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A Kantian approach to a sustainable development indicator for climate

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Abstract: How can the informed citizen know if the government is implementing a good-enough climate change policy? Most developed democracies have their own set of indicators for sustainable development, including indicators for climate change. These include yearly national emissions of greenhouse gasses (GHGs), global concentration of GHGs in the atmosphere and time series for global temperatures. However, without some kind of benchmark neither national emissions of GHGs nor global concentration of GHGs or temperatures, make it possible for the general public to evaluate the current climate policy of a nation state. In this paper we propose a benchmark for national climate policy based on a remaining CO2 budget allocated by egalitarian principles. Moreover, based on Kantian ethics we argue that this benchmark should be used as a sustainable development indicator for climate change. One way of interpreting Kantian ethics is to demand that each nation state should act as if a just global treaty on climate change were in place. We discuss possible important elements in a global treaty, and show how the different elements can be integrated in a forward-looking indicator of national climate policy.

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1 Introduction

The Brundtland commission report of 1987 (World Commission on Environment and Development - WCED, 1987) brought the concept of sustainable development into politics. In the follow-up of the Brundtland report Agenda 21 introduced the concept of sustainable development indicators. The text in Agenda 21 reads as follows “*Countries at the national level and international governmental and non-governmental organizations at the international level should develop the concept of indicators of sustainable development in order to identify such indicators*”.

Today most developed countries have their own set of indicators for sustainable development. A subset of these is climate change indicators. Some of these indicators focus on the state of the *global* climate, for instance, an indicator showing the global concentration of GHGs in the atmosphere or the global mean temperature. Others focus on national GHG emissions or national energy usage, for example, national emissions as compared to the Kyoto obligations, indicators for the energy intensity of the economy, and indicators tracking energy usage as a share of GDP (see appendix 1 for an overview).

Global warming represents man's biggest environmental challenge. In spite of the fact that the current concentration of greenhouse gases (GHGs) in the atmosphere is approaching critical levels, global emissions are steadily increasing. Many argue that continued world economic growth is incompatible with the proposed stabilization targets for GHG concentration in the atmosphere. This would imply that we are on an unsustainable path.

According to Alfsen and Sæbø (1993) a sustainable development indicator should provide *condensed* and *neutral* information about the state and development of an environmental or economic asset to the general public. In our opinion the indicator should additionally make it possible for the general public (the electorate) to evaluate current national policies (their politicians). As long as the indicator concerns states of the environment/natural resources over which the national government has some level of influence or control, there is a clear (sometimes even causal) link between government policy and bad performance on the indicator. However, none of the existing indicators for climate change fulfil this criterion.

Firstly, a physical climate change indicator showing a bad or disturbing global trajectory of GHG concentrations does not tell much about the current climate policy of a nation state. Most countries' emissions seen separately are simply too small to make any significant difference to global physical climate. Further, the indicators that focus on national emissions or other related physical accounts like energy usage fare little better, since they do not have any benchmark. For instance, projections of the global temperature based on current developments indicate that we will see higher levels than the commonly agreed target of maximum 2 degrees Celsius by the end of the century. Nevertheless, an indicator measuring EU's compliance with the Kyoto treaty would turn out positive, since the Kyoto treaty is insufficient in several regards. The existing indicators are backward-looking, with no foresight-component that addresses the future requirements of each nation state to impending global warming.

The rationale for having sustainable development indicators is to provide information in an engaging, easy communicable form that potentially can be used by the informed citizens to evaluate the current policies of the nation state. Thus, indicators for national climate policy should do more than simply report the state of the global climate or the absolute level of CO₂ emissions from a nation state.

In this paper we work out a proposal that the climate policy indicator can be based on Kant's categorical imperative (to be presented below). This imperative implies that the climate policy of a nation state should be judged by the extent it contributes to the global solution of the

climate change problem. Obviously this can be interpreted in a number of ways. We understand this to mean an ethical norm that *each nation state should act as if a sufficient global treaty on climate change were in place*.

There are a series of choices that must be made when constructing a forward-looking climate policy indicator. The first, and most basic, concerns the ethical foundation for the indicator. In most discussions on climate policy, the framework of cost-efficiency is used, which frames the discourse in economic utilitarianism: The climate policy should be chosen that contributes to the maximisation of utility and thus social welfare of its citizens. It is a consequentialist ethics, which restricts the scope to include the nation state's citizens and excludes concern with other nation states' citizens or global ecosystems.

An alternative approach to the state-centred utilitarianism is a Kantian ethics, which is based on duty rather than consequences. The first choice or question therefore becomes:

- 1) Should the climate policy indicator be based on state-centred utilitarianism or Kantian ethics?

If utilitarianism is chosen, one can then construct a climate policy indicator based on cost-efficient fulfilment of international obligations and on the capital approach (more below). If Kantian ethics is chosen, the second choice becomes:

- 2) What kind of benchmark should a sufficient global treaty on climate change have?

