Taking Down-to-Earth and Timely Action: An Axiological Examination of Climate Policymaking

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Abstract

I propose a threefold evaluation scheme for climate policymaking given value-based uncertainty in the interaction between science and policy. The carbon reduction target (CRT) is the example under examination. Using the comparison of the UN and Taiwan, I show that neither global agreement nor social trust in scientists is necessary for climate action when those value tensions may not help reduce uncertainty in implementing the CRT and evaluating its effectiveness. Moreover, reducing climate action to the CRT is epistemically and ethically risky. Socially responsible scientists and policymakers must communicate such risks to society in due process for improving climate policy and action.

1. Value-based uncertainty

This section characterizes three types of value-based uncertainty composed of various value tensions in the epistemic and political arenas. These tensions arise in climate policymaking whenever one must decide on (1) whether to conduct more research in order to enlarge the range of policy options, (2) considering losses from overestimating or underestimating risks and (3) including more general or specific information.

As conventional wisdom in philosophy of science often assumes, epistemic as well as non-epistemic values promise to reduce scientific uncertainty (Kuhn, 1977; Longino, 1996; Douglas, 2000). However, these mentioned types of value-based uncertainty may create not only difficulties in implementing the carbon reduction target (CRT) and evaluating its effectiveness but also opportunities for tackling wider consequences of climate change.

1.1. More research?

Science that helps to identify social problems and solutions has been a prominent feature of modern policymaking and governance for decades (Jasanoff, 2005; Kitcher, 2001). This political vision has been assumed in various management practices from ozone depletion to energy crises (Sarewitz, 2011). Science can help *fulfill* political missions. More research suggests that more problems and solutions may be identified, and that the problems may be solved or alleviated.

More research is, however, not necessarily conducive to *fulfilling* political missions (Rayner, 2012; Sarewitz, 2004), as it may, on the contrary, invalidate assumed political goals, or reveal their failures. For example, detailed analyses of geological drilling samples might invalidate a chosen location for permanent nuclear disposal (Shrader-Frechette, 2014). The government's claim of water quality improvement on hydrological modeling might fail as real water quality monitoring data showed it to be false (Rayner, 2012).

As the CRT has been validated based on the quasi-linear relationship between global mean temperature and human-induced carbon emissions, the political goal of avoiding the catastrophic consequences of the former is pursued by reducing the latter (Weingart et al., 2000; Asayama et al., 2019).

The first type of value-based uncertainty, thus, appears as one considers whether to do more research for enlarging the range of policy options. As an example, let me start with the contrast between the values of enhancing human conditions and of enriching understanding, to show how the commitment to different values through more research may challenge this relationship as well as the political goal.

In the pursuit of the value of enhancing human conditions, the concepts of solar radiation management (Stilgoe, 2015) and carbon sequestration (Sohngen & Fuss, 2010) might challenge the goal by disconnecting carbon emissions and temperature. Global mean temperature may be reduced by manipulating solar radiation, even if the greenhouse-gases (GHGs) concentration remains high. Carbon sequestration may likewise keep the temperature low by actively adjusting the GHGs concentration. These research projects may suggest the possibility of buying time and making up for delayed climate action by postponed mitigation.

By contrast, research on improving the understanding of carbon storage resulting from the interaction between historical natural forcings, pre-industrial human activities, pandemics, and depopulation might reveal potential failures of the same goal. This is because the current goal might not be sufficient to secure climate conditions by excluding underexplored factors that potentially bring about socioeconomic impacts such as those in the post-Columbian Great Dying (Koch et al., 2019). Hence, the assumed "pre-industrial" state of the climate might have seriously mistaken the human-induced impact on the climate before the Industrial Revolution as if the climate had never been influenced by human activity, a natural state which can and should be ideally restored. As a result, one could argue that this insufficient understanding leads to misguided climate policy, ignoring existential risks of human activity other than carbon emissions.

