Management Studies, Nov.-Dec. 2017, Vol. 5, No. 6, 545-554
doi: 10.17265/2328-2185/2017.06.007

Could It Happen: Global Warming Leads to the Extinction of Mankind?

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The upcoming COP23 at Bonn of the UN and its UNFCCC must outline how its COP21 objectives are to be promoted by means of concrete international and national management. Only a massive replacement of fossil fuels and wood coal by solar power parks, can wind power and atomic power save mankind from the grave threats of global warming. This paper presents a tentative estimation of what is involved with regard to the fulfilment of COP21's GOAL II—decarbonisation to 30-40 per cent of 2005 level of emissions.

Keywords: decarbonisation, the UNFCCC's COP21 Goals I, II, III, implementation gap, game strategies, common pool regime (CPR) defection

Introduction

The UNFCCC holds a new meeting this fall in Bonn with host country Fiji—the COP23. It has to find a way forward towards the implementation of the COP21 Treaty, although there is already one defection. The islands of Fiji fear of course the sea level rise attending global warming, as there is now a set of islands becoming inhabitable in the Pacific Ocean, e.g. Tuvalu. But the dangers involved in the global warming process concern all countries on the globe in various forms of risks, immense one in reality.

Herman Kahn showed in 1962 by *Thinking about the Unthinkable* that one can scientifically theorize future scenarios with the inter alia one terrible outcome, namely the elimination of the human species. Nuclear deterrent has proved effective against this result, with the possible exception of North Korea. But its leader knows that if the country hurts surrounding nations, it will suffer a terrible punishment. Global warming is different, as there is no efficient halting process in place.

Global warming theory (GWT) has come of age. It entails the possibility of a process of continuous warming of the globe until irreversibility is arrived at. Then, humanity is finished forever, as Mother Earth enters a new stage in its giant evolutionary path over hundreds of millions of years. What must be done by international coordination is to set up and operate a common pool regime (CPR) that is capable to halt this climate change process in the 21st century, and maybe reverse it. Is the UNFCCC framework this CPR? The author doubts that.

Overview of GWT: Natural Sciences

One may distinguish between two parts in GWT, one much developed set of hypotheses about the natural

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sciences' contribution to understanding climate change, and one poorly developed social sciences' set of hypotheses about the difficulties in engaging in collective action, like the COP21 common pool regime (CPR) for decarbonisation.

The first anticipation of the global warming mechanism was done by Frenchman J. Fourier in the early 19th century, but the theory was developed by Swedish chemist Arrhenius around 1895. He calculated that a doubling of CO_2 ppm would be conducive to a five degree increase in global average temperature, which is not too far off the worst scenario for the 21st century, according to UN expertise now.

Yet, it was not until Stephen Schneider published *Global Warming* in 1989 that the theory started to receive wide attention, no doubt strengthened by the work of Keeling in measuring CO_2 ppm globally. Moreover, techniques for viewing the CO_2 layer were developed, increasing the attention to climate change.

Now, the UN reacted with creating a few bodies to look into the changes going on, one of which was the COP framework. The economists jumped in besides the natural scientists, worried about the future costs of this transformation of the atmosphere. On the one hand, Kaya and Yokoburi (1997) presented a model that explained CO_2:s with energy and energy intensity of GDP. On the other hand, Stern (2007) called global warming the largest externality in human history, calling for international governance in order to stem the growth of greenhouse gases. Stern outlines a number of activities aimed at reducing CO_2 emissions, promising also a Super Fund to channel money from rich advanced nations to poor countries and developing economies. As little has been done through the UN system of meetings and agencies up to date, Stern (2015) later asked: "What are we waiting for?"

All theories need confirmation. When the polar ice mountains began to collapse, it seemed decisive evidence for the global warming theory. Other important test implications like glacier retreat everywhere, ocean warming and acidification as well as desertification in Africa also gave support for global warming theory. Denials of climate change appear more and more unfounded, although it is true that more of CO_2 may benefit some fauna or environment niches.

