased innovation effort through research and a focus on breakthrough innovation is unlikely to be substitutable by deployment and learning-by-doing because they produce different types of innovation. Indeed, increased deployment fosters the need for a strengthened effort in breakthrough innovation to avoid undesirable lock-in dynamics.

BENEFITS

- **8) Increased innovation effort can significantly facilitate clean energy transformation:** According to projections and expert elicitations increased innovation effort can strongly reduce global decarbonization cost and thereby make deep decarbonization more likely.

- **9) Robustness of benefits to being wrong:** If we were wrong either by underestimating the technological trajectory given current efforts (additional effort not essential to achieve climate goals) or the climate change scenario already locked in (too late for significant changes to climate damage through emission reductions) accelerating clean energy abundance remains highly beneficial in both scenarios.

V: EFFECTIVE ENERGY ALTRUISM - *Key Messages*

- **1) Translating into action:** This concluding chapter seeks to translate the rather abstract recommendations of endorsing energy pluralism (opposing energy tribalism) and advocating for accelerated innovation into actionable recommendations.

STRATEGIC ASSUMPTIONS

- **2) F(o)unding advocacy or other meta-organizations likely more effective for most:** Compared to directly funding companies or research teams, funding or founding advocacy or other meta-organizations in the field of clean energy innovation is likely much more effective given the sums and type of support needed and a relatively empty advocacy space. There are, of course, exceptions to this rule in case of an extraordinary fit for working directly in clean tech, research or venture capitalism.

- **3) Geographical context matters:** Recommendations need to be broken down and adjusted to different political and economic contexts.

- **4) Experimentation is needed:** Compared to other issues, this is a relatively unexplored issue in EA and more research and experimentation is needed.

LEVERAGE POINTS

- **5) Three domains:** Broadly speaking, three domains can be identified: The transformation of the domestic energy system (5), the energy innovation system to enable the local and global clean energy transformation (6) and the international economic and political relations of energy and technology (7).

- **6) Transformation of the domestic energy system:** In many (but not all) industrialized countries, the indirect effects of domestic energy transformation -- how they affect technological and political trajectories -- are likely more decisive for the global energy transformation than local emission reductions. With this in mind, priorities for EA action in this area could constitute (i) supporting the overriding importance of decarbonization vis-a-vis other energy policy goals, (ii) acting to avoid lock-in effects and (iii) deploying relevant technologies with high marginal learning-by-doing benefits.

- **7) Enabling the technological means of local and global clean energy transformation:** As discussed in Chapter IV, the strengthening of the energy innovation system is an extremely important, tractable and likely neglected cause. Within this domain, maintaining a broad portfolio while particularly advocating for technologies threatened by very successful predecessors as well as technologies considered crucial for long-run deep decarbonization but not yet gaining much attention.

- **8) Affecting the energy system of other countries directly:** Maintaining and expanding technology neutrality between clean energy technologies and a [?] should this generally be strengthened?

RISK & RAMIFICATIONS

- **9) Pluralism on the grand scale and tribalism at the margin:**
    - Avoid ..
- **10) Socio-cultural neutrality vs. positioning:**