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TECHNOLOGY CAN SAVE US, CAN'T IT? THE EMERGENCE OF THE 'TECHNO-FIX' NARRATIVE IN CLIMATE POLITICS

Abstract: The Paris Agreement of 2015 recognizes 'that climate change represents an urgent and potentially irreversible threat to human societies and the planet and thus requires the widest possible cooperation by all countries, and their participation in an effective and appropriate international response'. A common reaction to such a statement has been to call for emissions reduction. This, however, requires investment in energy saving technologies and the fundamental transformation of fossil fuel based economies and high-consumption life-styles. In other words, 'saving the planet' would spell the end of a concept of modernity, which has served as a vanishing point for most developing countries. The viability of this post-growth paradigm is questionable. National egoisms, vested interests of global corporations and the chronic social addiction to oil constitute considerable obstacles to address climate change.

One alternative to the post-growth narrative is centered around the 'techno-fix'. Here, technological innovation has not only instituted the problem of climate change, but will also provide the solution! Technologies such as solar radiation management and carbon sequestration are attractive precisely because they fix the problem without any lifestyle change: 'the technologist's way tries to avoid changing peoples habits or motivations'. Critics of the techno-fix narrative, however, argue that it should be rejected as the latest attempt of liberal proponents of pro-growth positions to delay 'necessary' social, political and economic change. In this contribution we analyse the presuppositions and implications of both the 'techno-fix' narrative and its critique. Both positions, we argue, fail to grasp the socio-political intricacies of technological development. Since technology is embedded in its social context it cannot be instituted or rejected prior to political decision-making, but rather necessarily involves on-going social and political analysis.

Key Words: *Technology, Climate change, techno-fix, ecomodernism, pluralism*

INTRODUCTION

The Paris Agreement of 2015 recognizes 'that climate change represents an urgent and potentially irreversible threat to human societies and the planet and thus

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requires the widest possible cooperation by all countries, and their participation in an effective and appropriate international response'. A common reaction to such a statement has been to call for emissions reduction and an acknowledgement of 'the limits to growth' as first articulated in the report of that name published in 1972 [18]. This response, however, would require investment in energy saving technologies and the fundamental transformation of fossil fuel based economies and high-consumption life-styles. In other words, 'saving the planet' would spell the end of a concept of modernity, which has served as a vanishing point for most developing countries. This paper examines an optimistic alternative to the limits to growth narrative, centered around the 'techno-fix'. Here, technological innovation has not only instituted the problem of climate change, but will also provide the solution! Technologies such as solar radiation management and carbon sequestration are attractive precisely because they fix the problem without any lifestyle change: 'the technologist's way tries to avoid changing peoples habits or motivations'. We delineate two different versions of this narrative; the 'ecomodernist' frame painting a bright picture of a future in which technological solutions will not only fix climate change but also help improving the Earth's climate to support a growing population; and the 'second-best solution' frame which acknowledges that emission reduction should still be given priority but welcomes geo-engineering as a second best solution and a means of buying time.

Critics of the techno-fix narrative argue that it should be rejected as the latest attempt of liberal proponents of pro-growth positions to delay 'necessary' social, political and economic change. In this contribution we analyse the presuppositions and implications of both the 'techno-fix' narrative *and* its critique. Both positions, we argue, fail to grasp the socio-political intricacies of technological development. Since technology is embedded in its social context it cannot be instituted or rejected prior to political decision-making, but rather necessarily involves on-going social and political analysis.

THE POLITICISATION OF CLIMATE CHANGE

Climate Change ranks among the most urgent of global challenges today. The increase of global carbon dioxide emission is explicitly addressed in the United Nations Development Goals (Goal No. 7 'Ensure Environmental Sustainability'). The establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988 or the launch of the European Climate Change Programme (ECCP) in 2000 underline not only an increased awareness but an apparent willingness to address the problem of anthropogenic climate change. But if, as this suggests, the fact of human influence on climate is becoming increasingly acknowledged within a variety of international bodies and agreements, why is there such delay in implementing effective climate policy? The lack of decisive action might come as a surprise to many.