We propose that it should be based on the 2⁰ C degree target. This target makes it possible to calculate the remaining global GHG-emission budget. The third choice is then:

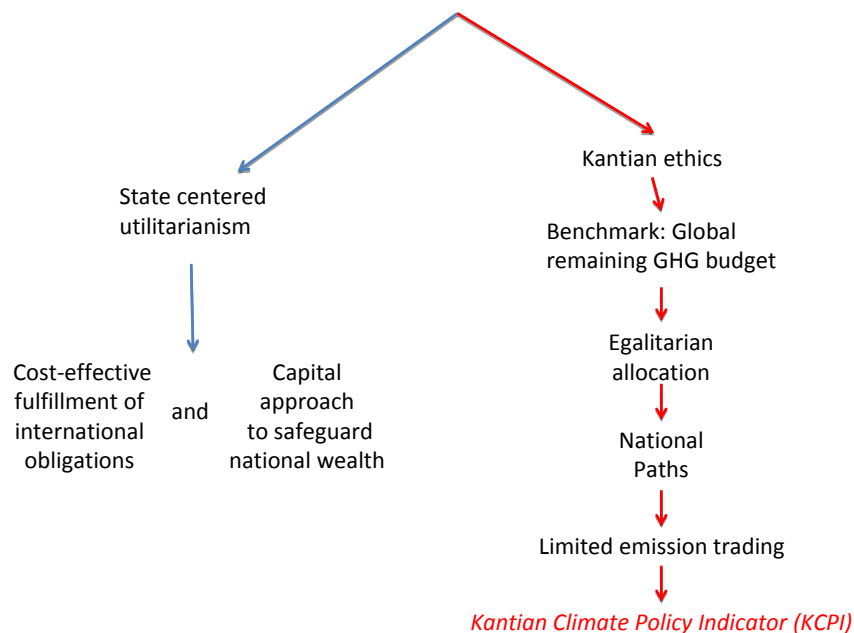
- 3) How should the remaining global GHG-emission budget be allocated between nation states?

We propose that it should be based on the egalitarian principle of allocation because it is simple and because it is coherent with Kant's moral philosophy. Having chosen an allocation principle, each nation can be given its share of the remaining global GHG-emission budget. The fourth and last question is:

- 4) To what extent should trade with CO₂ emission rights be "allowed" when keeping within the budget?

For reasons outlined below we are skeptical to unlimited emission trade. Instead we propose to use the rule *each nation state should act as if a sufficient global treaty on climate change were in place* as the guiding principle. This implies that nation states should act as if the international emission permit price were much higher than today. Based on review of studies by integrated assessment models we suggest that the price should be at least \$40. Figure 1 illustrates the stages described above:

Figure 1 “Choosing a sustainable development indicator for the global climate”



The figure also gives an outline of the structure of the paper: First we discuss the existing literature on sustainable development indicators. Next, the ethical basis (utilitarian or Kantian) of a climate policy indicator (CPI) is outlined. In Section 4 the question of the design of the sufficient global treaty and allocation between states is discussed. This leads to Section 5 where our proposed indicator, KCPI, is outlined with an example application of the indicator for the nation state of Norway. Section 5 also includes a discussion of emission trading.

In Section 6 we discuss some additional topics such as for instance how to treat emissions that happens outside the jurisdiction in question. One prominent example is Norwegian oil export, and the question of whether this export should be limited by climate concerns. We also include a brief discussion of implications for R&D policy. Finally, in the concluding section 7 we discuss and evaluate whether the KCPI meets important criteria for evaluation of indicators such as measurability, relevance and the precautionary principle.

2 The existing literature on sustainable development indicators

We have identified two main strands of literature. The first strand is coined the Driving forces - Pressures - States - Impacts - Responses (DPSIR), while the other strand is called the capital approach. We briefly go through both below.

2.1 DPSIR approach

This approach seeks to identify already existing statistics within some specified field and assign them to certain categories (driving forces, pressures, states, impacts, and responses). The framework was developed by the European Environmental Agency in the 1990's based on a pressure-state-response (PSR) model developed by OECD (EEA 1998, OECD 1991 and 1993). Each field should ideally include indicators from all categories. Applied to the climate change field, we could for instance end up with the following set of indicators that nearly all are in use by nation states today (see appendix 1):

- Driving forces indicators: Population growth, economic growth
- Pressure indicators: Total GHG emissions of a country, carbon footprint of final consumption etc.
- State indicators: National and/or global annual mean temperature, GHG emissions as compared to the Kyoto treaty target etc.
- Impacts indicators: Weather related accidents, economic losses from such events, etc.
- Response indicators: Income from CO₂ taxes, expenditure for GHG emission reduction activities etc.

One problem with the DPSIR approach is that it does not provide any guidance beyond the classification of indicators. Since there are very many possible measures of climate policy that fits into one of the categories, the selection of the final indicators is vulnerable to special interests and political pressures to present a glossy picture. Another problem is the lack of benchmark. This also applies to comparing a nation state's performance with the Kyoto treaty target. Most agree that Kyoto is insufficient, but is it then sufficient to comply with the Kyoto target?

2.2 The Capital Approach

The capital approach seeks to narrow down the number of possible indicators to the main forms of capital. The underlying idea is that welfare is 'produced' by use of various types of capital: real or produced capital, human capital, natural (including environmental) capital and, sometimes, social capital (UNECE 2009, Stiglitz et al. 2009, Alfsen and Moe 2008, Arrow et al. 2010). Sustainable development indicators should ideally concern status of the various stocks of capital, i.e. states of the environment, natural resources, human capital etc., and not flows like GHG emissions per year, energy usage per unit of GDP, educational attainment per year etc. Secondly, one should ideally measure all types of capital as the money value of the stock and not the physical value of the stock e.g. number of Atlantic cod, square kilometer of untouched nature etc. This is because it is hard to say if a situation with some increasing, and some decreasing physical stocks is good or bad if measured in different and incompatible units.

In the practical application of the approach stocks are divided into stocks that *can be given a monetary value based on market prices*, and stocks for which market prices are not observable. For the latter, calculation of market prices is currently controversial or impossible; see Alfsen and Greker (2007). While the former types of stocks can be lumped together and given an economic value, the latter types of stocks require that we keep separate physical accounts for each of the stocks. The stocks are measured in some physical unit, and the aim of policy is to ensure against depleting the stock below some minimum level.