The other example is that the values of consistency and accuracy can exhibit a tension in evaluating knowledge claims assumed in scientific advice on the CRT (Oreskes, et al. 1994; see also Section 3.3). For being consistent with the energy-consuming socioeconomic assumptions and the policy goal used since the 1990s, the baseline, no-policy scenarios in the IPCC AR5, may be found detached from the real world. Climate modelers used these scenarios as exploratory model input for speculating about the most probable future socioeconomic and technological conditions without policy intervention, and for estimating the effects of different policy options associated with different socioeconomic pathways.

However, a more accurate comparison between the projected fossil fuel demand in those no-policy scenarios with the global trends in the actual and the projected fossil fuel demand by the International Energy Agency shows that the assumed no-policy scenarios do not accurately represent these global trends, which are already shifting toward the IPCC sustainable socioeconomic pathways (Pielke & Ritchie, 2021; Lomborg, 2020; Ritchie & Dowlatabadi, 2017). The ongoing climate goals might thus need updates. Otherwise, the apparent policy effectiveness of any measure for carbon-reduction might result from a comparison of the real-world trends with inaccurate no-policy scenarios. The mentioned consistency about no-policy assumptions may furthermore indicate that the climate research community is conservative in developing policy-relevant knowledge (Oreskes et al., 2019).

1.2. Losses from overestimating or underestimating risks?

The CRT has been emphasized in the hope of avoiding consequences of climate change. Accordingly, the second type of value-based uncertainty may arise in deciding how one must weigh such consequences.

First, stressing technological innovation or intergenerational justice may lead to a different choice of social discount rate to approach the CRT (Broome, 2008; Pielke et al., 2008; Frisch, 2018). The losses from overestimating or underestimating climate risks may result from choosing an inappropriate social discount rate, as such a choice normally relies on the present estimations of future epistemic and material abundances. Based on these estimations, the present generation decides on whether their costs for developing climate measures are wisely invested and timely.

If future generations are estimated to be epistemically and materially better off than the present generation, one might find it wiser to shift the current, troublesome issues of climate change to the future replenished with advanced technologies. The future generation may be able to solve the issues at a lower cost, while the cost for the present generation appears too high (Lomborg, 2020). By contrast, if future generations are estimated to be epistemically and materially worse off than the present generation, then the present generation must take urgent action. Otherwise, the future cost may be higher than some indefinite future generation can afford, which will result in injustice (Broome, 2010).

Thus, whether an action is timely without overestimated and underestimated risks depends on how reliable the present estimations of future epistemic and material conditions for future populations can be. However, there remains no robust result about these, which can be reliably drawn from the existing IPCC scenario research (Pielke & Ritchie, 2021).

Second, stressing individual choice or social welfare may lead to a different understanding of losses from climate risks on the population level. For example, future losses may be overestimated due to an underestimation of the population effect (Broome, 2015). That is, a natural depopulation from a voluntary reduction in fertility may occur as the present generation makes their well-informed decision about reproduction by taking the expectedly unbearable climate conditions of future generations into account. The projected losses of a large future population might not be updated so that the ongoing climate measures might appear overdrawn later, as a future population smaller than expected will suffer from a world with unbearable climate conditions. Such a depopulation may, however, bring about losses from underestimating the risk of failing to secure a social security structure that can sustain social welfare for the present population such as pensions as well as the public funding to respond to climate change.

Besides, some studies show that population-relevant risks such as negative economic development, pandemics, and regional nuclear war have not been included in those projections, simply because they are politically unacceptable (Morgan & Keith, 2008; Pielke & Ritchie, 2021). Such preferences can lead to a systematic bias in understanding socioeconomic pathways and their consequences on the climate. These relevant risks and losses should have been included in the debates on economic policy based on the reliability of long-term demographic projections and risk studies, which do not exist in the recent climate policy debates.

The last example is that the contrast between simplicity and plurality in coping with consequences of climate change may lead to a different understanding of policy options. A policy focus on the simple CRT may be easier for international political coordination, but it can also lead to negligence of anthropogenic climate change in other forms (Chen et al., 2020; Shepherd & Sobel, 2020; Riahi et al., 2017). For example, attributing the observed increase in temperature in urban areas to carbon emissions may misunderstand the warming effect of urban heat islands and urbanization. A mistaken account of this warming may lead to a misunderstanding of climate change and of the effectiveness of the CRT. These may result in missing out on other policy options regarding land-use change such as transforming building materials, architectural design, and urban planning, which can contribute to a larger, regional increase in temperature than that from the GHGs. Weighing these options can become tougher when limited resources for managing the overall heating and solutions are in conflict.