For sure, the 'politicisation' of climate change has long been completed. A mere 200 years after Joseph Fourier discovered the greenhouse effect and 120 years after S. A. Arrhenius identified carbon dioxide as a 'greenhouse gas' [1] climate change has become a key issue of national and international politics [2]. However, the

ubiquity of the issue does not equate to a general consensus on the political actions to address climate change. Rather the opposite. Climate negotiations at every level have proven to be exceptionally difficult and protracted. Why might this be the case? One possible reason is that climate change was initially regarded through a 'limits to growth' narrative. According to this narrative, climate change demands dramatic deviation from the economic growth paths that lead the way to modernization since the times of industrialization. As a recent example of this understanding, in her 2014 book 'This Changes Everything' [3] famous writer and activist Naomi Klein portrays contemporary capitalism as incompatible with a sustainable climate friendly life style.

Regardless of whether one agrees with Klein's particular politics, one has to admit that climate politics cannot be separated from economic politics. Dealing with climate change is not limited to dealing with an environmental challenge. Climate politics are located at the intersection of economic, social and security politics, for the consequences of climate change will not be limited to changes in the 'natural environment'. The unequal distribution of environmental vulnerabilities and response capacities can lead to new political challenges like mass migration and conflicts on ever more scarce resources. And neither the risks of climate change, nor the consequences of climate politics, are a matter of the distant future. In September 2015 the Bank of England issued a report on 'The impact of climate change on the UK insurance sector' [4]. This report acknowledges not only the fact that climate change will affect the economy, but shows that a changing climate is already a drain on economic profits.

The dominant response, however, is business as usual. Property owners or agricultural industry might, on average, suffer from rising insurance fees or crop failure, other industries (e. g. insurance companies) might actually benefit from a changing climate. From the perspective of classical economic theory climate change could be discounted as just another example for capitalism's capacity for 'creative destruction' [5].

Even with the economic consequences of human made climate change looming in the near future, the costs are not likely to be taken into account in business decisions under the circumstances of contemporary shareholder capitalism. In his 2014 *The End of Normal*, James K. Galbraith argues that such a fundamental change to the business model 'would require the costs of climate change to be incorporated (...) It may be petty to discuss mere economics in the face of existential ecological threats, but the fact is, business decisions are made in the here and now'. [12] Certainly, issuing warnings on the dangers of climate change is, seemingly, neither sufficient to trigger large- scale reform nor to convince decision-makers that radical changes are inevitable. Conflicts of interests, concerted media campaigns by 'climate sceptics' [11] and the substantive difficulty to solve a tragedy of the commons situation [1] continue to hamper global climate negotiations.

PREFERRING NOT TO CHANGE EVERYTHING — THE APPEAL OF TECHNO FIXES

Climate change demands nothing short of a radical deviation from established, time-honoured modes of production. Climate Politics must envision and enable

a break with the past. Or so is said. In recent years an increasing number of voices offer a new narrative of global climate politics: Instead of staying within limits to protect the climate, the international community should find ways of ‘fixing it’.

While the cause of anthropogenic climate change is the development, implementation and global dispersion of various technologies, for some the answer is not to give up technologies and return to a more pastoral lifestyle, but rather to develop them further. This narrative relies upon human inventiveness to come up with green technologies. Technology, so is said is not (only) part of the problem, but a vital part of the solution too. Geo-engineering or ‘climate-engineering’ has been criticised as an ‘eclectic catch-all expression’ [6] and a term that ‘has come to mean a range of different things’ [8] and has been described a set of technologies which could contribute to a ‘Plan B’ to save the planet [8]. Overall ‘climate fixes’ refer to technologies that do not aiming at emission reduction but on ‘large-scale efforts to engineer the climate system to counteract the consequences of increasing greenhouse gas emissions’ [8] We can distinguish between ‘radiation management’ technologies and tools for ‘carbon dioxide removal’. Table 1 gives an overview of the most common technological option to fix the climate:

Table 1. Technologies to Fix the Climate

Technology	Mechanism	Description
Stratospheric Aerosol Injection	Radiation Management	Artificial injection of sulphur dioxide or hydrogen sulphur into the Stratosphere. Incoming solar radiation is reflected back into space leading to cooling effect in the lower atmosphere.
Marine Cloud Brightening	Radiation Management	Whitening of low-level clouds increases the amount of solar radiation reflected back into space. ‘Cloud ships’ would be employed to use spray jets of seawater to artificially increase condensation.
Urban (‘roof top’) Albedo	Radiation Management	The reflectivity (the so called ‘albedo’) of any surface depends on colour. Dark roofs for instance have an average albedo of 5%, meaning that 95% of incoming solar radiation is absorbed. White roofs in contrast have an average albedo of 75–80%. Rooftop whitening is therefore a comparatively simple way of advert ‘heat island’ effects and contribute to local radiation management
Carbon Capture	Carbon Dioxide Removal	Chemical ‘scrubbing’ of carbon dioxide out of the air and storing of carbon in deep reservoirs. Carbon capture technologies could reduce emissions of ‘point sources’ e. g. power plants and large factories given that suitable geological formations for storage are at hand.
Ocean Fertilization	Carbon Dioxide Removal	Oceans represent the largest carbon sink of the planet. Biochemical as well as biological processes drive carbon sequestration. One way to increase the later is to ‘fertilize’ oceans. Artificially adding nitrates phosphates and iron should increase algal production which in turn contributes to carbon sequestration

Source: see [6]. For ‘Urban Albedo’ see also [7]

The narrative of climate fixes, or 'geo-engineering' can be framed in two distinct ways: First, climate fixing technologies offer an alternative to a broken system. We call this frame the *second best solution* frame. The narrative attached to this frame can be summed up as follows: While emission reduction should still be given priority and 'greening the economy' should be the long-term objective geo-engineering should be considered as a tool to avert the most dire consequences of a changing climate. Geo-engineering might be instrumental in buying precious time to allow global climate politics to agree upon and implement effective means to lower greenhouse gas emissions? Nobel Laureate P. J. Crutzen, while being supportive of the idea of fixing the climate employs the second frame. In his view geo-engineering should be considered simply it offers a second best solution: By far the preferred way to resolve the policy makers' dilemma is to lower the emissions of the greenhouse gases. However, so far, attempts in that direction have been grossly unsuccessful (...) Therefore, although by far not the best solution, the usefulness of artificially enhancing earth's albedo and thereby cooling climate by adding sunlight reflecting aerosol in the stratosphere (...) might again be explored and debated as a way to defuse the Catch-22 situation just presented and additionally counteract the climate forcing of growing CO₂ emissions.[9]

The second frame is more closely attached to theories of modern capitalism and paint a much more positive picture of the future. Geo-engineering is embraced as yet another example for the efficiency of capitalist systems: While it is true, that industrialization and growth driven economic development have caused the problem of anthropogenic climate change, it is also true, that technological advancement can deliver the solution.

We call this the ecomodernist frame. 'Old' technologies increased the concentration of greenhouse gases in the atmosphere? New technologies will allow the 'scrubbing' of CO₂ out of the air. Greenhouse gases are blocking outgoing radiation thus creating a dangerous heating effect? New technologies will allow to preventing incoming solar radiation to reach the lower atmosphere hence leading to a global cooling effect! Harvard Professor David Keith is a strong advocate of 'stratospheric aerosol injection' (see table 1) as a means to create a global cooling effect. In his 2013 book *A Case for Climate Engineering* he makes a strong case for this particular variety of geo-engineering: 'This single technology could increase the productivity of ecosystems across the planet and stop global warming; it could increase crop yields, particularly those in the hottest and poorest parts of the world. It is hyperbolic but not inaccurate to call it a cheap tool that could green the world' [13]. Being a representative of the optimistic frame Keith goes far beyond the idea of 'fixing' the climate. New technologies will not only be able to 'put things in order' but will allow to 'improving' the climate, to customize it to human needs. This requires a rather high level of trust that feasible technological solutions to climate change will appear in time and without too much risk. In contrast to David Keith's optimistic claim that safe and affordable technologies are already available [13] the majority of scholars, including those who are open to the idea of climate engineering 'call for active scientific research of the kind of geo-engineering' [9] and fur-