Considering the probable damages from global warming, it is astonishing that global warming theory has not been better recognized or even conceptually developed or empirically corroborated. If global warming continues unrestrained, much of Asia will be negatively affected, just as Australia is on the verge of losing its coral reefs. There will be sooner or later:

(a) Great damages to Polar areas and reductions of glaciers;

(b) Huge land losses along the costs;

(c) Too high temperatures for men and women to work outside;

(d) Food production decline;

(e) Fish harvest decrease;

(f) Droughts and starvation;

(g) Lack of fresh water supply;

(h) Drying up of rivers, affecting electricity supply;

(i) Ocean acidification and species extinction;

(j) Highly volatile climate with tremendous damages.

This list is far from complete or exhaustive. One could even mention worse outcomes, like the transformations of warm and cold currents in the oceans. What one may underline is that so far no known negative feedback has been found that could stem global warming naturally. We have only positive feedbacks,

meaning outcomes reinforce each other in the same direction. It is far from easy to calculate exactly how increases in greenhouse gases impact upon temperature augmentations. Take the case of CO_2s, where a most complicated mathematical formula is employed:

(1) $T = Tc + Tn$, where T is temperature, Tc is the cumulative net contribution to temperature from CO_2 and Tn the natural one. "CO_2" refers to all CO_2, there is no distinction between man-made and natural CO_2.

But when it comes to methane, it is not known whether the tundra will melt and release enormous amounts. But methane does not stay in the atmosphere long, like CO_2s. For the other greenhouse gases, there is no similar calculation as for the CO_2s: If humans could eat less meat from cows, it would mean a great improvement, as more than a billion cows emit methane. Food from chicken should replace beef meat and burgers. The general formula reads:

(2) $dT = \lambda * dF$, where dT is the change in the earth's average surface temperature, λ is the climate sensitivity, usually with degrees Celsius per Watts per square meter (°C/[W/m^2]), and dF is the radiative forcing.

To get the calculations going, we start from lambda between 0.54 and 1.2, but let's take the average = 0.87. Thus, we have the formula (Myhre, Highwood, Shine, & Stordal, 1998): $0.87 \times 5.35 \times \ln(C/280)$. Figure 1 shows how CO_2 emissions may raise temperature to 4-5 degrees, which would be Hawking's worst case scenario.

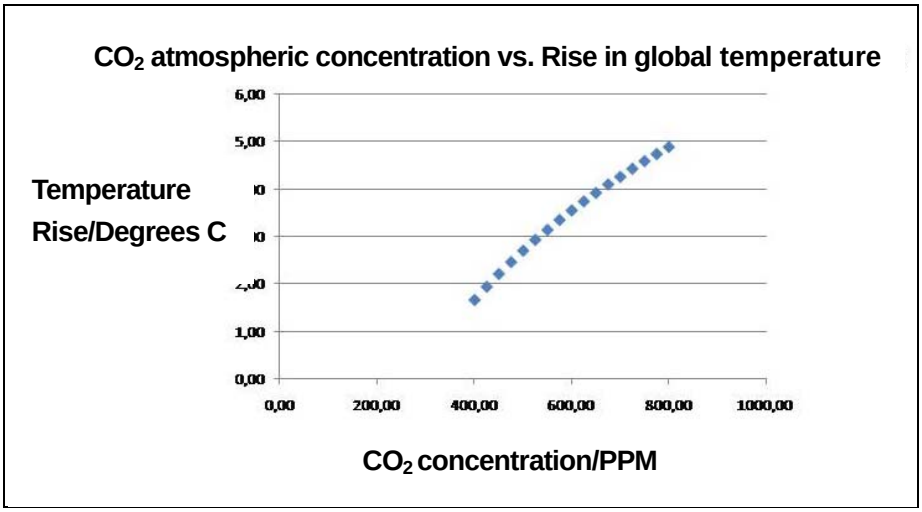

Figure 1. CO_2s and temperature rise in CELCIUS.

