Governing Rapid Climate Mitigation

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Abstract

Recent climate science studies reveal that the greenhouse gas emissions trajectory is moving towards 3 to 4ºC warming. This new projection most likely requires peaking total global greenhouse gas emissions as soon as possible followed by rapid reductions to near zero. Despite calls to immediately commence rapid mitigation, responses from most governments remain weak and show no sense of urgency. In cases where mitigation plans are present, these assume that existing governance arrangements are sufficient. In contrast, we argue that a new governance paradigm is necessary for mitigation to be rapid, inclusive, and efficient and, therefore, achieved deep emission cuts. Labelled as the 'rapid mitigation project', we elucidate this using historical accounts of rapid institutional restructurings. Of particular interest are accounts of World War 2 mobilisations where radical, rigorous and rapid institutional changes were conducted. While wartime experience suggests some potential strategies for rapid climate mitigation, limitations exist in the use of this analogy which should not be construed as a panacea.

Keywords

Climate change; rapid climate mitigation; governance

1 Introduction

Current warming trajectory is headed to 3 to 4ºC by the end of the century (New et al. 2011). This means that our state of living 'as we know it' would be entirely different if we don't take rapid, inclusive, and efficient mitigation actions to abate climate change. We, therefore, are in a critical period in which we must turn around this trajectory. There is now little to no chance of maintaining the rise in global mean surface temperature at below 2ºC within the century (Joshi et al. 2011, Anderson and Bows 2011, New et al. 2011). With the likelihood of a 3 to 4ºC warming, the expected impacts have been consequently revised upwards (see Gosling et al. 2012, Smith et al. 2009, Mann 2009). Consequently, policy advice must therefore shift from the current rhetoric of policy defined by reductions in line with the 2ºC threshold to a radical, dramatic and immediate emissions reduction project required in a new 3 to 4ºC warming narrative. In this paper, we label this approach as the 'rapid mitigation project.' This project would require substantive urgent, rapid and large-scale structural changes in the economy including the massive deployments of new energy technologies[1] and rigorous greenhouse gas (GHG) capture strategies in sectors other than energy.

The 'project' involves drafting contingency plans and strategies that governments can readily implement, and proposes an approach on how to implement these strategies. The intention of these plans is not to provide solutions, but to raise options for nation-states and their citizens. Perhaps one of the drivers, in fact the most likely, to the adoption of this approach would be the occurrence of climate-related and life-threatening emergencies. As presented in the scientific literature, the 3 to 4ºC warming scenario will most likely bring with it sudden major global impact, or what has now been termed as 'tipping points' (Lenton et al. 2008). These climate 'tipping points' have been predicted—and already are starting to manifest (Hansen et al. 2012). These include increased precipitation (Min et al. 2011, Allen and Ingram 2002), drought in currently arid and semi-arid areas (Dai 2012), strong storms, hurricanes and cyclones (Coumou and Rahmstorf 2012), wetter tropical areas, and increased global sea level by between 0.5 and 2 meters by the end of the century (Nicholls et al. 2011). Beyond 2100, a warming of 4ºC could mean larger sea level rises (SLR) triggered by the irreversible melting of the Greenland ice sheet and breaking–up of the West Antarctic Ice Sheet (PALSEA 2010, Nicholls et al. 2011, Vaughan 2008, Rignot et al. 2011, Lenton et al. 2008). SLR would lead to 'catastrophic consequences' (Guillerminet and Tol 2008);the impacts of a 2m SLR have been estimated to cost around $270 billion per annum, displace 182 million people, and lose 1.8 million sq km of area (Nichols et al. 2011). Ergo, these impacts could present us with unusual stresses in the social, demographic, economic and security realms resembling a crisis that would require strong responses in the category of an emergency. The causality between climate change and large-scale human crisis is not new. Historically, it has been shown in studies that past climate changes correlate with societal crises (see Zhang et al. 2011). In similar crisis-like situations, governments will possibly assume their emergency political powers and enforce stringent measures in response. Let us postulate further, that governments will finally reach an international agreement on rigid mitigation targets in addition to the expected emergency adaptation efforts as part of their responses to these climate 'tipping points'.

