# A Comparative Review of Climate Mobilization Plans

Long paper

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**Abstract.** Continuing failure of climate mitigation efforts to produce results has directed scholarly and public interest towards those episodes in human history where governments have enacted emergency measures for the common good. In particular, the experience of the industrial mobilization to the Second World War has been cited increasingly often as a possible model for emergency climate efforts. In this paper, we review the most notable "climate mobilization" proposals from the first explicit war mobilization parallel in 2001 to recent book-length treatments. We outline the common themes and suggest further research to the topic is warranted.

**Keywords:** climate mitigation, wartime mobilization, sustainability transition



## 1 Introduction

In recent years, there has been a marked increase in public, activist and academic interest in proposals to rapidly convert the world economy to a sustainable footing. Motivated by lack of progress in reducing greenhouse gas (GHG) emissions and the failure of existing, gradual, market-based climate mitigation approaches, these climate mobilization proposals envision an all-out, society-wide concerted and planned effort to end dependence on fossil fuels and stop other GHG emissions as well, once and for all. As the name suggests, climate mobilization plans are strongly inspired by experiences of past wars, particularly the Second World War, where democracies had to convert their industries and indeed entire economies to the production of war material in a few scant years.

These approaches are related to, but distinct from "mission-oriented" industrial policies (Mazzucato 2020) and "green new deal" type proposals: while green new deal proposals typically include significant government-led investments in low-carbon infrastructure, climate mobilization plans go a step further and envision a directly planned low-carbon transition underpinned, if necessary, by government's emergency powers. In other words, if green new deals represent a step change in government intervention to secure a sustainable future, climate mobilization plans envision a limited state of emergency until decarbonization targets are achieved.

The importance of the topic is not limited to climate change mitigation, however. All out efforts comparable to a major war may be necessary to stave off other existential threats, from future pandemics to asteroids to hitherto unforeseen phenomena. As experience from the COVID-19 pandemic illustrates, existing contingency plans have for the most part proven inadequate. A better understanding of past planetary scale emergencies could help improve emergency planning for the future.

This paper starts with a recap of the urgency of effective climate policies and the failure of the current approaches. This is followed by a brief historical description of the U.S. industrial mobilization for the Second World War, the main inspiration for the climate mobilization proposals. We then provide a review of the proposals from two decades, ranging from the first known explicit suggestion to confront climate change like wartime mobilization in 2001 to book-length treatments in 2020. We then synthesize the key lessons, commonalities and differences of these plans. Finally, we discuss the significance of the mobilization approach in the climate mitigation efforts, discuss some wider ethical aspects of the approach and provide some suggestions for future research.

## 2 Background: Why climate mobilization?

Despite numerous climate conferences and emission reduction pledges, greenhouse gas concentrations in the atmosphere keep growing. This lack of progress, combined with increasing awareness of potentially disastrous effects of even moderate warming (e.g. IPCC 2018, 1.5 report), has galvanized a new wave of popular climate activism. Spearheaded by increasingly radical movements such as Extinction Rebellion and youth-led Fridays for Future, these activists have been moderately successful in demanding far more ambitious climate policies.

At the same time, the limitations of market-based climate policies are becoming increasingly apparent. Even though market-based approaches such as the EU emission trading system promise cost-efficient emission reductions, unwillingness to adopt tight enough emission quotas and numerous loopholes built into carbon trading systems have resulted in woefully inadequate rate of emission reductions. A chicken-and-egg problem is apparent: politicians are loath to push for more ambitious climate policies because low-carbon alternatives are scarce and expensive, and low-carbon alternatives remain scarce and expensive because climate policies are insufficiently ambitious.

As a result, it is clear that humanity is rapidly running out of time to stabilize the Earth's climate to keep it conducive to the survival and well-being of complex, large-scale societies. Pathways to the target agreed upon in the Paris agreement of 2015, 1.5°C, now require exceptionally steep emission reductions and are unlikely to be achievable via incremental improvements to present policies (Fig. 1).