ther debating possible side-effects and negative, unintended consequences of these new technologies.

Is geo-engineering a necessity given the apparent ineffectiveness of emission reduction politics or does it simply prop-up the status quo? Technology based solutions, despite the mounting problems scientists and technicians face to develop applicable solutions, appears to be a rather easy way out. Geo-engineering is attractive, of course, precisely because it fixes the problem without any lifestyle change: ‘the technologist’s way tries to avoid changing peoples habits or motivations’ [8]. See also [2]. The techno-fix narrative accepts that climate change is a problem, and it attempts to solve this problem through developing technology in a new, green, direction. Here, even if industrial and technological development created the problem, technological development will provide the means to fix it. The attractiveness of these kinds of interpretations stems from them being consistent with the dominant economic paradigm and political order.

The ‘win-win’ narrative fits within theories of green capitalism that assume that technological innovation will be both be underpinned by, and rejuvenate, a thriving green economy. The possibility that a more radical response might involve challenging the growth paradigm is undermined by the fact that markets are seen as natural and rational entities. Accordingly any substantial deviation from the model of a market economy or even a market society must inevitably disturb the harmony with nature: ‘Even though there has not existed full consensus on just what sort of animal the market „really” is, the neoliberals did agree that, for purposes of public understanding and sloganeering, the neoliberal market society must be treated as a „natural” and inexorable state of mankind’ [15]. The appeal of geo-engineering can therefore be explained by a shift in the boundaries between society and nature. It is the *naturalization of markets itself*, which allows to interpret technological development to fix climate change not only to be feasible (or reasonable) but also to be the logical and *natural* choice. The two frames outlined above (and in particular the optimistic frame) are then just subcategories to market optimism.

From the perspective of the proponents of techno fixes to climate change the reply to Naomi Klein’s emphatic claim ‘This changes everything’ is plain and simple: Climate change is not changing everything. In fact it doesn’t change very much at all.

WHAT TO FIX? WHO DECIDES? THE PROSPECTS OF AN ENGINEERED CLIMATE

The idea, the vision of an engineered climate actually is tempting. After decades of cumbersome, complicated and sometimes frustrating attempts to swear the international community in to a more sustainable, climate friendly development there might be a silver lining: A Plan B to save, maybe even improve the climate. But it should have become clear by now, that not only the climate would be saved. Geo-Engineering promises to prolong a lifestyle that a majority of people in west-

ern countries have enjoyed for decades; a lifestyle that has become the vanishing point for the population in the developing world.

If emissions could be scrubbed out of the air, if carbon dioxide could be stored safely in underground deposits, and if global cooling technologies could balance global warming, wouldn't then a high carbon lifestyle become acceptable, reasonable, and sustainable for all? Aside from the feasibility of the technologies in question, geo-engineering could have major political and moral implications. The most important issues would be the problem of *liability* and the question of *authority*.

One could describe the historical developments that, over time, lead to the global, human made climate change as unintended even unwitting geo-engineering. When the first factories were built, when the trains and later the car began to revolutionize public transport, long-term consequences of rising carbon dioxide emissions were completely unknown. It was only in the mid 20th century that Roger Revelle and Charles Keeling discovered and described the adverse consequences of industrial development.