Section 2 envisages some of the general strategies for the rapid mitigation project. While these general strategies are easy to envisage owing to a number of studies recently published on the subject of 100% renewable energy system (RES), the government structures and governance process to

[1] The focus on reducing emissions in the energy sector is justified by it being the largest emitter of all sectors, i.e. about 66% of the 2005 total (World Resources Institute 2012). Also, climate mitigation literature (such as in Hansen 2009:173, Stern 2008:7, 8, Matthews and Caldeira 2008, Caldeira, Jain and Hoffert 2003) mentions the importance of reductions in this sector. Scientific conclusion also tells that if emissions could be quickly and entirely eliminated, temperatures would quickly stabilise or even decrease over time (Matthews and Weaver 2010).

rapidly implement these strategies have received little attention so far. To address this knowledge gap, we suggest an approach that takes a cue from rapid historical restructurings. Of particular interest is the production and deployment of munitions during World War 2. Section 3 justifies this choice by presenting the lessons of wartime mobilisation and providing a comparatively rich experience to commence and sustain the 'project'. Section 4 builds on this narrative to suggest the governance approach of the rapid mitigation project. Based on these parallels, we consider instituting a centrally controlled apparatus as a primary institutional structure for the project. While this approach could yield positive results, the type of governance envisaged here should never be construed as a panacea. Section 5 recognises these limitations and Section 6 attempts to respond to this array of issues. A conclusion section wraps up this paper.

2 General rapid mitigation strategies

The project envisages the carrying out of strategies aimed at transitioning towards a 100% renewable energy system (RES), and rapid mitigation strategies in sectors other than energy. The project calls for the simultaneous implementation of these strategies within a predetermined timescale. Nuclear power is not considered for making a significant contribution to the rapid mitigation project, because it typically has long construction and deployment times, median 9 years plus long planning and siting periods (Koomey and Hultman 2007), compared with large-scale wind and solar with typically 2-4 years.

During the past five years, a number of studies and models suggest the possibility of safe, ecologically sustainable energy systems based on a 100% RES in various scales from global to regional and national (e.g., Hand 2012, German Advisory Council on the Environment 2011). These studies point out that most of the technologies required to build these systems are already commercially available, either on a large-scale or in limited mass production. Building upon these studies, large scale RES would be possible if the following contingent strategies are built onto the project:

- *Legislation and planning*: Setting up national statutory climate protection and decarbonisation legislation that will translate into rapid emissions reductions policy and zero emission targets; drawing up a national RES expansion plan cascaded from national to local governments.
- *Regulation:* Instituting regulatory and economic frameworks to encourage the rapid retirement of conventional fossil fuelled power stations and motor vehicles, and industrial plants; phasing out the subsidies to the production and use of fossil fuels; and replacing the above fossil fuelled systems with RES systems.
- *Mitigating negative social effects:* Offering viable options to all affected sectors and regions; providing new and alternative opportunities for displaced labour; using some transitional fuels (such as natural gas) to minimise system shock.
- *Network expansion:* Rapid development, deployment and expansion of new transmission lines for efficient integration of RES with existing grid; incentivising transmission system operators and network providers.
- *Energy efficiency:* Setting up an absolute electricity demand limit and stabilisation of electricity demand over the long term via strong energy efficiency and 'smart grid' measures; comprehensive and compulsory demand reduction programs for all appliances, equipment and buildings.
- *Research and development (R&D):* Accelerating R&D of efficient energy storage, ecologically sustainable biofuel production, and carbon capture and storage technologies.

- *Support schemes:* Preparing renewable resource maps; labour retraining; identifying innovative financial capital and support instruments for each type of renewable energy.