1.3. General or specific information?

The third type of value-based uncertainty appears when emphasizing generality or specificity in information pooling for policy. Climate policy of any sort relies on knowledge claims about the climate, for instance, the CRT and the mentioned linear relationship. Such knowledge claims demand social attention in the context of policymaking. Studies about the climate produced by scientists in relevant fields, in particular those of the IPCC, have been considered authoritative and invoked for political decision-making in a global context (Shepherd & Sobel, 2020).

However, this assumption has created an epistemic situation, where some specific populations can challenge global claims about the climate on their epistemic grounds. I term it *the coherence problem of specific and general information*. For instance, it is known that the current climate projections of general circulation models have a higher degree of uncertainty regarding the dynamics of precipitation patterns in the tropics, and are unable to discern the distribution of precipitation within small regions such as London and Taiwan. Such limited resolution could be of great practical significance, as people living in these areas might find that global claims about local precipitation patterns do not agree with their on-site experience.

Moreover, when one assumes claims that the differences in carbon emissions are relevant to the 1.5-2.0 °C global mean temperature and the rise of the sea-level, Uyghurs and Himalayans might find it difficult to understand how the climate crisis can occur. The reason is that their everyday experience includes daily temperature oscillations of more than 20 °C, and their settlements are thousands of kilometers away from the seashore. Some indigenous groups in the Americas might feel ridiculed as the future climate scenarios are described by experts to be catastrophic, while their cultures have already perceived the present world to be dystopic, as compared to their world before European settlement (Whyte, 2018; Tuana 2012).

Therefore, such contrasts between knowledge produced by specific experiences, geographies, histories, etc., and information derived from global models exemplify the coherence problem described. Such incoherence may impede global climate action (see also Section 3.3.2). Local populations realizing this incoherence may come to believe that a global target of reducing carbon emissions alone has little connection to the problems they are facing.

2. Two models of climate policymaking

To contextualize these value tensions, I compare two apparently incommensurable models of climate policymaking: the UN and Taiwan. I show that neither global agreement nor social trust in scientists is necessary for climate action. Additionally, the mentioned value tensions within a global agreement, such as the Paris Agreement, may not reduce uncertainty in implementing the CRT and evaluating its effectiveness.

2.1. The UN model

The standard global setting for climate policymaking is under the UN framework since 1992, where the Member States tackle climate change in the light of the scientific import and policy advice from the Intergovernmental Panel on Climate Change. Carbon reduction has been included in response to climate change in the international agreements from the United Nations Framework Convention on Climate Change of 1992 (UNFCCC) to the Kyoto Protocol of 1997 to the Paris Agreement of 2015.

In the Paris Agreement, Article 2 states the first of its aims to be “Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels." And "Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development" and "Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development" follow as its second and third aims.

How to implement these general aims has been relegated to *nationally determined contributions* (NDC), with which each Member State makes and reports their own goals based on their capabilities for the regular reassessment of progress. The goals and capabilities can vary strongly at national and international levels.

Pielke and Lane (2020), for example, note that the organizational structure of the United States climate advisory committees have made themselves too sensitive to the president's value commitment, as they are appointed by the president. In a White House statement (2017), in which the president states his reasons for the withdrawal from the Paris Agreement, he claims that the US should pay a lot for subsidizing developing countries but will have to decimate jobs and revenues of specific American industries such as steel, cement, and coal. On the other hand, developing countries such as China are still allowed to continue more emissions and coal plants while receiving a large amount of subsidy from developed countries. The Agreement seemed unfair to him, as some national and international interests might be in tension. As the former President still received more votes in the second election than in the first one, this political value commitment still seems to have its weight.