When taking into account that global planning speak of a 20-30 percent increase in energy for the coming decades, then one clearly understands the warning of Schneider: the 21st century will be a greenhouse century for mankind as well as Stephen Hoawking's warning about irreversibility.

The Methane Threat

The global situation with regard to the greenhouse gases appears from Figure 1, where the economic expansion, measured by the GDP, is accompanied by an inexorable growth in GHGs. This trend must be halted and reversed, as otherwise the 21st century will be the greenhouse century of mankind, as Stephen Schneider warned already in 1989.

There are several greenhouse gases, but the two biggest are the CO_2s and methane. The UNFCCC has concentrated upon halting and reducing carbon dioxide, but now we are about to face a methane threat. The

UNFCCC must start paying more attention to other GHGs than only the CO_2s, but especially methan emissions that now increase sharply (Figure 2).

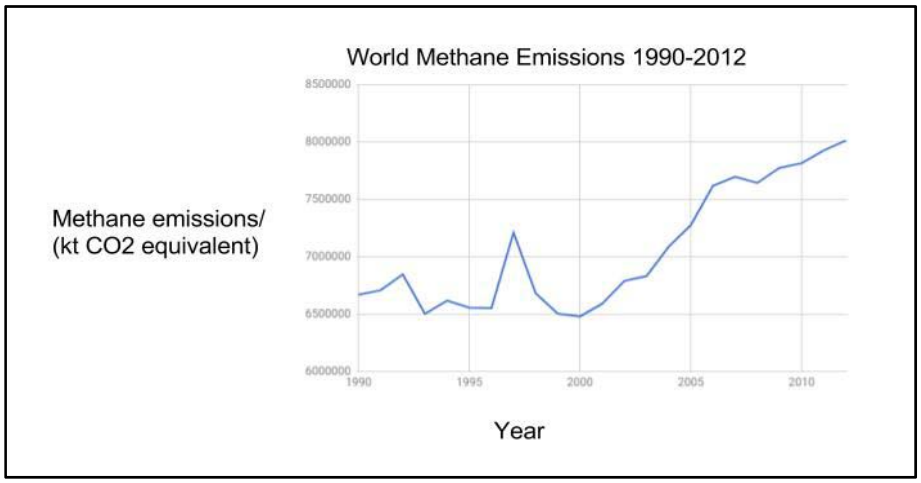

Figure 2. Methane emissons.

Social and Political Sciences

The part of GWT analyzing the coordination efforts within the UNFCCC as well as the different country responses to climate change is far less developed than the natural sciences' part. One finds practically nothing in the UNFCCC documents about the principal problems in large scale international governance, like defection. One may speak of two currents of social science theory that are highly relevant for GWT:

(1) *Implementation theory*: In the discipline of public administration and policy-making, some ideas about the so-called "implementation gap"—*Wildavsky's hiatus*—are highly relevant to the COP21 project (Pressman & Wildavsky, 1973; 1984). The COP21 has three main objectives: halt CO_2 increases by 2018-2020 (GOAL I), decrease CO_2 emissions considerable by 2030 (GOAL II), and achieve full decarbonistion by 2070-80 (GOAL III).

But how are they to be implemented? No one knows, because COP21 has neglected what will happen after the major policy decision. The COP21 project outlines many years of policy implementation to reach decarbonisation, but which are the policy tools?

(2) *Game theory*: A CPR is vulnerable to the strategy of reneging, as analysed theoretically in the discipline of game theory. The relevant game for the CPR is the PD game, where the sub game perfect Nash equilibrium is defection in a finite version of this game (Dutta, 1999). This is not recognized by Elinor Ostrom (1990) in her too optimistic view about the viability of CPR:s. It is definitely not the case that Ostrom has overcome Hobbes, as one commentator naively declared when she was awarded both the Nobel prize and the Johan Skytte prize (Rothstein's website, 2014).