Although the project will be dominated by narratives regarding transition towards 100% RES due to its prominence in the mitigation literature, we recognise the need for significant reductions in other GHG-contributing sectors. Parallel and drastic reductions in these areas could, in fact, easily advance without much controversy and yield positive results quickly (Shindell et al. 2012, Kerr 2012). Strategies in this sphere could include:

- *Land management:* Upscaling reforestation and afforestation projects at national scale; termination of native forest logging; changing agricultural practices (terminating energy-intensive production of chemical fertilisers, supporting organic production).
- *Changing consumption patterns:* Exploring rapid options to reduce meat and dairy production and consumption; R&D on steady-state economic systems; non-coercive policies to stabilise population, including poverty alleviation.
- *Methane reduction:* Rapid implementation of methane reduction projects in landfills and agriculture (livestock and rice farming).

The above-mentioned strategies will require massive resources, including human and financial. Although studies on the technical feasibilities of the transition and the required labour and financial capital have been wide and far-reaching[2], literature on how to implement—or 'govern'—this rigorous undertaking including the kinds of organisational structure needed, particularly at the national level, considering the required speed and scale, remains scarce. While there is no denying that contemporary literature on transition governance exists, the focus has predominantly been towards rapid innovation and niche development of the renewable industry (e.g. Atkinson et al. 2011). Generally, these kinds of studies lack the specific ingredient, necessity and urgency to cut emissions deeply . Recognising the scale and scope of this requirement, we investigate one possible approach by turning to history to seek possible and comparable responses and strategies. Of particular interest is an analogous project—the massive and rapid mobilisation for war.

3 Wartime restructurings

The comparison between climate mitigation and wartime economic restructuring has been used in recent discourse as a strong political slogan in both policy and scientific circles. During the 2009 World Forum on the Enterprise and Development in Oxford, for example, Al Gore likened the 'battle against climate change [as something] like fighting the Nazis' (Gore 2009). The martial metaphor, however, has evolved from its use as a metaphor to a policy model in responding to climate change. The war-climate model has been discussed in the scholarly literature, albeit the treatments are few in number and are scattered into various strategies. For example, several authors, particularly Delucchi and Jacobson (2011) and Brown (2008), utilise the parallel of quick mobilisation of war technology in America to emphasise and bolster the technical case of large-scale RES deployments. Bartels (2001) has also put forward a warlike approach to a climate emergency by calling on massive deployments of RES along with seemingly draconian prohibitions on meat and dairy consumption. At the global level, Gilding (2011) employs the war-climate model to suggest rapid climate change response calling for the establishment of an international crisis response plan to address climate change. The underlying assumption in these studies is that governments have the capacity to initiate large-scale projects.

[2] See for example Wei et al. (2010) and Chapman and Lounkaew (2011) for labour studies; and Shellenberger et al. (2008), Olmos et al. (2012) and Delina (2011) for financing studies.

To show that governments are capable to initiate and sustain large-scale projects we focus on the American experience and the ability of its government to enable its industries to churn out unprecedented quantities of war munitions. America's formal war participation[3] signalled the shift on the country's social and economic paradigm from free-market to a government-led system. This change occurred almost overnight. Invoking the mandate provided to it by Congress, the Roosevelt government took over the administration of vital production industries and intensified wartime mobilisation. Consequently, military budgets were revitalised with additional resources. In 1942, the budget for defence took almost a third of American GNP; in 1944, this share further increased to 42% (Harrison 1998). As the new economic system emerged, the role of the private sector diminished and public investments rose to become the dominant source of financial capital. Between 1942 and 1945, the US Government invested a total of $128 billion compared to private investment of around $35 billion[4] (both figures in current dollars) (computed from Higgs 2004:504, Table 1). How did the US Government raise these enormous amounts of funds? Governments, regardless whether they are at war or not mobilise financial resources in three ways: printing money, raising taxes, and borrowing. During the war, however, the latter two options became the most common forms of public funding. Governments simply feared inflation from printing money. In the US, around 55% of total wartime financial requirements were sourced from bond sales while about 45% were raised through taxation (Kennedy 1999:625, Lumer 1954:20).