When stocks are given a monetary value, sustainability does not necessarily imply keeping the capital value of each stock intact. Exchanging natural capital with human made capital in order to increase total stocks is referred to as *weak sustainability*; see Harris (2002). It requires that natural and human made capital is substitutable. On the contrary, taking the *strong sustainability* approach, we would keep separate accounts for natural capital even if they could be given an economic value, and ensure against depleting any of these stocks below some predetermined minimum level.

Most of the applied literature on the capital approach has chosen to focus on the genuine savings indicator (World Bank, 2006), also called comprehensive investments by Arrow et al. (2010). The genuine savings indicator aims to measure all changes in the capital stocks. In addition to investments in man made capital, all types of investments connected to

environmental degradation and depletion of non-renewable natural resources are also included. The investment flows are given a monetary value, and summed for each year. The genuine investment indicator can be seen as a direct application of the weak sustainability concept: If the genuine investment indicator is positive, the economy is sustainable.

More recent applications of the genuine investment indicator have also included CO₂ emissions as damage, or negative investment. In the book "Where is the wealth of nations?" (World Bank, 2006), Hamilton et al. calculate the genuine savings indicator in the following way:

Genuine savings =

- I. + Net investments in physical capital
- II. + Expenses for education e.g. wages paid to teachers, but excluding investment in buildings etc. (investments in human capital)
- III. - Rents in the non-renewable natural resource sectors
- IV. - Damages to the environment from particulate matter
- V. - Damages to the environment from emissions of carbon dioxide

With respect to V), Hamilton et al. used the CO₂ emissions of the country in question multiplied with a price of CO₂ emission as a proxy for the damages to the country.

This way of calculating the damages from CO₂ emissions does not take into account that climate change is a global environmental problem, that is, countries are hurt not only by their own emissions, but also by global emissions. In contrast, Arrow et al. (2010) uses global emissions, and calculates the total global damages from these emissions (now and in the future). Finally, a share of the total damages is attributed to the country in question based on its "climate change vulnerability".

The national policy response to increasing climate disinvestments in the genuine savings indicator could be to increase investments in other areas such as human capital.

More importantly, decreasing national GHG emissions will for most countries not improve genuine savings since most countries' emissions seen separately are too small to make any significant difference to global emissions. Hence, the genuine savings indicator, even if it includes climate costs, cannot be used to judge national climate policy.

3 Ethical bases for a national Climate Policy Indicator (CPI)

3.1 A state centred utilitarian approach

Many would argue that the best response to an international climate treaty for a nation state would be to simply comply with the treaty in the least expensive way possible. If the treaty includes trade in emission permits, this can be achieved, assuming efficient markets, by introducing a uniform tax on GHG emissions faced by all emitters equal to the international price on emissions permits. Compliance is then assured at minimum cost by buying or selling emission permits on the international market for such permits. This approach constitutes what we call a *state centred utilitarian* approach to climate change. According to this approach, the question of a separate indicator for climate policy is trivial: The indicator should just be measuring compliance with the international treaty. Moreover, damages from climate change should be taken care of by investing in other types of capital as prescribed by the capital approach above. In Figure 1 the left-side pathway for constructing a climate policy indicator illustrates this.

But what if it is generally acknowledged that the international climate treaty is insufficient? That is, a majority of countries would like deeper emission cuts today, but all the same, they do not succeed in building this into the treaty. This situation invites a deeper ethical

reflection: What is the *right* thing to do, when we have an insufficient global treaty? One could argue that it is no point in going beyond the treaty anyhow as the benefits to the country's citizens would be outweighed by the increased national GHG abatement costs. On the other hand, each nation state then restricts its ethical considerations only to its own citizens and only relates to its citizens as consumers, while not taking other persons and the global situation into account. Moreover, if all states act in this way, one could argue that it may be more difficult to improve the international treaty since no state is willing to provide a "good example". Finally, and most importantly, this ethical view may not fit with the reasoning of the citizens in the country in question.

Today, we have an *insufficient* climate treaty in several senses. The Kyoto protocol is insufficient both since it fails to specify targets for the years after 2012, and since it limits emissions only from a minority of countries. There seems to be a demand from many worried and informed citizens that a nation state should do *more* than just complying with an imperfect treaty in the least expensive way possible. This could be due to these citizens already reasoning along the lines of another type of ethics than "state centred utilitarianism".

3.2 The Kantian approach to climate change

In Kant's moral theory, it is through the concept of duty one determines which actions are prescribed (or forbidden), regardless of the consequences of the action (or inaction). These duties are rooted in the categorical imperative, a rule that is used to judge maxims, or plans of actions. Kant formulated three versions of the categorical imperative, which describes the same basic "moral law" from separate perspectives. These versions can be dubbed 1) Universal law, 2) Dignity of persons and 3) Kingdom of Ends. The first, "Universal Law" is the most commonly known version of the categorical imperative: "act only according to that maxim whereby you can at the same time will that it should become a universal law" (Kant, 1785, p. 421). This form is based on consistency; for instance, if everyone adopted a maxim of lying, no one would believe anything that anyone said, and lying would lose its effectiveness.