Also, some studies show that the demography of Trump voters is highly correlated with the non-Hispanic white working class which has experienced worsening labor-market opportunities. Their life expectancy has been decreasing and suicide and drug abuse rates have been increasing in the past two decades of globalization, which is unique in developed countries (Case & Deaton, 2017; POLITICO, 2017). In this sense, restricting carbon emissions by cutting off relevant opportunities may worsen their living conditions (see also Section 3.1).

The upshot is that the American climate policy may not be sufficiently consistent from administration to administration. Such a policy inconsistency cannot be avoided in the American democracy, and it is hard for the climate advisory board to shield its scientific advice from political pressure. While the Republicans' and Democrats' opinions about climate measures disagree (PEW, 2020), a climate policy subject to the bipartisan settlement would be more stable on a long-term basis than a political appointment in a short-term presidency (Pielke & Lane, 2020). For convenience, I will hereafter use the American case for contrast.

2.2. The Taiwan model

By contrast, three features of Taiwan's Greenhouse Gas Management and Reduction Act of 2015 (GGMRA, 溫室氣體減量及管理法) seem to be remarkable. First, Taiwan has never been a Member State under the UNFCCC, but this international framework is assumed in Article 4 of the Act. Second, according to the legislative records, the

Act was first proposed by Executive Yuan (行政院, the Administration) in 2012, and passed by Legislative Yuan (立法院, the Congress) in bipartisan agreement and promulgated in 2015, even earlier than the Paris Agreement.

One might expect that these two features indicate that its Congress well represents the Taiwanese citizens who trust in scientists and believe in climate change. No. The third feature is that Taiwanese citizens generally do not have a lot of trust in scientists, but most of them believe in the reality of serious anthropogenic climate change.

Pew Research Center (2020) reports that only 17% Taiwanese (43% Germans, 23% Japanese, 38% Americans) have *a lot of trust* in scientists, while 42% have *some trust*, to do what is right. However, in the same report, 80% Taiwanese (64% Germans, 70% Japanese, 53% Americans) believe that climate change is a very serious problem, and 78% Taiwanese (58% Germans, 49% Japanese, 49% Americans) believe that human activity contributes a great deal to climate change.

As a result, Taiwan appears to have developed a normative framework for climate action without international pressure, roughly in line with the international standards, based on climate science, approved by its Congress in bipartisan agreement. Moreover, such a framework is not supported by a lot of social trust in scientists, but by a firm belief in serious anthropogenic climate change (see also Section 3.2).

3. The threefold evaluation scheme for the CRT

Agreement and social trust in scientists are normally assumed to be preconditions for climate policy, which might be true in cases like the US. The Taiwan model provides a counterexample. The assumption of social efforts to combat serious anthropogenic climate change via carbon emission reduction before and after the GGMRA has never been challenged by policymakers, critics, or even industry leaders.

No significant criticism of the Act demands more research, blames scientists for overestimating risks, or complains about legally bound periodic assessments of governmental progress in the Taiwanese media. Besides, academia, media, formal education, and NGOs have actively replenished the global concerns with more local specifics. There appears to be *something* that aligns the value-based uncertainty in the Taiwanese context.

My novel attempt here is to show how to clarify the aforementioned value-based uncertainty regarding the CRT if taking effective action to climate consequences is preferable.

3.1. Telic and instrumental values

I propose the first distinction as an alternative to the traditional distinction between epistemic and non-epistemic, and that between constitutive and contextual values in philosophy of science (Kuhn, 1977; Longino, 1996). I use it elsewhere to analyze debates on values involving multiple epistemic and practical systems, particularly in intercultural settings, such as the reception of Western science in East Asia.

A telic value is a value assumed in choosing a specific goal, while an instrumental value is a value assumed in choosing a specific strategy for reaching the goal. The former should be synergistic with as many instrumental values as possible, while the latter should not be antagonistic to the former.

Let us return to the CRT in those normative frameworks. Is the CRT a goal chosen in the light of some telic values, or a strategy chosen in the light of some instrumental values?