These massive outpouring of resources for defence purposes yielded positive results. To illustrate, American industry produced 299,300 airplanes, 86,700 tanks, more than 100,000 naval vessels, more than 20 million rifles, 2.4 million trucks and jeeps, 41 billion bullets and millions of other war-related items between July 1940 and May 1945 (Cardozier 1995:157, Overy 2006, Smith 1991:3-31). The increased supply of labour is another vital contributor to this 'wartime production miracle.' By 1944, an additional 7.7 million Americans were employed in non-military work (Cardozier 1995:149). In terms of per cent increase, this was about 35 per cent over 1943 (Rockoff 1998:100). As a consequence of intensive labour deployments, unemployment rates significantly dropped. To illustrate, 10 million Americans were out of job during the Depression; in 1944, this number was significantly down to 670,000 (Rockoff 1998:101).

The 'socialisation of investment' (Higgs 2004:503) and the increase in labour resources during the war clearly illustrate a government's capacity to mobilise two important resources—financial and personnel—for a huge project. There are, of course, attendant government policies (such as controls and other forms of interventions) that allowed these resources to be mobilised and used; however, analysis of these contingent policies is currently beyond the scope of the paper. What we would like to highlight, at this point, is the capacity of government to rapidly mobilise these resources to respond to an acute emergency. Our use of the wartime analogy as a policy map for rapid climate response, however, does not end with quantitative capacities mentioned in this section. Of equal importance, but somehow neglected in the literature, are the tsunami-like changes that governments employed in ensuring that military production targets were achieved within an established time constraint. In the context of this paper, this is important. As an overriding issue in the 'rapid mitigation' narrative, we turn to these particular strand of wartime mobilisation to conceptualise its temporary restructuring of government and of governance processes.

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[3] Although the US had already been supporting the UK and other Allied states through munitions provision before the attack on Pearl Harbour, only in December 1941 that did the US issued a formal declaration of war against the Axis nations.

[4] Despite the primacy of public finance during this period, the proportion of government and private investments returned to its 1940 balance six years later. In 1946, government investment decreased to $3.5 billion while private domestic investment increased to $31.1 billion (both figures in 1946 dollars) (Higgs 2004:504, Table 1).

4 Governance approaches and government structures

An event that imposes clear, acute and direct evidence of threats to the security of the general public (and governments) drives governments to impose rapid response. The threats posed by foreign invasions served as important drivers for governments to quickly change their economic systems during the war. Democratic states originally based on a free market system rapidly were converted into a centrally controlled, government-led structure. In the US, for example, the Roosevelt government shifted to this system following the Japanese attack on Pearl Harbour and US-controlled Manila. The goal to produce munitions quickly, massively and efficiently as possible with limited external interventions motivated this shift. Practically, the market system that defined American industrial production was suspended to guarantee that munitions production was afforded the utmost priority. Although there were prior attempts to accomplish this task, the Roosevelt government was only able to exert control on production after Pearl Harbour. In the case of the 'rapid mitigation project', we can posit that similar shift in economic system may be necessary and could rise out of the impacts of climate tipping points. In his paper on rapid climate response, Bartels (2001:229) recognised that 'a widely-perceived increase in the frequency of extreme weather events [would] lead(s) to massive political support for an international effort to reduce GHG emissions.' The strategic importance of these 'tipping points' is therefore significant in arguing the case for massive, rapid and deep mobilisation programs such as those envisage by the 'project'.