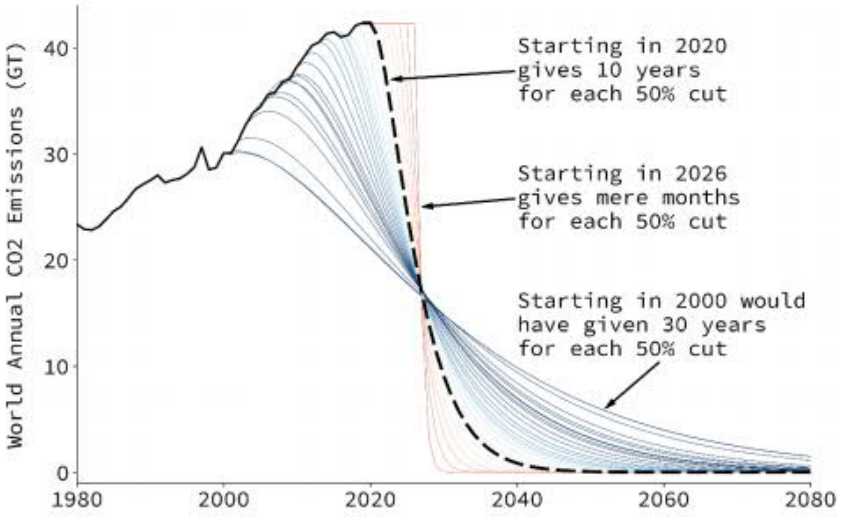


**Fig 1:** Mitigation curves required to hit a 1.5 degree C world. From Griffith et al. (2020).

At the same time, events have overtaken the conventional wisdom that abhors direct government intervention in the economic sphere. From the 2008 financial crisis to the 2020 COVID-19 pandemic, states have been the backstops that prevented crises from escalating into cataclysms. Ideas that were until recently considered beyond the pale are becoming self-evident policy. For example, in 2020 alone, the world's largest 50 countries announced 14 600 billion US dollars' worth of spending to counter the effects of the coronavirus (O'Callaghan & Murdock 2021). Even though only about 368 billion dollars were earmarked for green initiatives, the spending spree provides yet another proof that governments have the means to pursue substantially more ambitious environmental policies, and that at least in time of crisis, have much more financial latitude to do so than often has been assumed. No wonder, then, that ideas such as the Green New Deal and "build back better" have gained currency in political discourse. The European Union has adopted an "European Green Deal" with the stated purpose of becoming the first climate neutral bloc by 2050. Even the United States is currently on track to spend 2000 billion dollars on rebuilding its infrastructure, including $174 billion boost to the electric vehicle market, $100 billion to update and harden the country's aging electric grid, $35 billion in research and development of climate change mitigation, and another $10 billion to establish a "Civilian Climate Corps" to employ people to restore land.

However, even though the post-COVID policies represent a laudable step in the right direction, they too are unlikely to be sufficient. With less and less time available, more and more radical climate plans are being proposed. While some envision a contraction of industrial civilization, voluntary or involuntary, others propose a radical, all-out

effort to reconstruct national economies on a decarbonized basis. These proposals are the focus of this paper. Before reviewing them, let us take a look at the inspiration behind them, the U.S. industrial mobilization for the Second World War.

## 3 The Example: U.S. industrial mobilization for the Second World War

The industrial might of the United States is broadly acknowledged as a key factor in the allied victory in the Second World War. The economy-wide redirection towards war production happened within mere years and the output of all manner of strategic goods expanded tremendously. Within mere years, the output of all manner of strategic goods expanded tremendously (table 1).

**Table** 1: Expansion of U.S. military production, selected products, 1939-1945. Source: Wilson 2016, p. 79. Figures in metric tons unless otherwise specified.

| **Product** | **Pre-war production** | **Peak production** | **Ratio peak/pre-war** |
|---|---|---|---|
| Synthetic rubber | 3250 tons (1940) | 936 800 tons (1945) | 288 |
| Aviation fuel | 4000 barrels/day (June 1940) | 520 000 barrels/day (March 1945) | 130 |
| Ocean-going freighters | 0,3 million gross tons (1939) | 18 million gross tons (1943) | 60 |
| TNT (explosive) | 45 tons/day (June 1940) | 1815 tons/day (Dec 1942) | 40 |
| Completed airplanes | 3000 (1939) | 93 600 (1944) | 31,2 |
| Aircraft fuselages | 9200 tons (1940) | 361 560 tons (1944) | 39,3 |
| Magnesium | 5440 tons (1940) | 166 920 tons (1943) | 30,7 |
| Aluminium | 148 320 tons (1939) | 1 043 260 tons (1943) | 7 |
| Electricity generation capacity | 28 000 MW (1940) | 44 000 MW (April 1944) | 1,6 |
| Steel | 74,4 million tons (1949) | 87 million tons (1945) | 1,2 |

In retrospect, the mobilization effort is sometimes presented as a given and the outcome as obvious: once the Japanese attack on Pearl Harbor and Germany's subsequent declaration of war galvanized the U.S. public opinion, it seemed to be only a matter of time before the latent productive capabilities of the richest country on Earth would crush the Axis powers. In reality, however, president Roosevelt and others who saw that a war was coming and realized the United States could not afford to stay out of it faced a long, grueling uphill battle to put the U.S. industry to war footing. The task was made even harder by the public's bad memories from the First World War - "the war to end all wars" - where the industrial mobilization was mismanaged to the extent that, for example, the U.S. Army ordered 945 000 saddles and two million feeding bags

for its grand total of 86 000 horses, and railroad transport along the Eastern seaboard became so hopelessly jammed that eventually the Army had to take direct control over the railroad companies to sort out the mess (Wilson 2016:19). In short, the First World War industrial mobilization was conducted in the belief that private companies and "the market" will sort everything out for the best; the result was chaos, inflation and profiteering on a vast scale, with "merchants of death" seeing their profits rise more than 10-fold while others died in the mud in France, equipped with British and French weapons because the U.S. industry was not able to produce military equipment in appreciable quantities before the war was over.