Apparently, it is a goal that is normally mentioned in the aims and characterized as a target. But it is actually of instrumental value for reaching something else. For instance, in Article 3 of the UNFCCC, the first guiding principle states "The Parties should protect the climate system *for the benefit of present and future generations of humankind* [emphasis added]"; in Article 1 of the GGMRA, the reasons for implementing the CRT is to "Strengthen environmental justice and the shared responsibility of environmental protection and *national development* [emphasis added]." In these normative frameworks, the quoted sentences are statements about their assumed telic values. The commonality of the two articles refers to a sort of utilitarian argument, that is, either for the benefit of present and future generations, or national development.

Given that the CRT is of instrumental value for these telic values, we can evaluate it by asking whether the CRT is antagonistic to these telic values.

Since I have not found a clear struggle in the Taiwanese context (some indirect ones discussed in Section 3.3), we use the American example to examine the telic value assumed in the UNFCCC. Can the CRT be antagonistic to "the benefit of present and future generations of humankind"? A risk can arise if it can contribute to an increased rate of mortality and morbidity of particular populations experiencing worsened labor-market opportunities (Case & Deaton, 2017; POLITICO, 2017). As a result, the telic value of the benefit for part of the present generation is not necessarily enhanced or even decreased via carbon reduction measures. The principle does not indicate how one should choose between the benefits for the present and future populations if there arise some conflicts such as a decrease in the benefit for part of the present generation and the climate risks for future generations. Such conflicts should have been particularly addressed in climate policymaking.

However, although the CRT might be in some respect antagonistic to the utilitarian telic value of the UNFCCC, it does not suggest that carbon reduction is necessarily unachievable (PBL Netherlands Environmental Assessment Agency, 2018). In the same White House statement (2017), the president recognizes that "between the years 2000 and 2014, the United States reduced its carbon emissions by 18-plus percent," "not through government mandate," but "through innovation and technology of the American private sector." This range was even slightly larger than the German attempt at pricing carbon during the mentioned period (Pielke, 2012).

This mentioned long-term carbon reduction effect since 2000 suggests that the CRT in the UNFCCC could be, to some degree, met without substantial bipartisan agreement on paper. There appear to be possibilities that have brought about positive climate effects, given that there exist intensive tensions of political telic values. Such possibilities of reducing carbon emissions might even be conducive to all partisan telic values, regardless of the alternate attitudes to the CRT of the presidents.

3.2. Blocking and enabling social robustness

The second distinction is introduced to analyze political reliance on science, and its risks harming both science and society, such as coercive population control as well as fake science used in climate denialism.

Social robustness is an evaluative concept for analyzing the suitability of science-relevant action in society (Carrier & Krohn, 2016). Generally speaking, a specific science-relevant action is socially robust if enabled or blocked within a sufficiently wide range of telic value commitments. These two types of social robustness constitute an evaluative benchmark for *whether or not* scientifically recommended policies or actions and their effectiveness can be appropriately tested in social context. That means a socially testable policy or action is one that is *enabled AND not blocked* within a sufficiently wide range of value commitments.

In this respect, the contrast between Taiwan and the US is that the CRT is not blocked in the former, but partially blocked in the latter. My analysis of telic values in Section 3.1 partially accounts for this American blocking of social robustness. One might speculate that it is the American antagonistic party setting that contributes to blocking social robustness. However, the GGMRA was passed in bipartisan agreement without party confrontation.

Largely ignoring details, I briefly discuss two social, empirical conditions that favor such a science-based policy to be enabled and *not to be socially blocked* in the Taiwanese context: 1) perennial natural disasters and 2) formal science education.

The common, direct experiences of perennial natural disasters such as typhoons and earthquakes are usually more horrifying than the standard description of the worst climate scenarios. In particular, typhoons strike Taiwan almost annually, and nearly "everyone" can experience how catastrophic they can be. One can hardly be skeptical about climate risks so that the social threshold for enabling the CRT is lower (one might relate why the social threshold for enabling a mask mandate in Western countries is so high). By contrast, in addition to the unresolved telic value tensions, the Californian wildfires or Louisianan hurricanes are no direct experience shared nationwide, which may create cases of the coherence problem (see also Sections 1.3 and 3.3.2).