Utilising this historical analogy, the 'Pearl Harbour effect' suggests that threats to national sovereignty and life could drive nation-states to provide extraordinary powers to their governments and enable the latter to simultaneously and rapidly address the crisis. The shift in economic system during World War 2 catalysed two substantial socio-economic restructurings that brought in 'new' type of governance approaches in the history of democratic societies: first, governments took over the market to allocate resources for industrial production, and second, governments rapidly changed its structures and organised new institutions in response to this 'new' role as resource allocator. In retrospect, wartime governance became a monocentric structure with central government by the executive as the locus of power. Under this arrangements, central governments—the Roosevelt administration in the case of America—gained 'new' administrative powers to (1) prioritise the manufacture of certain war items (Plumptre 1941, Walker 1939:75); (2) stop the production of specific goods and services; (3) force manufacturers to accept military contracts (Dickinson 1997); and (4) implement wartime controls such as prohibitions and rationing among others. In overseeing these massive efforts, Roosevelt created and empowered a single mobilisation agency called the War Production Board (WPB). Accordingly, governing wartime mobilisation and production rested on the shoulders of this particular agency. This central structuring approach characterised by a dominant agency proved to be efficient in organising and coordinating actors involved in war production which include military agencies, an expanded bureaucracy, material suppliers, and the private sector. In addition, the monocentric approach finally overcame the pre-Pearl Harbour barrier of competition among public agencies about issues such as which receives a priority material and which gets it first (Dickinson 1997). The structural design of the Board (i.e. reporting directly to Roosevelt and structurally above all other wartime executive departments) enabled it to exercise these vital roles and address administrative challenges that characterise American mobilisation efforts before Pearl Harbour. Shortly after the defeat of Japan, this central structure was accordingly abolished. In all, the War Production Board existed for four years (1942-1945).

The monocentric approach to administrating a large-scale, rapid and rigorous undertaking such as mobilisation for war as illustrated above could therefore be viewed as a possible primary governance arrangement of the 'rapid mitigation project'. In this approach the executive branch of government

would be given appropriate powers to lead the strategies outlined in Section 2 and accomplish them within a pre-determined timescale. Furthermore, mobilisation, this approach suggests that a powerful agency under the executive branch could be allocated with the following administrative competencies:

- *Plan.* Conduct technology requirement studies, assess electricity grid requirements (including large-scale transmission line route identification); set and enforce national RE technology production goals and priorities
- *Facilitate.* Institute efficient and transparent contracting procedures
- *Coordinate.* Serve as the coordinating agency for all transition activities, which include but are not limited to:
    - Raising capital, organising funding for the construction of key infrastructure particularly new transmission networks.
    - Implementing new and innovative financial incentives and schemes for the renewable industry players and disincentives to the fossil-fuel industry (e.g. progressively rising carbon tax).
    - Implementing labour strategies.
    - Increasing funding for specific areas of education, training and retraining.
    - Setting and monitoring mandatory energy efficiency standards.

Structurally, this agency could be designed following similar WPB arrangements. This means that within a predetermined program, it will report directly and regularly to the chief executive and that it is administratively and structurally placed a notch higher than the ministries. Although this arrangement worked effectively for WPB, it may not for the rapid mitigation agency. WPB was able to successfully accomplish its tasks within the predetermined period partly because it was working under a singular administration—an arrangement that could not be readily secured in contemporary democracies where cyclical government changes and political opinion swings are common, if not the norm. Another approach would be to purposely insulate it away from various political pressures. Contemporary examples, which can be used as templates in designing this agency, include independently structured agencies such as Central Banks and elements of the judiciary. More importantly and regardless of choice of arrangement, a parliamentary mandate would be necessary for the agency. Such statutory mandate should cover the description of its structure and powers, and coverage and timeline of rapid mitigation activities.

This state-dominated model of governance offers a number of advantages. First, it has a historical precedent in the WPB which proved to be an efficient agency in delivering the fundamental requirement of wartime production. Second, central governments have the proven capacity to distribute powers and responsibilities between the agencies of national government itself, the regional and local governments, and the civil society (Hirst 2000). Third, citizens continue to view their government as the main institution of democratic legitimacy that they understand and are willing to accept (Levi 1997). Fourth, and based on the slow pace of previous energy transitions (Smil 2011, Kramer and Haigh 2009), a much stronger role for government may be essential. Despite these strong points, the use of wartime mobilisation as a policy model and the suggested monocentric approach to rapid climate mitigation has its own weaknesses to consider.