Kant further makes a critical distinction between two major types of duties; perfect and imperfect duties. One understanding of this distinction is that perfect duties are duties of action, while imperfect duties are duties of ends: "the distinction which Kant has in mind is that between a law commanding (or prohibiting) an action and a law prescribing the pursuit of an end" (Gregor, 1963, p. 98). Perfect duties require precise actions, or abstinence from actions: do not lie, do not kill, etc. Perfect duties, insofar as they are negative duties (as most are), *constrain* the agent from using certain actions to achieve their ends based on inclination. Imperfect duties, being less precise, state ends, such as beneficence, that should be adopted, because the ends are in accordance with the categorical imperative (understood as the Universal law, Dignity of Persons, and the Kingdom of Ends). Kant leaves the rational agent some discretion regarding how heavily to weigh these dutiful ends against one's self-interested ends. He suggests that they should be pursued when it would not lead to excessive hardship or sacrifice on the part of the agent: "How far should one expend one's resources in practicing beneficence? Surely not to the extent that he himself would finally come to need the beneficence of others" (Kant, 1797, p. 454).

The question regarding this distinction in our context becomes: Is reducing the emissions of greenhouse gases a "perfect" or an "imperfect" duty according to Kantian ethics? A case can be made that since climate change may imperil human lives – now and in the future, avoiding climate emissions is a perfect duty in a Kantian sense, similar to "do not kill". However, another argument can be made that "do not lie" and "do not kill" are duties with an *a priori* and immediate self-evident connection to reason and the dignity of persons. But "do not emit GHGs" may be said to be more indirect since it bases itself not on immediate recognition of logical inconsistency with the categorical imperative, but on theoretical and empirical, i.e. *a*

posteriori, assumptions about connections between GHG emissions and the long term destructive potential of climate change. We believe that the latter argument is stronger, and hence “do not emit GHGs” becomes an imperfect duty – a duty of ends to be balanced according to the situation.

In the case of climate change, we interpret Kantian ethics that each person should act according to a “universal law”. Further, if we can apply the same Kantian ethics at a national level, then *each nation state should act according to a sufficient global treaty*. However, since the imperative “do not emit GHG” is an imperfect duty, there is no such thing as one “ideal” and sufficient global treaty on climate change. Rather, the *sufficient* global treaty has to be defined by the nation state itself before it can start to act *as if* this treaty were in place.

In our opinion, the nation state is however not fully free to design its own version of a sufficient treaty. Rather it should strive to comply with both the categorical imperative in a priori sense and with the existing international treaties or commitments in a posteriori sense. Thus, if the nation in question has agreed to the United Nations Framework Convention of Climate Change (UNFCCC), the provisions in the UNFCCC should be taken into account when defining what we above have coined a *sufficient* global treaty. If not the nation could be said to break another duty e.g. nations should aim to comply with international treaties it has ratified (ie. “do not lie” and “do not break agreed treaties”).

For a nation state to be able to act as if a global sufficient treaty is in place, then this global treaty must be made explicit. The work of UNFCCC provides a common starting point. The main objective of the UNFCCC is to stabilize GHG concentrations in the atmosphere at a level which prevents dangerous anthropogenic interferences with the climate system (Article 2). Thus a global treaty on climate change must put some kind of restriction on the GHG emissions of the countries involved. Moreover, in the Copenhagen accord most nations agreed to set the level of “dangerous anthropogenic interferences with the climate system” to a maximum of 2 degrees global temperature increase. This restriction can be formulated as a given global remaining GHG budget.

Since the proposed indicator (KCPI) is based on an explicit description of the envisioned treaty, each nation must go further than the UNFCCC and the Copenhagen Accord in describing what their version of a sufficient treaty would look like. Only then can the nation state act as if such a global treaty were in place, and only then can the indicator measure to what extent this is the case.

4 The GHG budget and allocation between nations

4.1 The remaining global GHG budget

In order to calculate the remaining GHG budget one must specify: a) a maximum allowable global temperature increase (target), b) a sufficient probability of not exceeding the target, c) a time frame for counting and adding emissions. The EU has agreed on maximum 2 degrees C as their temperature target. Now this target has been ‘taken note of’ by the signatories to the Copenhagen accord (2009), and has thus received a near global, if informal, acceptance. The relationship between the temperature increase and the concentration of GHG gasses in the atmosphere is not known with certainty. One therefore also has to decide by which probability the target should not be exceeded. For instance, it makes a huge difference whether one allows for a 50% or a 25% likelihood of exceeding the target. There is no global consensus on this matter, and research is likely to continuously produce new knowledge about the relationship between concentrations and likely global temperature increases.

Setting a time scale is also necessary to make the notion of a remaining GHG budget practical. Meinshausen et al. (2009) suggest looking at the time period from year 2000 to

2050. According to Meinshausen et al., the remaining GHG budget for the period 2000 to 2050 is 2000 GtCO₂-e if we settle for a 50% probability of exceeding 2 degrees C and 1500 GtCO₂-e if we settle for a 25% probability of exceeding 2 degrees C.

4.2 Allocation of the remaining GHG budget

The next major question is how to interpret the Kantian approach in regards to the allocation between nation states. There exists a large literature on allocation principles. The following table (Table 1) based on a similar table in Vaillancourt and Waaub (2004) lists some ethical criteria.

Table 1 “Equity principles to allocate remaining global CO₂ budget”

Principle	Significations	Applications
Sovereignty (grandfathering)	Past emitters should be held harmless and their current emissions constitute a right established by past usage	Equal percentage cuts from a historical level
Egalitarianism /human rights	Each human being alive has equal rights to common global resources	Proportional allocation of budget based on population
Ability to pay	The rich should pay for the abatement	Proportional reduction to GDP i.e. high GDP -> small share of the GHG budget
Comparable costs	Countries should be affected similarly i.e. burdens should be comparable	Equal GHG abatement costs as a proportion of GDP
Historical responsibility	Past emitters should pay according to their historical emissions	High historical emissions → higher cost share as proportion of GDP

Countries do not agree on one principle. Moreover each principle yields a different allocation of the remaining GHG budget. For instance, we can illustrate this by comparing the principle of “sovereignty” with the principle of “egalitarianism”. We invoke year 2000 as the year of allocating the budget, and focus on the “50% exceeding 2 degrees Celsius probability” budget.