The COP21 project houses lots of reneging opportunities of various sorts, which will become clear as this CPR project moves forward. One major partner has already defected, which may trigger other governments to renege. The only way to control defection in this global CPR is to employ selective incentives, which is what the planned Super Fund could offer, if at all workable.

The Problematic of Global Warming: Anthropogenic Need of Energy

To have a firm foundation for understanding the immense increase in CO_2 emissions the last two decades,

we resort to the Kaya model, linking CO_2:s with energy and affluence. One basic theoretical effort to model the greenhouse gases, especially CO_2:s, in terms of a so-called identity is the deterministic Kaya equation. The Kaya identity, "I = PAT"—model type, describes environmental (I)mpact against the (P)opulation, (A)ffluence and (T)echnology. Technology covers energy use per unit of GDP as well as carbon emissions per unit of energy consumed (Kaya & Yokoburi, 1997).

The Kaya model findings show that total CO_2:s go with larger total GDP. First, we see that CO_2 emissions are closely connected with energy consumption, globally speaking. And the projections for energy augmentation in the 21st century are enormous (EIA, BP, IEA).

Figure 3 shows how things have developed since 1990.

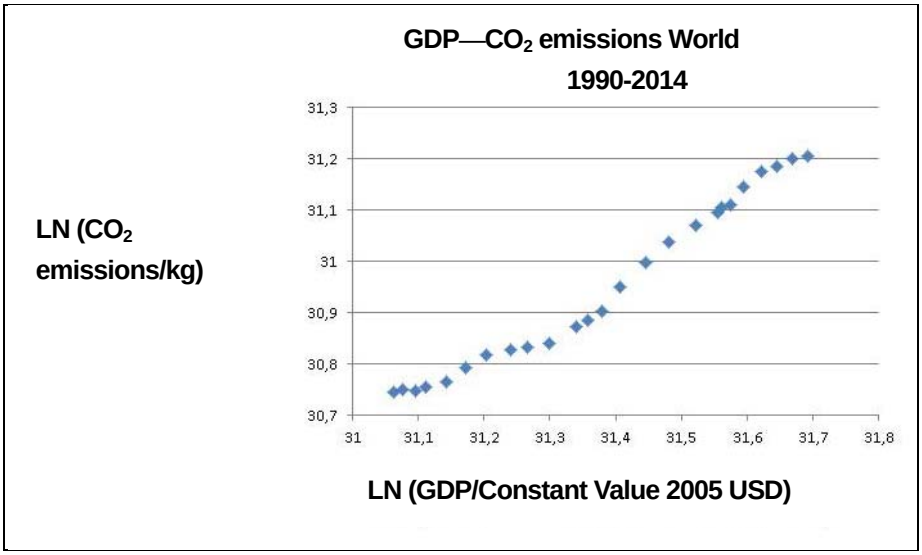

Figure 3. GDP—CO_2 emissions.

To make the dilemma of energy versus emissions even worse, we show in Figure 4 that GDP increases with the augmentation of energy per capita. Decarbonisation is the promise to undo these dismal links by making GDP and energy consumption rely upon carbon neutral energy resources, like modern renewables and atomic energy.