Of course, such a characterization involves science miscommunication because it lumps meteorological and climatic phenomena together. Translating simulation-based climate risks into direct weather perception with a reachable deadline has become a dominant journalistic strategy for science communication about climate change (Asayama et al., 2019). Since the Taiwanese media frequently connect climate change with stronger typhoons and persistent hot weather, everyone can understand its badness. As one projects catastrophic climate consequences via media-focused, perceivable weather phenomena, one could ignore that the rates of mortality and economic losses from climate-related risks such as floods, cyclones, and wildfires have been, counterintuitively, largely declining over the past century (Lomborg, 2020). The betterment of popular news media, however, has led to an impression of a counterfactual world with increased climate damage, which may be an example of psychological negativity bias (Rozin & Royzman, 2001). Such an incoherence between the long-term climate damage trend and short-term weather perception attracts little discussion in the Taiwanese context.

The second condition is about science education. Although the 2020 Pew survey shows that a large portion of Taiwanese people do not have a lot of trust in scientists, most of the Taiwanese citizens have 8-to-10-year formal science education (90%, 2017, from the 3rd grade on, before higher education). For example, the course content about the Kyoto Protocol was included in the official 9th grade earth science textbook as early as in 2000. Course materials have been selected, written, and updated by university professors in relevant fields. Specific content about climate change in the Taiwanese context has also been included for years. Given that most people no longer care about scientific content after graduation, one has at least some common basis for discussing and thinking about its social relevance.

3.3. Openness to epistemic plurality and social responsiveness

I argue elsewhere that openness to epistemic plurality (OEP) and social responsiveness (SR) are two essential instrumental values in disaster policymaking, where knowledge claims carry weight in policy options such as earthquake forecasts for earthquake policy. The lacking of both OEP and SR can make scientific claims unintentionally harmful to science and society.

They are emphasized in science communication for prioritizing management strategies given a wide range of social value commitments. OEP stresses the importance of not prematurely excluding epistemic alternatives, and SR stresses that of one's self-awareness of doing good to others to the best of one's ability.

OEP in/between epistemic communities is best suited to reduce epistemic risks by enhancing alternative plurality and additive plurality of knowledge claims. In terms of knowledge space, alternative plurality is enhanced to synchronically minimize the chance of being wrong, while additive plurality is enhanced to diachronically maximize the chance of being right; SR is best suited to reduce ethical risks by distinguishing the social roles between scientists and policymakers, as well as their knowledge claims as expertise, or as policy advice. Policy advice is a subset of expertise but serves specific political purposes assuming specific political telic values.

Stressing these two instrumental values, I compare the recent American and Taiwanese modes of communicating the CRT by the governments and their respective epistemic and ethical risks.

3.3.1 Openness to epistemic plurality and epistemic risks

As the Taiwanese climate action guided by the GGMRA specifically targets the challenge of carbon reduction, the Bureau of Energy, Ministry of Economic Affairs takes the lead in increasing the investment in renewables over years. This emphasis on energy dominates the policy discussion of climate change and its socioeconomic impact.

This legal preference has led to an epistemic risk of ignoring other forms of anthropogenic climate change which lack governmental incentives and social attention but contribute much to local climate conditions such as temperature and precipitation patterns (see also Section 1.2). Alternatively, more research may have been needed to address problems of the urban environment, which can intensify the mentioned changes on an everyday-life scale more than the GHGs. That means the current policy lacks alternative plurality. The energy-focused climate action can lead to a false assessment of the ongoing climate policy, which does not address the mentioned forms of climate change. Notably, how such local climate responses can conflict with the ongoing policy deserves further research.

By contrast, the current lack of OEP appears in the US, as scientists producing the IPCC and the US national climate assessments all assume the same baseline, no-policy scenarios (see also Section 1.1) as if there are no epistemic alternatives, assuming other probable socioeconomic and technological futures. Such a choice can lead to a limited view on policy options in response to climate change, as a large part of the scenario literature is disregarded that lacks alternative plurality (Pielke & Ritchie, 2021; Edenhoder & Kowarsch, 2015). Similarly disregarding information appeared in the 1995 IPCC report, as the scientific advice by economists had focused on adaptation by mass migration, instead of carbon reduction. It was later criticized for the Committee not being open to alternative views in economics in the Executive Summary (Shaw, 2020). This changed composition of the Committee could be considered a positive case of additive plurality.