As a consequence, the struggle to mobilize the United States for a second war was real. Furthermore, this often overlooked struggle, waged by Roosevelt and his allies in earnest from about 1937, was immensely important for the Allied victory. For example, without warships and airplanes that had been put into production in 1938, despite considerable political and popular opposition, the Japanese conquest of the Pacific would've been met with little resistance and forced the counteroffensive to begin from a very precarious position. Similarly, without the 1.4 billion dollars spent between June and December 1940 by the New Deal-era Reconstruction Finance Corporation to build new defense plants and the strongly opposed Lend-Lease act of March 1941 that permitted war material to be transferred to the opponents of the Axis, the Soviet defenses might have collapsed under the Nazi onslaught - a fact admitted not only by Russian historians but by none other than Stalin himself (Khrushchev & Khrushchev 2004, pp. 638–639; Weeks 2004).

Even more remarkably, these astonishing feats of production were achieved with practically no sacrifice on part of the general population. As e.g. Mason and Bossie (2020) and Lacey (2012) show, diverting even up to 44 percent of GDP to war production did not mean austerity or cause more than a small and temporary decrease in civilian consumption - totally contrary to what military leaders and civilian planners and economists believed would inevitably happen (Mason and Bossie 2020:15) . Massive public investment in new industries led to rapid growth of output and productivity: instead of having to choose between guns or butter, as the saying goes, the U.S. economy produced much more guns and more butter (Mason and Bossie 2020:7). In fact, U.S. workers gained considerably during the war. Not only were the last vestiges of the Great Depression expunged and nearly full employment achieved, but tight labor markets served as a powerful force for redistribution. Those at the bottom of the hierarchy - blacks and women - benefited the most. For instance, Mason and Bossie (2020) note that the gap between median black and white wages closed much more during the war years than in any subsequent period, even despite the lack of effective anti-discrimination measures.

Finally, the war mobilization demonstrated that in a crisis, the financial apparatus of a modern economy permits states to finance practically everything that can be physically constructed. In a thorough review of the economics of the U.S. war mobilization, Lacey (2012) notes that thanks to careful economic planning and active measures to control inflation, the Second World War became the first war in human history where the strength of participants was limited not by the depth of government's coffers, but by the economy's physical capacity to produce war material (see also

Rockoff 2016, Mason and Bossie 2020). These massive public outlays were financed by a combination of taxes, debt, and money creation (Rockoff 1998, Lacey 2012). A later analysis found out that the financial means of the U.S. government would've easily enabled it to continue the war at least until the end of 1946, and almost certainly for even longer (Lacey 2012).

In sum, despite its destructive purposes, mobilization for the Second World War remains a heartening example of what human societies can achieve if they truly want to. Even more so than singular technological triumphs like the Manhattan project or the Apollo program, the war years provide an example of a society focused on a single goal, willing to upend the existing arrangements and conventions for the benefit of future generations. It is indeed easy to see how an increasing number of authors and organizations have come to use the war mobilization imaginaries to promote more ambitious climate policies.

In the following section, we will explore some of the common themes of these proposals. This paper is intended as an introduction to the topic, not an exhaustive review, and we will return to the topic in later papers in more detail.

## 4 Proposals

The proposals reviewed for this paper are as follows (Table 2).

**Table** 2: Climate mobilization proposals reviewed in this paper.

| Year | Main authors | Type | Focus area, key points |
|---|---|---|---|
| 2001 | Bartels | Academic article | Generic proposal to treat the climate emergency like the Second World War mobilization. Canadian focus. |
| 2008 | Spratt and Sutton | Book | Calls for a combined approach to solve not only the climate crisis but other pressing issues, such as peak oil, affordable food and water, and biodiversity. Refers Brown's Plan B version 3.0. |
| 2009 | Brown | Book | Latest iteration (4.0) of Brown's Plan B. Four integrated components: cutting net CO2 emissions 80% by 2020; stabilizing world population at 8 bn or lower; eradicating poverty; restoring the Earth's natural systems. Food security is in the center of the analysis. |
| 2010 | Randers and Gilding | Academic article | Overview proposal of "One Degree War Plan", a plan to stabilize the climate to <1 degree warming. High level modeling by C-ROADS climate model to verify the results. 5-year "climate war" to jumpstart climate action, followed by 15 years of stabilization phase ("climate neutrality") and 80 years of "climate recovery." Electricity, fossil cars, gasoline rationed; |

| | | | |
|---|---|---|---|
| | | | 50% of the world's aircraft grounded in 5 years. Funded via carbon tax. |
| 2011 | Gilding | Book | Expands on Randers & Gilding 2010. |
| 2013 | Delina and Diesendorf | Academic article | Focuses on governance issues. Calls for a special ministry for transition to a low-carbon future as the principal agency to drive the transition. |
| 2016 | Delina | Book | Expands and fleshes out the themes of Delina & Diesendorf 2013. Focus on governance issues; suggests a body comparable to the UN Security Council to manage the transition. High emission countries would have 15 to 20 years to decarbonize, poor low emission countries as much as 35. |
| 2016 | McKibben | Article | Popular article, one of the first in a major outlet to argue for climate mobilization style effort. Argues climate fight is not "like" war but an actual war. McKibben also reports participating in the group writing the platform for Bernie Sanders's presidental election campaign. The rhetoric of wartime mobilization ended up in the Democratic Party campaign although it was fronted by Hillary Clinton. |
| 2016/2019 | Silk, Bamberger | Report | A report by the Climate Mobilization NGO. Suggests the U.S. has the capacity to end net greenhouse gas emissions by 2025 while creating full employment via large-scale deficit spending. Social equity and redistributionary aspects explicitly discussed and promoted as a reason to adopt a radical approach. Detailed suggestions of agencies the U.S. government should set up to manage the effort, largely modeled on WW2 and New Deal examples. Original from 2016, updated in 2019. |
| 2020 | Klein | Book | Makes the case for Canadian climate mobilization. Very explicit about the need for social equity and "just transition". One of the only works so far that draw lessons from other than the U.S. war mobilization. |
| 2020 | Griffith, Calish and Fraser | Report | Proposes a strategy to rapidly electrify the entire United States energy system; draws parallels to the WW2 mobilization effort and the New Deal rural electrification efforts. Showcases potential job creation benefits. Proposes state-backed loans and other financing as a major, understudied tool for increasing the adoption rate for low carbon alternatives. |