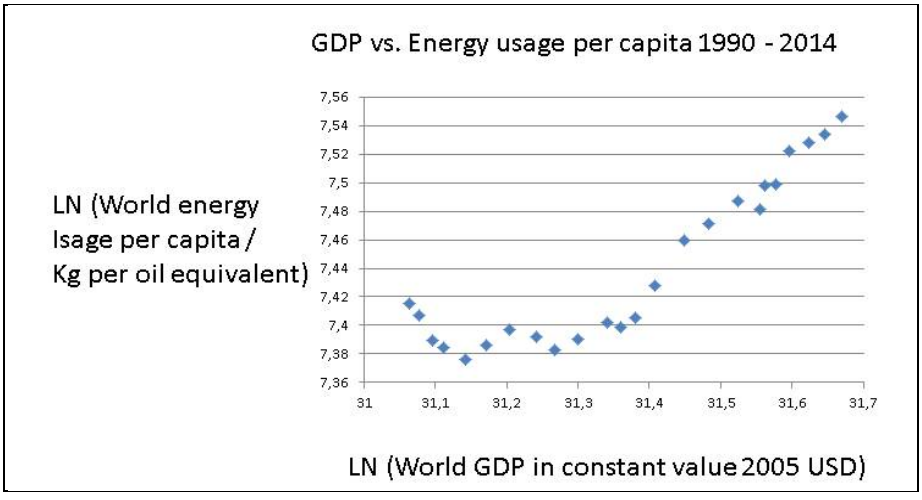

Figure 4. GDP against energy per person (N = 59).

Thus, we arrive at the energy-emissions conundrum: GDP growth being unstoppable requires massive amounts of energy that results in GHC:s or CO_2:s. The only way out of this dilemma is that renewables increase so massively and effectively in a short period of time and that decarbonisation becomes feasible and likely, not merely desirable.

Solar Power Plants

Let us examine what this hoped for reduction of fossil fuels implies for the augmentation of renewable energy consumption, here solar power. The use of atomic power is highly contested, some countries close reactors while others construct new and hopefully safer ones. The author here bypasses wind power and thermal power for the sake of simplicity in calculations.

Consider now Table 1, using the giant solar power station in Morocco as the benchmark—How many would be needed to replace the energy cut in fossil fuels and maintain the same energy amount, for a few selected countries with big CO_2 emissions?

Table 1

Number of Ouarzazate Type Solar Plants for Decarbonisation 2030 in COP21 Treaty (Average of 250-300 Days of Sunshine Used for All Entries Except Australia, Indonesia, and Mexico, Where 300-350 Was Used)

Nation	CO_2 reduction pledge/ % of 2005 emissions	Number of gigantic solar plants needed (Ouarzazate)	Gigantic plants needed for 40% reduction
United States	26-28[1]	2,170	3,100
China	none[2]	0	3,300
EU28	41-42	2,300	2,200
India	none[2]	0	1,700
Japan	26	460	700
Brazil	37	170	190
Indonesia	29	120	170
Canada	30	230	300
Mexico	25	120	190
Australia	26-28	130	190
Russia	none[3]	0	940
World	N/A[4]	N/A	16,200

Sources: Paris 2015: Tracking country climate pledges. Carbon Brief, https://www.carbonbrief.org/paris-2015-tracking-country-climate-pledges; EDGAR v 4.3.2, European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research (EDGAR), release version 4.3.2. http://edgar.jrc.ec.europe.eu, 2016 forthcoming; CO_2 Emission Reduction With Solar http://www.solarmango.com/in/tools/solar-carbon-emission-reduction.

Allowing the author to doubt that the UNFCCC or the COP21-22 is aware of the immensity of the task of implementing GOAL II until 2030. Several countries will find even GOAL I hard to fulfill! The COP23 must urgently clarify how such enormous amounts of solar power can be achieved by 2030—plan or spontaneous order? Such an enormous energy transformation can only be made by the use of market initiatives and incentives (Barry, 1982; Hayek, 1991), but governments must put down the rules of the game: subsidies, charges, and taxes?

[1] America pulled out from the deal in June 2017.
[2] China and India have only made pledges in terms of CO_2 emissions per GDP, not absolute targets.
[3] Russia made pledge of 25-30% compared to 1990 levels, but this has already been met due to a shrinking economy.
[4] Unclear sum of all countries pledges, several nations have interval in their commitments.

Dismal Science: Rejection of Sachs' Moralism

World star economist Sachs (2015) preaches this message, but it is only ethics. Economics is, as Carlyle said, a "dismal science", analyzing the IS and not the OUGHT. And the Malthusian predicament is with us with a vengeance in the form of the energy-emissions conundrums. The author will develop this position by means of some country examples.