If the world is going to stay within its remaining GHG budget, it cannot on average emit more than 39,2 GtCO₂-e per year in period from year 2000 to year 2050. Since world emission was 41,8 GtCO₂-e in the year 2000, it is necessary to reduce emissions by 6,1% in that year and keep emissions below the level. The principle of sovereignty would thus require all nations to reduce their emissions by 6,1% in year 2000 and keep those emissions.

Of the principles above, egalitarianism is probably the closest to Kantian ethics, with its emphasis on Dignity of Persons. The principle of egalitarianism implies that each person living at the time of the allocation receives an equal share of the remaining GHG budget. In the year 2000, the estimated world population was 6.1 billion.¹ Hence, each person living in the year 2000 is allocated 6.4 tons of GHG emissions on average per year in the period from 2000 to 2050. Table 2 presents a short glimpse of the implications for selected nations of the two principles:

¹ US Census Bureau gives 6.090 bill., see <http://www.census.gov/ipc/www/idb/worldpop.php>

Table 2 “GHG emission per year per capita year 2000”, Tons CO₂-eq. per capita

Country	Year 2000 ²	Reduction based on “sovereignty”	Reduction based on “egalitarianism”
United States	22.9	1.4	16.5
South Africa	9.5	0.6	3.1
Bolivia	8.1	0.5	1.7
Sweden	7.5	0.4	1.1
Norway	11.9	0.7	5.5
China	3.9	0.2	-2.5
India	1.8	0.1	-4.6

As one can see from Table 2 the principle of sovereignty would demand that also developing countries like India should reduce their emissions by 0.1 tCO₂-e per person (5.5%) from year 2000 levels, and keep this low level forever. Thus, countries with low emissions would never be able to increase their emissions. This seems to be in conflict with the UNFCCC Article 3.1 which states that the developed countries should take the lead in combating climate change, and with Article 3.2 which states that the specific needs and special circumstances of developing country parties should be given full consideration. The principle of sovereignty also seems to be in conflict with the equality inherent in the “Dignity of Persons”.

The principle of “egalitarianism” allows growth in emissions both in India and China; see the negative number in column four in Table 2. On the other hand, even the principle of egalitarianism implies that poorer countries like Bolivia would have to reduce their emissions, and very rich countries like Sweden are close to the target already. Such anomalies are the reason why principles based on abatement costs and current incomes (such as ‘ability to pay’) are being brought into the debate. Clearly, such principles are much more complicated to apply, as they require information about country specific abatement costs, and a rule for how to take account of current wealth.

Both for practical (complication) and for ethical reasons (Dignity of Persons), we therefore propose the principle of “egalitarianism” for the allocation rule for our proposed Kantian climate policy indicator.

5 The Kantian Climate Policy Indicator applied

If one follows the path of choices outlined above, a climate policy indicator that builds on Kantian ethics, a fixed remaining GHG budget and egalitarian principles, can be constructed. With a given current emission level and a given population, a national path of GHG emissions for the nation state can be calculated.

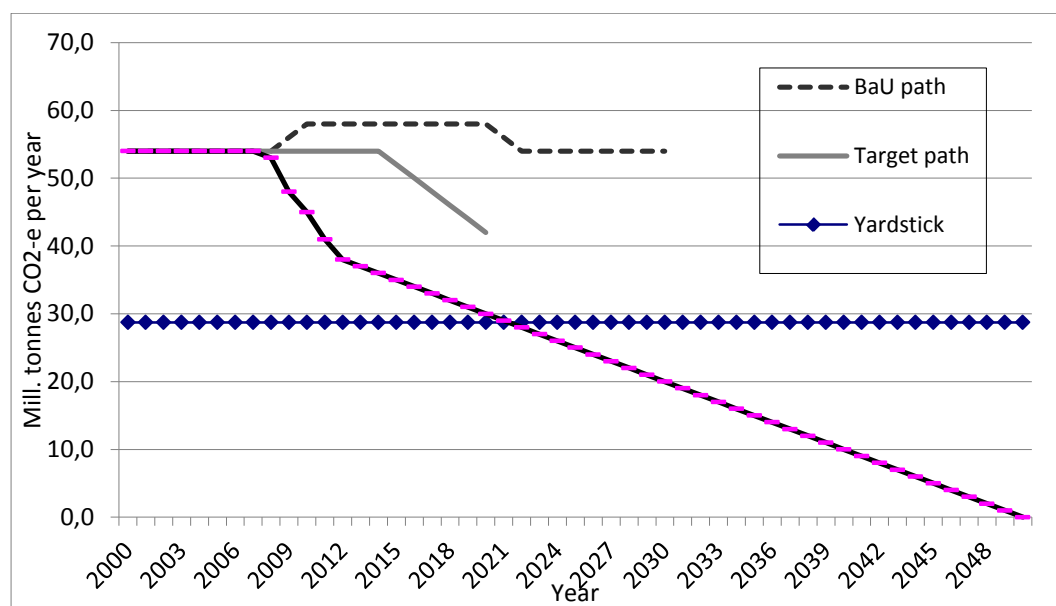
We use Norway as an example, and invoke year 2000 as the year of allocating the budget. We also focus on the “50% exceeding 2 degrees probability”. In year 2000 the world population

² Source: World Resources Institute: www.wri.gov

was 6.115 billion, while the population of Norway was 4.5 million. By simple equality Norway's remaining GHG budget is then 1.5 GtCO₂-e.