| | | | |
|---|---|---|---|
| 2020 | Bossie and Mason | Working paper | Examines how the U.S. government created new war industries during the Second World War; suggests these lessons are relevant if the U.S. needs to make large scale economic readjustments for other reasons, not just because of climate change. |
| 2020 | Mason and Bossie | Working paper | Using the WW2 example, examines how public spending could restore the normal functioning of the economic system, decrease inequality, and help transform the economy to a more sustainable basis. |
| 2020 | Malm | Book | Analyzes the differences between the COVID and climate response. Argues that states have to confront the vested interests that prolong the status quo; suggests that the mobilization metaphor should not be discarded but complemented with another metaphor and analogue, "war communism". Discusses at length the dilemma of executing control measures in an emergency without trampling on democratic rights, but rather by securing, building on and drawing force from them. |

### 4.1 Common themes

The common denominator for the texts reviewed here is that they call for emergency action and use the industrial mobilization in the Second World War as a potential model for rapid climate mitigation. Otherwise the texts are varied. Some of them are article length, published in academic journals or popular media. Some of them are books published by commercial publishers or as independent publications. Some of the writers are researchers and academics with various backgrounds, some are activists and environmental writers, some are a combination of both. This section presents the common themes and the following sections briefly illustrate the unique contributions of each particular proposal.

**Individualist and market solutions are not enough in an existential crisis**

*"The ecologically necessary is politically infeasible, but the politically feasible is ecologically irrelevant."* William Rees, professor emeritus at the University of British Columbia and the creator of the ecological footprint concept, quoted in Klein (2020:xix)

All the proposals share the same underlying concern: existing individualist, market-based solutions championed by most governments and business interest groups around the world are plainly inadequate for the scale of the challenge required. The authors argue that climate change should be treated as an existential crisis requiring collective emergency response, rather than a minor problem treatable by the present gradualist approach. Many point out that the Second World War presented a similar existential threat for democracy, and that individualist, market-based solutions would've been just

as woefully inadequate back then as they arguably are today. This argument could be summarized as "the Second World War was not won by increasing taxes on personal cars and providing incentives for the production of bombers". Instead, the governments should assume at the very least a coordinating function, providing not only targets but plans, financing and other support required for collective response to the threat.

**Inequality prevents action**

Furthermore, many of the proposals correctly note that the prevailing market-based approach is bound to increase societal inequalities and that this may well be a part of the reason why climate response has so far been so inadequate. For example, Klein (2020) directly argues that inequality is "toxic" to social solidarity and mass mobilization that is now required. "A successful mobilization requires that people make a common cause across class, race and gender, and that the public have confidence that sacrifices are being made by the rich as well as middle- and modest-income people" (Klein 2020:15).

In fact, the plans reviewed here present an interesting case study of climate activists coming to the realization that inequalities are central to the environmental crisis. The earliest proposals such as Bartels (2001) barely mention societal inequalities; Brown (2009) holds up the eradication of poverty (but not of inequality) as one of the goals of his "Plan B", and Gilding (2011) argues for adaptation measures that "reduce hardship and geopolitical instability caused by by the unavoidable physical changes to the climate, including food shortages, forced migration, and military conflict over resources". Particularly when contrasted with proposals made just a few years later, the focus is on global poverty and there is a lack of discussion about the effects of inequality within rich countries. For instance, Silk (2016:10) argues "in order to secure dignity and justice for all, to increase the odds of victory, and to preserve our highest ideals during this long emergency, Marshall Plan-like international aid efforts and equity-based New Deal type social welfare programs should support this World War II-style emergency mobilization of our entire society and economy" (emphasis added).

Klein (2020) repeatedly emphasizes a "just transition" that provides support and new employment opportunities to those whose livelihoods are threatened by the transition, and highlights the importance of respecting not only human rights in general but indigenous communities in particular. Klein also argues that just transition probably requires rationing of goods and services. Examining the inequality aspect even further, in their paired papers, Mason and Bossie (Mason and Bossie 2020, Bossie and Mason 2020) explicitly emphasize how the mobilization style approach would be a powerful force for more equal redistribution. In fact, Mason and Bossie's papers do not go deep into the details of what a climate mobilization would actually look like: instead, they take the feasibility of such a program as their starting point and investigate how public spending on a massive scale to avert a climate disaster could accelerate the economic transformation while serving as "an engine of growth and equality" (Mason and Bossie 2020). Finally, in the most radical of the proposals reviewed here, Malm (2020) exhorts his readers to a state-led confrontation against the vested interests that are currently hindering timely climate action. Malm argues that the state should be given wide ranging emergency powers, and predicts that the result would be broadly analogous to

"war communism" in the 1920s Soviet Russia, where the bolsheviks "stumbled from one emergency to another" with the result of radicalizing their policies.