5 Limitations

The central limitations of this approach pertain to its monocentric form, which undermines the fundamentals of democracy. Providing extensive powers to government, particularly the executive

branch, may lead to coercive governments, that even control individual activities (Oreskes 2011:224). In the same vein, such emergency powers may be extended beyond the pre-determined timescale as illustrated in dictatorial governments of recent history (Martin 1990). The monocentric approach also tends to raise issues regarding representativeness and the ability of the public to actively participate in rapid mitigation activities.

Wartime experience suggests there is danger of creating an oligarchic wartime administration, where not only elected officials but also a few privileged individuals gained access to enormous powers. The American experience is a case in point. Realising that industrial mobilisation was beyond his capacity, Roosevelt reached out to an elite group of industrialists and asked them to lead important agencies and play significant role in rapid mobilisation efforts (Lumer 1954, Cardozier 1995). The administration of WPB itself fell on the hands of the industrialist Donald Nelson, chair of Sears Roebuck. In addition to their appointments in powerful agencies, businessmen were also guaranteed a number of huge, massive military contracts. Recognising this historical precedent, therefore, the monocentric approach to rapid mitigation may revive the oligarchic character of wartime governance. With few people in power, decision-making, leading and administering rapid mitigation activities would not be inclusive and would destroy the representativeness character of democratic governance.

Similarly, the strong leaning of the suggested approach towards macro-level actions generated at and flowing from the top could particularly diminish, marginalise and exclude the importance of actions that could potentially sprout at the micro level such as households and local communities. Although such 'small' actions may not guarantee impressive results in rapid emission reductions, the support of micro-level actors is absolutely necessary for guaranteeing success in efforts of such scale and scope. Furthermore, governments need to rely to a great extent on the willing cooperation by their citizens for those policies to succeed. We saw this crucial dynamics at the micro level played out when mobilising for war. Although wartime mobilisation strategies did not involve much participatory democracy when they were implemented, inherent public support primarily took over public psyche in light of the consequences of defeat (Walker 1939, 1947). War bonds, for example, were selling like hotcakes and citizens willingly accepted rationing schemes and complied with new tax regimes without much objection during the early years of the war. Moreover, the war experience also recorded actions at the local level as significant elements of wartime mobilisation. In Australia for example, local governments became effective conduits of wartime programs on labour, housing, policing and emergency supplies arrangements (Walker 1947).

6 Towards an inclusive and democratic governance

Governing the rapid mitigation project—just like any instance when a crisis situation triggers governments to take immediate action—is a complex and challenging process. The limitations identified are but few of many challenges that may surface when a monocentric approach is adopted. In response, we suggest two ways that may address these challenges: a balance-of-power institution and a more inclusive and active public participation.

One way to compensate for the seemingly overly powerful executive government in this approach is creating an institution that will provide citizens the means to judicially examine the decisions of the government, particularly that of the executive and the special agency. An independent agency could be instituted to ensure judicial balance of all rapid climate mitigation activities and to make sure that these activities follow a predetermined direction and timescale. Several examples of existing contemporary structures could be considered in the preliminary structural design of this balance-of-power institution (e.g. New Zealand's Parliamentary Commissioner for the Environment, and the

Auditor-Generals of various states). In addition to this institutional recourse, environmental and social justice NGOs, along with the media, should provide a countervailing force to misuse of government power (Diesendorf 2009).