In Figure 2 below we compare different emission paths. Firstly, we have drawn a yardstick path, which is only the remaining GHG budget of Norway divided equally among the years from year 2000 to year 2050. Secondly, we have drawn three paths which show Norway's predicted business as usual emissions (BaU path), Norway's targeted emissions from Norwegian jurisdiction (Target path) and finally, Norway's targeted emissions including planned emission permit acquisitions (Target with trading).

Figure 2 "Emission paths for Norway"



In the period from year 2000 until 2008 Norway has already emitted 465 million ton CO₂ equivalents. These emissions form the first eight years of the BaU, Target and Target with trading paths. The predictions for Norway's BaU emissions do not go longer than year 2030. Further, Norway has yet set no target for emissions from Norwegian territory beyond 2020.

What can we say about Norway's performance? The indicator has two parts: A yardstick path, and the actual emissions including emission permit acquisitions/sales. Thus, in the first 8 years for which we have figures, Norway is not doing well. On the other, the plans look better, but of course, it remains to be seen whether plans will be followed up. Moreover, there are a number of further complicating issues to be discussed. First among them is the issue of trade in CO₂ emission rights, which is included in one of the projected emissions paths in Figure 2.

6 Include trade with emission rights?

In a global treaty in which all countries had accepted the allocation of the remaining GHG budget, emission trading would likely be desirable. This would likely mutually benefit both developed and developing countries. Emission trading as a principle is established in the UNFCCC Article 3.1., and the rules are specified in the Kyoto treaty. Hence, it is possible for countries to engage in internationally agreed emission trading already today. So why shouldn't emission trading be taken into account when measuring to what extent a country was running a deficit on its remaining GHG budget?

With trade in emission rights a market price for emission rights will emerge. Since emissions no longer are costless for the country, the economy will adjust accordingly. Note that, the initial allocation of the remaining GHG budget and the equilibrium price on GHG emissions is independent of each other, that is, assuming free global trade all allocations are likely to result in the same equilibrium price. This is because the size of the remaining GHG budget is the same. However, the prices we observe today are likely not the prices we would observe if a sufficient global climate treaty were in place. It could therefore be argued that extensive emission trading in order to fulfil the KPCI is not consistent with acting as if a sufficient global treaty were in place.

In order to act as if a sufficient global treaty were in place, the government needs to have an opinion of what the equilibrium global price on GHG emissions would be in the hypothetical situation. There exists a strand of studies based on global economic models designed to predict the GHG price that would emerge given some GHG concentration target. Table 3 presents a synthesis of these studies. With respect to the 2 degree C target, a concentration of 450 ppm CO₂ equivalents or 400 ppm CO₂ is sometimes argued as a sufficiently low concentration of GHG gasses.³ From the studies in table 3 we see that this requires a GHG price of the order of \$200 per tonnes CO₂-equivalent in year 2050. (See Hoel et al. 2009 for a more in depth survey).

Table 3 Predictions of the GHG emissions equilibrium price

Study	Criteria	Initial Price on GHG emissions	Price on GHG emissions year 2050	Price GHG emissions year 2100
IPCC, 2007	535-590 ppm CO ₂ -eq.	US\$ 20-80 (year 2030)	US\$ 30-150	
IEA, World Energy Outlook, 2008	450 ppm, CO ₂ -eq.		US\$ 180 (year 2030)	
Stern Report	500-550 ppm, CO ₂ -eq.	US\$ 40 (year 2005)	US\$ 98 (2% growth)	
Nordhaus, Dice	420 ppm, only CO ₂	US\$ 40 (year 2010)	US\$ 189 (year 2055)	US\$ 208 (year 2105)

Clearly, there are large uncertainties with respect to the hypothetical permit price. Depending on technological development, the efficiency of the GHG emission permit markets etc., the models may either under or over estimate the GHG price. As long as the models are our best guess, it is however, hard to see any reason for departing from the “best guess”.

If we assume an international market for emission right with banking and borrowing, the price on emission rights would likely increase the risk adjusted real interest rate. For instance, if the

³ IPCC estimates 450 ppm CO₂e to give 2,2 degrees C as best guess.

GHG price increases by 4 per cent each year, the price today must be \$42 in order for the price to be \$200 in the year 2050. According to the studies above, a price of \$200 in 2050 is likely to limit emission such that the world stays within its remaining GHG budget.

Thus, we propose the following rule with respect to emission trading:

1. Carry out all national GHG abatement projects that has a price in \$ *per ton GHG gasses abated* below or equal to the hypothetical permit price
2. In case the KPCI is not fulfilled, buy emission permits in order to stay within the budget

In order to ensure that I) is fulfilled the main KCPI, including acquired emission permits, should be accompanied with a graph depicting the discrepancy between the national price of GHG emissions in the different sectors of the economy and a price path based on the assumed global price to 2050. If the KCPI-price is too low according to this assumed price path, then the climate policy is too weak, independently of whether the nation is staying within their given GHG budget.

Should CDM or other kinds of project based emission trading with developing countries be included in II) above? As long as countries participating in emission trading do not have a binding emission ceiling, it is very hard to know to what extent emission reduction projects lead to real emission reductions (see e.g. Rosendahl and Strand, 2009). First, it should be possible to include this kind of uncertainty when emission off-sets are counted. Second, we interpret Kant's formulation of the universal law as saying that countries should act as if a sufficient global treaty were in place. In the global treaty low cost GHG abatement options in developing countries would be carried out albeit to higher price on what we observe on CDM today which is taken care of by I) above.