**Catastrophes may motivate, but are they enough?**

All the proposals acknowledge the problem of mobilizing public support in favor of emergency measures. Earlier proposals assume that public support will be mobilized after a sufficiently disastrous climate event, a "Pearl Harbour moment" (Brown 2009:256) shocks societies into action and the public opinion shifts from "best we can" towards "what is necessary" attitude (Gilding 2011). These earlier proposals eschew from discussing active PR measures that may be necessary for the emergency mentality to emerge. Later ones, such as Silk (2016, 2019) and Klein (2020) tend to point out that even during the Second World War, the emergency mentality did not so much emerge spontaneously as it was emerged via conscious effort on part of alarmed politicians and the press who declared an emergency and then used mass media to educate the citizenry of the threat and what to do to overcome it (see e.g. Klein 2012 for a discussion of U.S. public opinion's role in the WW2 mobilization effort; Klein 2020 discusses the Canadian experience). As discussed above, contrary to commonly held assumption, the U.S. mobilization for instance started years before the "Pearl Harbor moment", and had required an active political struggle by farsighted politicians. As noted by most of the authors discussed here, if a "Pearl Harbor moment" is required to mobilize public support, then it may already be too late. Brown (2009:256-259) discusses three stylized models of societal change, the "Pearl Harbor moment" , the "Berlin Wall" (gradual change followed by a sudden change), and "the Sandwich" (strong grassroots movement supported by the political elite), concluding that the Pearl Harbor probably comes too late, the Berlin Wall scenario may take too long, and therefore favoring the Sandwich approach where activists push sympathetic political elites to the right direction. Whether the model is applicable in a world where reactionary far right rebels against "progressive elites" is another question, however.

In an incisive critique, Malm (2020) dissects the differences between the state-led emergency response to the COVID pandemic and the inaction on climate, arguing that the climate crisis is more comparable to the process where zoonotic diseases emerge due to biodiversity loss, and that prompt action was due to the rich being among the first rather than last COVID victims. However, Malm also notes that the public opinion is already in favor of stronger climate action, and that decarbonization policy would never have to ask the people to submit to something as unpleasant as the COVID lockdowns. In a crisis, measures that were previously considered impossible soon become self-evident policy.

**Rapid energy system transformation is a necessary but not sufficient condition**

Since cleaning up the energy system is a sine qua non of climate mitigation, all mobilization plans are chiefly concerned with rapid energy system transition. By and large, the proposals suggest a transition to 100% or nearly 100% renewable energy generation in 10 to 20 years. Most proposals provide only high-level overviews of the task required, rather than detailed plans for this energy transformation; some shorter treatments do not even go as far as to assign target numbers for various energy sources.

Brown (2009) suggested an overall global renewable energy production mix that would satisfy the world energy demand while reducing GHG emissions by 80 percent in a decade. Delina (2016) and Klein (2020) base their plans on the "100% WWS" model by Delucchi and Jacobson (Delucchi and Jacobson 2011, Jacobson and Delucchi 2011), which calls for the installation of 4 million 5 MW wind turbines, 2 billion 3 kW rooftop solar photovoltaic (PV) arrays, 90 000 industrial scale (300 MW) concentrated solar power (CSP) and PV plants, 270 new hydroelectric plants, 5350 geothermal plants, 720 000 wave energy devices, and 490 000 tidal turbines. These would provide about 90% of estimated 2030 global energy supply; furthermore, significant investments in power grid expansion, energy storage and carbon free aviation fuel technologies are required. Even though the 100% WWS model has been strongly criticised (see e.g. Heard et al. 2017, Clack et al. 2017) and one would be advised to treat it as an order of magnitude estimate rather than an exact plan, this model provides a useful approximation of the scale of transition required. For instance, to reach the goal of 4 million 5 MW wind turbines in ten years, current wind turbine installation rates (93 000 MW in 2020) would have to increase approximately 20-fold (Figure 2). Increases of similar scale are required across the board.