Recognising the merits of micro-level support democratises and further strengthens the structural framework of the rapid mitigation project. In the process, the role of the public as co-creators of rapid mitigation strategies is acknowledged, overreliance on monocentric approach is countered, and the central role of governments is refocused. This involves prompt deliberation proceedings with the corresponding inclusion of scientific expert knowledge and non-professional expertise in the rapid mitigation narrative. This means that the public is involved in all stages of the rapid mitigation project—prior to its commencement, as it develops, and as it ends. This process should go hand-in-hand with an open, frank, transparent and pluralistic public discussion of the relevant issues and strategies. This emphasises the role of the central government as an 'enabler' of productive public discourse rather than an 'imposer' of a pre-determined policy. Building public support, enhancing trust, and ensuring transparency for the 'project' is a challenge in itself and is beyond the current scope of this paper.

7 Conclusions

This paper has focused on governance approaches and government structure that could facilitate the rapid transition to a safe climate. During World War 2 the warring nations resorted to a centralised system with considerably increased executive power to direct industry and the community at large and thus drive rapid socio-economic change. We find that this approach has both strengths and major limitations that must be considered. In wartime most citizens support the government and those who dissent are given short shrift. The situation is more complex in the case of responding to climate change. The monocentric approach is potentially a threat to the democratic system of government. Therefore, we have suggested that a statutory institution with countervailing power to that of the executive be set up to ensure that the direction, transparency and environmental/social impacts of the rapid transition process are acceptable. In addition, we also have to acknowledge the central role of the public as co-creators of strategies; hence, their participation in the rapid climate mitigation discourse should be seriously considered.

Government policy can only claim legitimacy if all levels of government and the community at large participate in decision-making, rather than being simply expected to give their consent or accept them ex post. This means that the forthcoming socio-economic changes should concern and activate public support from all these realms: from households to local communities, and all levels of government—from local to state/provincial to national. The rapid mitigation project therefore should open up avenues for a new culture of participation across these levels grounded and motivated by the idea that every individual should share in greater responsibility for the environment. A successful rapid climate mitigation policy should be pursued along these interconnections: institutionally via strong government with a statutory institution to provide checks and balances, and procedurally via active grassroots movements that spring from the community level. Importantly, this policy should be accomplished in a coordinated and democratic manner and built on the values of participation, trust and transparency. Considering the urgency of the required emissions reduction, however, this also means that rapid mitigation activities should proceed as soon as possible.

In this paper, we attempted to develop national contingency plans to rapidly mitigate climate change. While that intention is clear, we are only able to design partial strategies that, to our hopes, could commence the debates and set the stage to enrich the literature on the possible use of wartime

mobilisation strategies as policy framework to affect deep cuts in emissions reduction. Important to the rapid mitigation narrative, yet beyond the current scope of the paper, are several items that need in-depth analysis. First, the complexities and limitations on the use of the wartime policy framework for rapid climate mitigation needs to be closely interrogated. For example, the quantitative capacity of a government to quickly mobilise financial and labour resources during the war came with attendant regulations and interventions. Since it would be necessary for governments in a rapid mitigation scenario to marshal similar (or even larger) quantities of resources, whether similar wartime financial and labour controls could be employed remains an open question. Second, the suggested institutions in this paper are but preliminary ideas that need to be properly defined. Important questions such as what sort of powers these institutions could and should have, and how they should fit contemporary government structures need to be delineated and analysed. Fourth, ensuring that the partnership between government and citizens is inclusive and adheres to democratic norms need further studies. We have initially recognised the role of government as 'enabler' and citizens as co-creators of rapid strategies, but this needs to be elucidated. Fifth, the paper's current focus on climate mitigation technology and how to rapidly deploy it does not mean that it could fix the entire climate problem; rather, it should be viewed as one of the many elements in a wide array of possible solutions to a complex problem such as climate change. Therefore, rapid climate mitigation policy should also envision strategies on how to effect behavioural and cultural changes and shift our current unsustainable production and consumption habits and patterns. Sixth, while we focused on governing at the level of the nation-state, we do not discount the importance of regional and international actions in rapid mitigation. Bringing the rapid mitigation narrative at the global level is important and studying it at length is highly suggested.

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