7 Other considerations

7.1 Emissions caused abroad

We focus on emissions from jurisdictions not distinguishing between emissions coming from the production or from the consumption of goods as long as the emission take place within the country in question. Some argue that emissions from production of export goods should not be counted, and that emissions in other countries caused by imports should be counted. In our opinion this way of counting emissions is not consistent with the concept of a sufficient global treaty. When the treaty allocates the remaining GHG budget to countries, the responsibility for emission reductions must rest on the country itself. It is hard for countries to regulate emissions in other countries in an efficient way, and hence, it is hardly desirable to give countries responsibility for emissions originating in other countries.

As long as other countries have GHG taxes below the globally optimal, import of GHG intensive goods will likely be too cheap and hence excessive. In theory this could be accounted for some appropriately set border tax. However, one should not underestimate the complexity in calculating such border taxes. Moreover, as long as the method is hard to agree on, exporting nations will suspect the border tax to be hidden protectionism.

Further, countries like Norway, with its high export of fossil fuels, is often met with critique for not limiting its fossil fuel production and thereby bringing about GHG emissions reductions abroad. Clearly, as long as other countries have GHG taxes below the globally optimal, export of fossil fuels from Norway will likely be excessive. This could be amended by introducing an export tax on oil consistent with the hypothetical price on GHG emissions. On the other hand, we will argue that doing so is in conflict with the concept of a sufficient

global climate treaty in which each state only are responsible for the emission from their own jurisdiction.

7.2 Technology policy

It seems impossible to reduce global carbon emissions without significant technological progress (within zero emission energy technologies, zero emission vehicles, etc.) in combination with regulatory and institutional change. Technology policy is consequently becoming more and more an integral part of climate policy. But do market pull policies such as limiting national emission or putting a price on carbon emissions give sufficient incentives for technological development alone? Many scientific contributions on this topic suggest not (Stern, 2006). Thus, technology policy should play a part in a “good” climate policy, but how do we measure whether this is done by a sensible approach and to the right degree?

There are many reasons for why the current research and development (R&D) effort with respect to less GHG intensive technologies may be too low. Firstly, there are the market failures related to all technology development. Governments in most countries try to correct for these market failures by subsidizing R&D etc. Secondly, since the current climate treaty is insufficient, global demand for less GHG intensive technologies is too small. This again could imply that too few resources are going into R&D on such technologies. Finally, new emerging fields of technology development may have problems attracting researchers and research finance because doing research on existing technologies pay better, see for instance Acemoglu et al. (2010).

Although, it seems impossible to deduce some kind of benchmark for determining a certain level of technology support like we have done for GHG emissions and the GHG emission price, an indicator could track the level of R&D going into GHG reducing technologies as compared to R&D spent on traditional technologies. Thus, we propose that countries should track and categorize their R&D effort relevant for GHG emission reductions. These effort should be measured in money, number of man-years and output in the form of patents, demonstration plants etc.

7.3 Regulation policy indicators

Daniel Esty and Michael Porter have built statistical data from legal, regulatory and environmental domains to compile a ranking and indicator of the environmental performance of countries (Esty and Porter 2002, 2005). They point out that environmental performance is not merely a function of economic development, but also of conscious policy choices. They further argue against the traditional trade-off between being green or competitive, and argue that the evidence points towards strong environmental performance being positively correlated with competitiveness and economic development (op. cit. 2002, p. 86)

Two NGO's, “GermanWatch” and “Climnet” have contributed to a global indicator of Climate Change Performance Index, CCPI, published annually, see <http://www.germanwatch.org/klima/ccpi.html>. Its basis is the performance rating by climate change experts from non-governmental organizations in the countries that are evaluated. By means of a questionnaire, they give a judgment and "score" on the most important measures of their governments in the sectors energy, transport, residential and industry. In addition, the national and international efforts and impulses of climate policies are also scored. The climate policy is weighted to 20% of total (while the level is 30% and the trend 50%). Over 120 selected national climate experts contributed to the evaluation of the 57 countries of the CCPI 2009. They evaluated their own countries' national and international policy. The latter is also

rated by climate experts that observe the participation of the respective countries at the climate conferences.

Thus, we would not rule out that it could be beneficial to supplement the KCPI with a KCPI-regulation, which includes the development on a climate change performance index based on expert judgment.

8 Conclusion

Maybe the most fundamental question that this approach raises is whether Kantian ethics is applicable to not just to persons, but also to countries. Can – and should – we expect actions according to Kantian ethics from a nation state?

The dominant approach to political science is rational choice theory. This approach can be represented in a number of ways, including the one we coin “state centred utilitarianism”. The underlying metaphor is that “each nation is like a rational utility-maximizing actor”, and thus the nation acts in a pure state centred welfare maximizing way as described above. However, this is not the only approach to understand state behaviour. The political scientist Alexander Wendt (1999) distinguishes international relations on the basis of three cultures of anarchies: Hobbesian, Lockean and Kantian. In a Hobbesian culture of anarchy the dominant logic is a type of self-interest that will not shrink from violence to grab whatever it wants. While in a Lockean culture there is rivalry, it is more in the sense of competitors who will use whatever means to advance their interests but refrain from using violence or killing each other. Finally, in a Kantian international culture of anarchy, nation states will refrain from using violence to settle their disputes and work like a team towards a common set of ends, as for instance against security threats (op. cit. p. 258). In this third culture of anarchy, nations will act so that the maxim of their acts can be a universal law for the whole “team” to follow (op. cit., 1999, chapt. 6). In other words, the logic of Kantian anarchy is based on shared knowledge of each other’s peaceful or moral intentions to follow the “Universal law”.