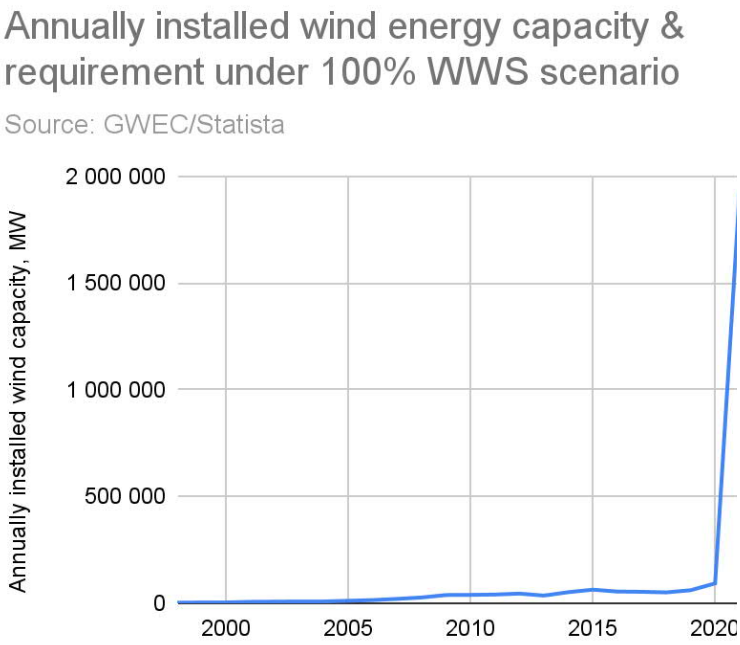


**Fig 2:** Annually installed wind energy capacity and the required increase

**Rapid transition could be cheaper than a slow one**

One of the most interesting arguments made by proponents of rapid transition (and not only by those who advocate for climate mobilization) is the counterintuitive insight that

rapid transition to a low-carbon economy could well turn out to be cheaper than a slow, gradual approach (Mason and Bossie 2020). While part of this argument rests on probable damages caused by destabilizing climate, it is very important to note that even in absence of such costs (which are difficult to calculate), rapid transition could be cheaper, if production is subject to increasing rather than decreasing returns. The textbook economics model of production suggests that each additional unit of production costs more than the last one. In such a decreasing returns situation, higher demand pushes costs up. If the supply of low-carbon infrastructure is subject to decreasing returns, then decarbonization can be painfully costly, and slow and gradual transition is warranted.

However, there are good reasons to believe that actual production of the goods required to decarbonize societies is more often subject to increasing returns. As more wind power plants, solar PV panels, batteries, electrolysers, heat pumps and countless other items of low-carbon infrastructure are produced, they are likely to become even cheaper to produce, a phenomenon variously known as learning by doing, learning curve, or economies of scale. As a result, static analyses that do not account for decreasing costs tend to overestimate the cost of transition, and support a gradual rather than rapid decarbonization. So far, the actual evidence suggests that increasing returns seem to be the norm rather than an exception - see, for instance, how the cost of solar PV installations, batteries, and electric cars has collapsed in mere decades. As Mason and Bossie (2020:13) note, increasing returns also provide the rationale for strong government support for crucial technologies (such as hydrogen electrolysis equipment, required for energy storage and to provide carbon neutral feedstock to chemical industries) at their early stage, when the technologies are not yet profitable for private companies to adopt. Public investment at this stage has done wonders before, and there is little reason to believe it wouldn't work again. Again, a coordinating function of the state would be beneficial here.

Notably, some researchers have independently argued that the proper way to calculate the social cost of carbon, i.e. the basis of proposed carbon prices, should acknowledge the fundamental uncertainties and grievous risks of worst case scenarios (Daniel et al. 2019). Calculated in this manner, the "proper" carbon price would start high, to reduce uncertainties about the effects of GHG emissions rapidly, and diminish slowly. Such a calculation suggests that rapid transition is the financially prudent strategy.

**Money is a flow, not an object**

As mentioned above, the Second World War was the first war in human history where the economy's physical productive capacity, not state finances, limited the strength of the warring nations (Lacey 2012). Modern financial instruments, ranging from loans, public bond issues and new taxes to outright money creation, permitted countries to direct the output of their economies towards the overriding goal of victory. Climate mobilization proposals argue that given the existential threat involved, a similar approach is now necessary and possible. In this thinking, money is seen more as a tool to guide the flow of physical and human resources to where they are needed: the state would borrow, tax, and create funds and then spend them in projects that serve the

overriding goal of rapid decarbonization. Disastrous inflation would be averted by draining the excess liquidity via taxation and, if necessary, by rationing inflation-causing "bottleneck" goods in the short term, while using public funds to increase their supply in the long term (Mason and Bossie 2020, see also Rockoff 2016).

Again, there is a notable difference between earlier (Brown 2009, Gilding 2011) and later (Silk 2019, Klein 2020, Mason & Bossie 2020) proposals: the former suggest levying the funds via carbon taxes, while the latter take a stance that is more aggressive and more closely aligned with the WW2 example (see Lacey 2012) in advocating for money creation and taxing excess wealth and corporate profits directly. While all the proposals reviewed here, with the possible exception of Malm (2020), acknowledge that it is only just to promise corporations a fair return on investment for work they do for decarbonization, the latter proposals argue for the adoption of WW2-style excess profits taxes and the setting of profits to a decent but not outrageous level. This is seen as necessary not only to control spending, but even more importantly, to retain a sense of fairness and justice by preventing "profiteering": as Klein (2020) notes in his review of historical experience, the WW2 mobilization effort was nearly doomed by the public's bad memories of the First World War mobilization and its outbreak of profiteering. Likewise, a climate mobilization effort would be hindered if not prevented altogether, if it were to be perceived as an opportunity for obscene profits.