3.3.2 Social responsiveness and ethical risks

The energy-focused climate action and the neglect of policy-relevant information encounter ethical risks.

As the Taiwanese government has been emphasizing the importance of renewables such as wind turbines and solar panels for the governmental ideal of nuclear phase-out (Nordhaus & Wang, 2020), these energy alternatives are normally described to be carbon-free, and eco-friendly in order to attract investments. However, years later, an increased media focus has been directed to their harmful consequences. They might reduce carbon emissions but are not exactly eco-friendly.

For instance, the production and transport of these turbines and panels still largely rely on fossil fuel. As Taiwan is also a global producer of these panels, the chemical pollution in the environment due to their production and disposal has just loomed large and the recycling scheme for coping with these side-effects is yet to be completed. Besides, conflicts in land use appear, as farms and forests have been used for setting up the panels and turbines. The original ecosystems are being negatively influenced. Moreover, the installed offshore turbines have an impact on the fishery industry as the fishing grounds have been restricted. These ethical risks about specific industries and ecological disturbances have not been fully communicated by the government, and one may find the previous governmental reassurances socially irresponsive. Such negative consequences might additionally reflect a built-in preference for energy experts dominating the communication about climate solutions, underrating other expertise required for tackling their side-effects.

In the US, the neglect of policy-relevant information by both socially irresponsive scientists and policymakers can lead to ethical risks. For instance, the mentioned limited view of policy alternatives may arise out of climate research communities' uncritical use of scenarios and policy-relevant assumptions, thus reinforcing the misunderstanding of the actual socioeconomic and technological developments (Pielke & Ritchie, 2021). Their policy advice may thus be one-sided, which can wrongfully reject policy alternatives.

Also, it is ethically risky for policymakers to dismiss the established scientific advice. For instance, a day earlier than the publication of the Fourth National Climate Assessment of 2018 authorized by the Congress, the president twittered and mocked: "Brutal and Extended Cold Blast could shatter ALL RECORDS - Whatever happened to Global Warming?" The President was then referring to the extremely cold weather in the US.

This is socially irresponsible in the sense that, first of all, the president did not have scientific expertise, and could not better evaluate scientific claims. He should have focused on policy. Although the mentioned coherence problem exactly requires particular attention for climate action, it is scientifically inappropriate to use particular weather events to refute a global claim about climate change. When using specific information inappropriately, he could run an ethical risk of misleading people into the belief that climate change is unreal and thus underestimating its harm.

4. What could alternatives look like?

Section 3 presents my threefold evaluation scheme for the CRT across different contexts of climate policymaking, as the CRT is generally assumed to be the most important climate action to consequences of climate change for society and nature.

Based on my analysis of values regarding norms, action, and communication, I challenge but do not deny the importance of this policy assumption:

1) **Norms**: The CRT might have been, in some respects, antagonistic to the utilitarian telic value of the benefit for present and future generations assumed in the international agreements. Policymakers should take into account the tensions between national and international interests. Although industries and job opportunities may be created in the process of dealing with climate change, the declining well-being of particular populations potentially brought about by labor-market-related carbon reduction measures should have been addressed in climate policy debates. Moreover, identifying a 1.5-2.0 °C warmer world with a catastrophe can be misleading in relevant policy debates because some warmer climate scenarios can be more desirable than those lower than this range under specific socioeconomic conditions (Hulme, 2020), which attract little political discussion. Taken together, a commitment to a specific temperature range can be antagonistic to, and not necessarily conducive to the assumed telic values;

2) **Action**: Implementing the CRT may be partially blocked for there exist contesting partisan telic values, which should be specified for better science communication in policymaking (Edenhoder & Kowarsch, 2015). However, such value tensions are not necessarily a barrier to bring about positive climate consequences, as carbon reduction could be possible without political emphasis on the target, although this possibility is not favored by some activist groups seeking definite action (van Vuuren et al., 2012). Such a positive result from unintentional action is perhaps a chance to rethink the relationship between normative frameworks and effective actions;

And 3) **communication**: different epistemic and ethical risks of communicating the CRT can occur with or without governmental emphasis, which may lead to losses of underestimating and overestimating its effectiveness. They are generally negative for the social good.