Since the harmful effects of high concentrations of greenhouse gases in the atmosphere were discovered only 200 years after the industrial revolution set in, the question of 'liability' is difficult to address and is usually contested in global climate negotiations. Developed countries can argue that they can hardly be held accountable for emissions of the past for the simple fact that the negative consequences had been completely unknown.

Geo-engineering would change the situation radically. With the deliberate use of climate fixing technologies one would move from negligence to intentionality. This would raise the question of liability. Who can be held accountable for possible side effects of geo-engineering experiments? The question would be extremely difficult to answer since the attributing a singular weather phenomenon (say a flood, a drought, etc.) to a particular geo-engineering project would be very difficult. This means that geo-engineering would recreate a situation of systematic irresponsibility in which no one can be held accountable in a particular damage case.

In a recent paper David Keith and two of his colleagues address the difficulties of designing and enforcing a system of legal liability in the case of Stratospheric Aerosol Injection (SAI):

'If a country were damaged by negative effects from SAI, should that country be compensated for its loss? If so, by what mechanism? Could such effects be persuasively linked to SAI? Who should pay for damages, and how much should they pay? The extraordinary difficulties presented by this issue have led some observers to conclude that building a just and effective system of liability and compensation for SAI would be virtually impossible' [16].

Although the paper discusses a variety of options for designing a system of legal liability the authors come to the conclusion that '[i]n the end, questions about SAI liability will be secondary to more fundamental questions about whether SAI should be deployed, and whether geo-engineering is desirable in the first place'. But liability is not just about legality. It also has a moral meaning. Since geo-engineering would mean deliberately attempting to change climatic conditions the moral implications would be immense. Essentially geo-engineering would mean

to perform a (risky) scientific experiment at the global stage. It is difficult to see any reason for why normative standards and rules of 'good scientific practice' shouldn't apply in this case. Geo-engineering experiments are likely to directly affect the wellbeing of people and its effects inevitably transgress national borders.

Relatedly, there exists the question of who can *authorize* global geo-engineering experiments. Given the complexity of the technologies involved and taking the enormous costs of such an undertaking into account the answer seems quite obvious: the most developed countries. Since geo-engineering poses not only technical questions but involves legal and moral expenses, the group of potential suspects are reduced to relatively powerful elite, within a handful of countries. Thus, while it remains doubtful whether climate fixing technologies provide the means to save the planet they could be instrumental in cementing existing power imbalances. The same industrialisation that turned the United States, China or the EU into major emitters of CO₂ enables them to take the lead in engineering the climate. The biggest polluters of the climate become its saviours. Economic development, for long seen as contributing to anthropogenic climate change becomes the necessary prerequisite for fixing the problem.

In short, what these problems reveal is that what is missing from the techno-fix narrative is any acknowledgement of the *power relations* that will condition the implementation of geo-engineering and, moreover, be reaffirmed by it. What we seek to highlight is that any decision about geo-engineering is highly political and is likely to be contested by numerous parties for myriad reasons. In its very attempt to smooth over social cleavages and difficulties in climate change policy, the techno-fix actually *exacerbates* them. Geo-engineering, however it is framed, is steeped in politics. Although advocates both presuppose and promote the idea that a technofix is a *natural* solution, we argue that this reification disguises the contingency and contestability of any implementation of technology.

REJECTING OF THE MYTH OF PROGRESS: TECHNO-WARINESS

Many have responded to the alacritous techno-fix narrative with caution and alarm. For example, so-called 'deep green' ecologists, such as Paul Kingsnorth and Dougald Hine reject the idea. Their 'Dark Mountain Manifesto' states: 'We reject the faith which holds that the converging crises of our times can be reduced to a set of 'problems' in need of technological or political 'solutions'. ' [19] It calls instead for a rejection of civilization: 'The myth of progress is to us what the myth of god-given warrior prowess was to the Romans, or the myth of eternal salvation was to the conquistadors: without it, our efforts cannot be sustained'...We do not believe that everything will be fine. We are not even sure, based on current definitions of progress and improvement, that we want it to be. ' [19]