**Governance is critical, and requires both community participation and vigilance towards civil rights**

All the proposals reviewed here acknowledge that it is one thing to propose drastic action like climate mobilization, and an entirely different thing to actually make it happen. The difficulties facing such an effort may seem insurmountable, but, on the other hand, so did they seem in 1938. The proposals realize that in order to turn policy suggestions into concrete hardware, a variety of governance mechanisms are probably required. As the discussion about climate mobilization is still in its early stages, it is understandable that the proposals are not particularly detailed. However, some, such as Klein (2020), Silk (2019) and Delina (2016) go into considerable detail about what kinds of government agencies could be plausibly required, based on the WW2 experience. On an international level, Delina (2016) proposes a body of comparable status to the U.N. Security Council to oversee the transition.

The post-2016 plans in particular emphasize the need for citizen and community participation in the setting of objectives and in actual execution of the plans. As noted in the above section on inequality, there is clearly an increasing awareness that environmental measures have to be perceived as just. For example, whereas the 2008 proposal by Spratt and Sutton rather casually mentioned that labor planning may be needed (implying that the government would direct workers to where they are needed), the 2020 book by Klein examines in considerable detail a three-tiered support structure for people affected by the transition. At individual worker level, income support, early retirement, training and education, relocation support, and other support measures are offered; at a community level, communities reliant on fossil industries are to be provided with help on recruiting new industries and employers, as well as green

infrastructure and energy projects; and at the macro level, broader issues of climate justice and the transition to an equitable post-fossil economy are considered.

That said, it seems likely that Malm's (2020) observation is correct, and some measure of coercive authority would probably be required. Malm and Klein in particular express concern that emergency response that by necessity would involve at least some coercion could easily end up trampling democratic and civil rights (a threat expressed in Kester and Sovacool's 2017 critique of climate mobilization metaphor as well), and exhort for vigilance in ensuring that no vulnerable group is sacrificed, like the "enemy aliens" were during the Second World War. Both Klein and Malm are also concerned that the rise of climate denialist far right, or outright "fossil fascism" (Malm 2020) could occur.

**War metaphor relies almost totally on North American World War II experience**

Climate mobilization plans reviewed here draw from a singular experience: that of North American countries, USA and Canada, during the Second World War. At least in English, studies that more than mention the experiences of other countries as examples to follow are extremely rare, and experiences of wars other than the Second World War are mentioned only in passing, as in Klein (2020) when he uses Canada's First World War experience as an example to avoid.

Speculating on the reasons why is somewhat beyond the scope of this paper, but we can hazard a guess that one reason is the different public perception of the war in North American and European experience. In Europe, the war was enormously destructive: in North America, aside from relatively few men suffering on distant battlefields, the war was practically an economic boom with few if any downsides to those whose friends or family were not directly fighting. Based on our discussions with European environmental activists, we believe the "war metaphor" indeed seems to be far less favorably received in Europe, compared to its reception in North America.

Perhaps as a consequence, the most detailed European proposal we were able to find for comparison was a proposal for "ecological reconstruction", which borrows its central metaphor not from the war but from Finland's post-war reconstruction effort (Järvensivu et al. 2019). As its authors argue, the reconstruction metaphor may well be a more suitable metaphor for the conversion of the economy to a sustainable footing. "Reconstruction" implies a long process of rebuilding and repairing the existing, damaged institutions, whereas the mobilization metaphor implies a short, sharp break from the normal, followed by a return to status quo once the imminent threat is defeated. What's more, the reconstruction metaphor avoids the problematic connotations with war and militarism, which - as argued by Kester and Sovacool (2017) in their critique of Delina & Diesendorf (2013) and Delina (2016) - risk "militarization" of the climate effort and the adoption of zero-sum competitive mentality on part of participating nations. As Kester and Sovacool ask, do we really want to go to war?

That well justified cautionary note withstanding, there are benefits to be had from studying the North American experience. For one thing, for all their differences, the U.S. and Canadian economies in the 1940s operated according to principles pretty much similar to those that are now universal among industrialized countries. The North American mobilization serves as an "existence proof" that largely democratic countries

whose market economies were almost entirely based on private ownership could direct immense resources towards solving a pressing problem, and that the public opinion can be steered to approve it. If nothing else, the history of war mobilization shows that humanity is still far from having been knocked out of the climate fight: in reality, we haven't yet even begun to fight. Even if a destabilized climate causes far more devastating disasters than it has hitherto done, our societies retain stupendous if latent powers that they could marshall for the common good. Simply remembering that this is possible and has been done before, on a far larger scale than anything that is yet required for stabilizing the climate, is an advantage, and an argument against despair. As the famous poster put it, we can do it.

## 5 Discussion

*"The fatal blow to the conventional wisdom comes when the conventional ideas fail signally to deal with some contingency to which obsolescence has made them palpably inapplicable."*

J. K. Galbraith, The Affluent Society

As famously noted by J. K. Galbraith, the enemy of the conventional wisdom is not new ideas but the march of events. It is therefore unlikely that climate mobilization ideas by themselves will ever cause the governments to adopt such drastic policies. However, it is completely conceivable that some future circumstances provide the sufficient impetus for the adoption of more drastic policies. Even if climate mobilization "contingency" plans are unlikely to be enacted in full, their existence helps to move the terms of what is perceived as conceivable and what is not, i.e., the Overton window of climate policy ambition towards targets that are, in light of climate science, more realistic and conducive to the survival of human civilization.