The Kantian approach to choice locates morality in universal rules and duties. These would order the preferences differently than in a utility-maximising preference set. Some rules constrain economic action; others would work by reordering preferences. However, the Kantian approach soon runs into several challenges too (just like utilitarianism). First, not all moral problems can be solved by rules and individual will (van Staveren 2007, p. 26, Walsh 2003, p.285). It excludes situations where the choice lies outside of the reach of the human will, such as poverty, destitution or in situations with strong social norms or bonds. Second, in situations where there are many conflicting rules, there is no higher-level rule that enables a unique ranking of moral rules according to their moral importance: “What about a situation in which one needs to choose between two evils, such as lying in court and betraying a friend?” (van Staveren, 2007, p.26). Thirdly, Kantian ethics is strictly rational and universal, and does not allow for a plurality of rationalities nor different cultural and religious worldviews. Some of these limitations are more or less solvable within the Kantian approach, but they require a very subtle reasoning and a deeper understanding of the sometimes very complex arguments of Kant himself and the huge literature of commentary on Kant that his philosophy has generated.

Acting in a Kantian way with respect to climate change can also be understood from a “rational choice” perspective. Since it is in the long term interest of its citizens that the climate problem is solved, the utilitarian state should – even if it cannot accurately calculate the future benefits to its own citizens - work for a better treaty through international forums, and claim to be ready to comply with the better treaty once it materializes. Working for a better treaty is nearly costless. Hence, if nation states were acting from a purely utilitarian ethics, they could pretend to work for a better treaty while having no intention to participating in the treaty if it were to realize. In other words, working for a better treaty is not a credible

commitment to contribute to solve the global climate problem. Clearly, one way to make it credible, and the only truly ethical behaviour according to Kant, is *to act today as if a better treaty were already in place*. Then there can be no doubt that the nation is ready to participate in the better treaty. Thus, if the reason for the current lack of progress in UNFCCC climate treaty negotiations is lack of credibility among nations, acting in a Kantian way could improve matters (even if such consequentialist considerations hold little weight in a strictly interpreted Kantian ethics, where one should act rightly irrespective of consequences).

Finally, there are several important criteria with which to judge the usefulness of indicators, among them: a) Measurability, b) Condensed information about critical developments, c) Relevance for policy in democratic nation states, and d) Capable of foresight by connecting with the precautionary principle

Clearly, our Kantian Climate Policy Indicator (KCPI) does not fulfil all criteria. It scores high on a) and c), but it does not say anything about international developments, and thus scores low on b). Moreover, it only indirectly takes into account the precautionary principle d), through its incorporation of the future remaining GHG budget. We therefore believe it beneficial that the KCPI be accompanied by more indicators showing:

- Current value of damages to the country in question caused by this year global emissions (like Arrow et al., 2010)
- Predictions of global temperature increases for this century based on extrapolation of current emission trends
- Predictions of global temperature increases for this century based on countries emission reduction plans (Copenhagen accord)

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10 Appendix

10.1 Current status of national climate/energy indicators

We have examined existing indicators in most EU countries, some non-EU OECD countries, some developing countries, and international institutions by downloading their current indicator sets and definitions from their respective websites. Table 1 shows the different climate and energy indicators found. The table also indicates how many countries are using each indicator, and the level their importance (headline or other type of indicator).

Two indicators stand out as the most common:

- Green house gas emissions from own jurisdiction
- Share of energy (and electricity) from renewable resources

Emissions of greenhouse gases (including comparison with Kyoto goals) is by far the most common indicator for climate. All the examined countries have this indicator in their sustainable development indicators set, and all except one have it as a headline indicator.

Table A1

Indicator	Frequency	Frequency of headline indicator
Climate		
Emissions of greenhouse gases (compared to Kyoto goal)	12	11
Emission of greenhouse gases, by sector	4	
Greenhouse gas emissions from land use, land use change and forestry	1	
Emissions of CO ₂	2	
Emissions of CO ₂ , by sector	1	
Emissions of CO ₂ , from traffic	1	
Emissions of CO ₂ associated with electricity generation	1	
Emissions of CO ₂ associated with household energy consumption	1	
Emissions of CO ₂ per inhabitant, by county	1	
Emissions of CO ₂ per inhabitant, nationally, OECD countries and developing countries.	1	
Emissions of CO ₂ from private cars and car-km	1	
Emissions of CO ₂ from freight and tonnes-km	1	
Greenhouse gas intensity of energy consumption	1	
CO ₂ intensity	2	1
CO ₂ intensity of private motorised modes of transport (CO ₂ /person-km)	1	
Emissions of CO ₂ associated with national consumption, by sector	2	
Carbon footprint (CO ₂) from final consumption	2	
National and global annual mean temperature	3	1
Public expenditure on environmental protection	1	
Environmentally related taxes paid, CO ₂ and energy taxes shown separately	4	

Energy

Share of renewable energy in primary energy consumption	7	
		5
Share of renewable energy in electricity consumption (or production)	5	dR 1
Gross inland energy consumption (by type of fuel)	6	D 3
Consumption of primary energy per inhabitant	3	2
Consumption of energy in the residential sector, (some incl. service sector)	2	
Final energy consumption in the transport sector	1	
Energy production	1	
Energy intensity	5	2
Energy intensity: Wh/GDP, by type of energy produced	1	1
Energy intensity: Wh/GP by county	1	
Energy intensity of of means of transport (energy / person-km and tonnes-km)	1	
Gross energy supply by type of energy	1	
Energy prices: electricity and fossil fuels	1	
Implicit tax rate on energy (€/ TFC)	1	
Energy (import) dependency	3	