A similar 'techno-wariness' appears in more academic sources. Peter Emberley sees the advance of the global network mobilised by of modern technology as doing nothing less than 'reorganizing our way of being in the world with a vision in opposition to what has for a long time preserved decency, stability, and moderate expectations' [20: 743]. To be sure, it is not the individual technologies that he sees as

the problem, but rather the general shift in structures and discourses of the 'second phase of technological growth' which he believes is efficiently autonomous and are dissolving individual subjectivity: 'There is widespread recognition that the transitions we are undergoing have the effect of rendering the individual impotent or without the capacity to bear responsibility for action [20: 749]. It is a mistake to believe that technological progress, in the way it currently exists, is an affirmation of human progress. Rather it produces such 'relentless instability and perpetual uprooting' that we are unable to grasp its danger [20: 764].

However, such dismissal of the techno-fix stumbles on the same question of authority as its proponents. For if these technologies exist, then who decides who gets to develop and use them? Might this not result in the denial of access to resources to tackle climate change to those who need them most? The impact of climate change will not be evenly distributed. It is perhaps easier to dismiss technological solutions when one is not confronted with immediate environmental risk and damage.

To believe that technological change is radically reordering social relations today, is to forget that it has always been part of the human condition [21]. Human societies have always experienced the emergence of technologies that generate fundamental transformation. Citizens have always had to negotiate the resources devoted to research and the pattern of access to its results. What is distinct about the political negotiations of the contemporary era is that they are expected to occur democratically. But the narrative of 'techno-wariness' seems to forget this. The critique of the 'techno-fix' therefore reproduces exactly the same de-politicisation as its target.

At the very beginning of his 2014 Book *Can Science Fix Climate Change?* Mike Hulme invites the reader to imagine an Engineered Climate. Imagining and debating the likely effects, the side effects and the unintended consequences of the various climate technologies that are currently discussed is certainly of exceptional importance. But this imagining and debating is not a matter of determining an overarching strategy that be decided once and for all. The debate over these technologies must be an *on-going practice of reassessment*. The use of geo-engineering must be carefully weighed up in each particular circumstance. For sure, this risks undermining some long-term vision. But any long-term vision is likely to be rendered problematic by the numerous repercussions that cannot be known in advance.

CONCLUSION

We have identified various narratives surrounding geo-engineering. In contradistinction to the 'limits to growth' narrative, there is a 'techno-fix' narrative in which two discursive frames are employed by supporters of geo-engineering. An outright optimistic 'ecomodernist' frame painting a bright picture of a future in which technological solutions will not only fix climate change but also help improving the Earth's climate to support a growing population. A second, more cautious 'second best solution' frame acknowledges that emission reduction should

still be given priority but welcomes geo-engineering as a second best solution and a means of buying time.

While both frames are consistent with dominant views of the problem-solving ability of technology, neither is able to address the important issues of liability and authority. Reducing the question of liability to a secondary problem is not feasible liability involves not only a legal but also a moral dimension. Complying with the ethical standards of research in the developed world would be extremely difficult given the current state of knowledge in geo-engineering. Moreover, since geo-engineering would be very costly and likely to provoke protest and resistance, only wealthy and powerful countries could afford to consider the large-scale projects necessary to effectively change the climate.

The question of whether technology can save human society is often asked. So far the safety, the effectiveness or even the moral tenability of geo-engineering is questionable. But the more pertinent question asks what would be being saved? A high emission lifestyle? A capitalist mode of production which favours focusing on short term decision and immediate profits? Current power relations? On the other hand, however, rejecting such technology outright may well reproduce inequalities. Answers to these questions will not be provided by technology itself, nor by its imagined dismissal. Answers can only be determined through on-going political negotiation and difficult discussion. The only response to the issue of the way in which technology may allow human societies to respond the onset of a changing climate, is to keep asking the questions.

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