This paper is a general and in many ways a preliminary review of the climate mobilization approach but leaves several questions open for exploration. We seek to continue our exploration into this topic in further papers, and welcome others to collaborate with us. Breaking from the limited conventional wisdom calls for historical and non-Western insight along with philosophical and ethical considerations. In the following, we recognize some historical research avenues and connect the topic to wider philosophical discussions.

Further historical research could, first, expand the scope of inquiry towards the experiences and lessons learned in other participants of the Second World War, and second, learn from the mobilization efforts for other emergencies to form a more comprehensive picture of emergency economic and industrial policies. Also the policies and institutional arrangements of the post-war reconstruction - the inspiration for the idea of ecological reconstruction - could be studied in more detail to allow for more historical models for climate mitigation apart from the New Deal in 1930s and wartime policies in the 1940s.

An important thread in further historical research would be the limitations and dangers of the mobilization approach and the war metaphor. Aside from the paper by

Kester and Sovacool (2017), there is little academic critique of the use of war metaphor to promote climate action. We suspect, but do not know, that aversion to the war metaphor is greater in Europe than it is in the United States for instance. What alternate metaphors could convey the sense of urgency and collective commitment? Could the "ecological reconstruction" metaphor of Järvensivu et al. (2019) be a better choice for a broad-based movement, or would we be better off by pressing for a Green New Deal instead?

Fertile ground for research may also be found in the study of Cold War contingency plans for industrial mobilization and "total defence". In the U.S. for instance, the lessons of the industrial mobilization were thoroughly studied in the immediate post-war period and volumes of material, often originally classified but now available, were prepared so that the hard-won lessons from two world wars would not have to be learned again (see e.g. Yoshpe 1953). This planning was abandoned once the reality of thermonuclear war sunk in: from the early 1960s, it became clear to everyone that a war between the superpowers would be over well before factories could be converted to war production, and quite possibly before the factory workers had time to duck and cover. However, these now obscure plans, and other contingency plans from smaller powers who adopted a "total defence" strategy, such as Switzerland, Sweden and Finland, should be combed through with the intention of finding insights that could be useful for climate mobilization or for other unexpected contingencies.

After all, the climate crisis is only a part of a broader sustainability crisis, and sustainability crisis is merely one threat facing the human experiment. The most dangerous dangers tend to be those we fail to foresee, and there may well come a time when humanity has to undertake an effort as or even more strenuous as the Second World War. Particularly in the close aftermath of the COVID pandemic, it seems unwise to not consider, coolly and before there is a pressing need, the problems a large-scale societal response to some crisis would entail.

The apparent limits of conventional policy framework to address the sustainability crisis raises a need for a more comprehensive evaluation framework. In addition to historical research, this invites fundamental philosophical and ethical questions.

Within philosophy of technology there is a spectrum of attitudes towards technological modernity, from the pessimist and even primitivist views to techno-optimist and techno-solutionist ones. Climate mobilization in general falls into the optimist side. In contrast to the techno-pessimist critiques, the mobilization approach does not call for political revolutions or rollback of the technological society. It does not view technology as such as the problem, but the current technological structures resting on fossil fuels and carbon emissions. Decarbonizing technological infrastructure and the economy can be done within the current political institutions with relatively small legislative and institutional reforms.

Unlike some accelerationist forms of techno-optimism though, the mobilization approach is not reliant on new technologies, e.g. geoengineering, solving the environmental wicked problems. As the source of historical inspiration might suggest, the technological solutions in the climate mobilization are instead quite traditional, based on products that are well developed and commercially available. Further, the techno-solutionism of the mobilization approach is not deterministic but stresses a

range of active political measures - investments in the research and development of new technologies are only a part of the project.

The advantage of the mobilization approach is that it operates within historical experience of the modern industrial societies. There is no need to rely on technologies that do not yet exist and no need to comprehensively reimagine the political institutions. The policies proposed are something that have already been tried and found functional. It is relatively straightforward to start implementing the policies. However, further evaluation in the light of critical philosophy of technology would allow the optimist rapid climate mitigation and especially the energy transition to stand on a more solid footing.

Especially non-Western perspectives to rapid climate mitigation and the metaphor of wartime mobilization are much needed for several reasons. First, people in the Global South are in the most dangerous position in the face of ecological crises. The success or failure of the environmental policies affect their survival rather directly. Second, they are often the least advantaged people in global production chains. Industrial and economic policies in the Global North are likely to affect working and living conditions in the South. Third, if Europeans are less likely to have a glorified experience of the Second World War compared to North Americans, non-Western people are even less so.

Finally, even accepting the premises of the climate mobilization approach there are several more concrete research questions to answer regarding the policies and institutions of the mobilization. What is the status of the current governments around the globe and their readiness to implement rapid mitigation policies? How to do the transition from business as usual to emergency measures and back again? More generally, from the starting point of non-interventionist governments and their market-based economic, industrial and technology policies, how to set up institutions that are able to coordinate economic and technological activities towards a sustainable path? One possible avenue of approach would be to link these discussions with ongoing debate about “mission-oriented” industrial policy, as proposed by Mazzucato (2020) and others.

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