To minimize these risks about the CRT and maximize the benefits for the present, future, social, and/or natural world, socially responsible scientists and policymakers should be open to epistemic plurality in seeking different solutions to a wide variety of consequences of climate change, which go beyond merely targeting the carbon emissions and increased global mean temperature (Asayama et al., 2019; Pielke, 2019; Lomborg, 2020; Pielke & Ritchie, 2021; Edenhoder & Kowarsch, 2015). They should also seek to make up for the losses resulting from scientific advice and political reassurances assuming this policy preference. Otherwise, consequences of climate change, in the long run, may render scientific policy advice unhelpful and illegitimate.

Scheme	Case	T. v. I values		E. v. B social robustness		OEP. & SR.	
		Telic v.	Instrumental v.	Enabling s. r.	Blocking s. r.	Openness to epistemic plurality	Social responsiveness
Characterization		1. A value assumed in choosing a specific goal 2. Synergistic with as many instrumental values as possible	1. A value assumed in choosing a specific strategy for reaching the goal 2. Not antagonistic to some assumed t.v.	Socially testable policy or action is *enabled* within a sufficiently wide range of value commitments	Socially testable policy or action is *not blocked* within a sufficiently wide range of value commitments	1. Not prematurely excluding epistemic alternatives 2. Alternative plurality and additive plurality	1. One's self-awareness of doing good to others to the best of one's ability 2. Distinctions between scientists and policymakers, and between expertise and policy advice
S 1.1	1. Solar radiation management, carbon sequestration	Enhancing human conditions	Technological innovation				
	2. Studying historical natural forcings, pre-industrial human activities, pandemics and depopulation	Better understanding nature Enhancing human conditions	- Better understanding nature				
	3. Comparisons of IPCC scenarios with IEA projections	Benefit for humankind	Consistency; IPCC scenarios consistent with its predecessors Accuracy; IPCC scenarios compared with global energy projections and recent use				
S 1.2	1. Social discount rate wrt future scenarios	Benefit for humankind	Technological innovation; better future expected, higher social discount Intergenerational justice; worse future expected, lower social discount				
	2. Population effect, present and future generations	Benefit for humankind	Individual choice; decreasing population, worse future unrealized, declining tax basis Social welfare; increasing population, worse future realized, sustained tax basis				
	3. Negative economic development, pandemics, regional nuclear war	Benefit for humankind	Politically unacceptability of some possibilities; overly idealized future, potential harm underestimated				
	4. Urban heat island	Benefit for humankind	Simplicity; CRT focused, non-carbon ACC underestimated Plurality				
S 1.3	1. Preference for the IPCC modeling expertise	Scientific truth Benefit for humankind	Generality, coherence Scientific truth				
	2. Specific experiences, geographies, histories	Empirical adequacy Epistemic justice	Specificity Coherence				
S 3.1	1. CRT in UNFCCC	Benefit for present and future generations of humankind	Simplicity, intergenerational justice; CRT focused, declining benefit for part of				

			present generation, globalization Technological innovation; autonomous carbon reduction without target on paper				
	2. CRT in GGMRA	Environmental justice, environmental protection, national development	Simplicity; energy-focused, carbon reduction Plurality; various renewables				
S 3.2	1. CRT in American society			Partially enabled, State, private sector initiatives, executive order	Partially blocked; fossil-based industries, jobs, no bipartisan agreement, coherence problem		
	2. CRT in Taiwanese society			Enabled, bipartisan agreement	Not blocked; natural disasters, science education, media, technocracy, non-UN State climate diplomacy, industrial structure, metaphysics of change		
S 3.3	1. Current policy implementation in the US					One-sided scientific advice on no-policy scenarios for science communication and policymaking Alternative views in economics	Coherence problem, underestimation of consequences of climate change
	2. Current policy implementation in Taiwan					Focusing on energy, non-carbon heating factors	Socioeconomic and environmental impacts of renewables

Table 1. Threefold evaluation scheme for the CRT

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