Insisting upon the positive nature of economics, "positive" referring to the understanding and prediction of the IS, one cannot but realize that sustainable development theory deals with the OUGHT. The gulf between normative utopia and harsh reality forces one to look for how adherents of sustainable economics get from realities to vision. Take the example of Sachs, stating about SDG (sustainable development goals):

> … the SDGs need the identification of new critical pathways to sustainability. Moving to a low-carbon energy system, for example, will need an intricate global interplay of research and development, public investments in infrastructure (such as high-voltage direct current transmission grids for long-distance power transmission), private investments in renewable power generation, and new strategies for regulation and urban design. The task is phenomenally complex.

But Sachs does not inform us how something so "phenomenally complex" is to come about, going from the IS to the OUGHT. He continues:

> Market-based strategies (such as carbon taxation) can help to simplify the policy challenge by steering private decisions in the right direction, but politics, planning, and complex decision making by many stakeholders will be unavoidable. (Source: p. 2210, www.thelancet.com, Vol. 379, June 9, 2012)

Of course, but what is the likelihood that a carbon tax can be put in place (where, how much) as well as how large is the probability that planning works? Only wishful thinking!

Sachs realizes the gap between desirability and feasibility, but he confronts the gap by almost religious beliefs:

> The SDGs will therefore need the unprecedented mobilisation of global knowledge operating across many sectors and regions. Governments, international institutions, private business, academia, and civil society will need to work together to identify the critical pathways to success, in ways that combine technical expertise and democratic representation. Global problem-solving networks for sustainable development—in energy, food, urbanisation, climate resilience, and other sectors—will therefore become crucial new institutions in the years ahead. (Source: p. 2210, www.thelancet.com, Vol. 379, June 9, 2012)

What is at stake for most people who understand the risks with climate change is not the desirability of decarbonisation in some form or another. Their crux of the matter is feasibility: How to promote decarbonisation so that real life results occur? The real obstacles for any decarbonisation project stem from the logic of collective action, if we stick to the social sciences, as ethically neutral and truthfully objective. The energy-emissions conundrum is probably unresolvable until fusion power arrives!

The need for solar power parks is apparent everywhere. Table 2 shows the number of huge solar parks necessary for a few Asian countries. The numbers are staggering, but can be fulfilled, if turned into the number ONE management priority. Some of the poor nations need external financing and technical assistance from the promised Super Fund with the UNFCCC.

Table 2

Number of Ouarzazate Plants Necessary in 2030 for COP21's GOAL II. Asian Scene (Note: Average of 250-300 Days of Sunshine Was Used for Kazakhstan, 300-350 Days of Sunshine per Year for the Others)

Nation	CO_2 reduction pledge/ % of 2005 emissions	Number of gigantic solar plants needed (Ouarzazate)	Gigantic plants needed for 40% reduction
Saudi Arabia	none[ii]	0	150
Iran	4-12[iv]	22	220
Kazakhstan	none[ii]	0	100
Turkey	21	60	120
Thailand	20-25[iv]	50	110
Malaysia	none[ii]	0	80
Pakistan	none[ii]	0	60
Bangladesh	3.45	2	18

Notes. i) The United States has pulled out of the deal; ii) No absolute target; iii) Pledge is above current level, no reduction; iv) Upper limit dependent on receiving financial support; v) EU joint pledge of 40 % compared to 1990.

Let us finally look at the American scene in Table 3.

Table 3

Number of Ouarzazate Plants Necessary in 2030 for COP21's GOAL II: American Scene (Note: Average of 250-300 Days of Sunshine per Year Was Used for Canada, 300-350 for the Others)

Nation	CO_2 reduction pledge/ % of 2005 emissions	Number of gigantic solar plants needed (Ouarzazate)	Gigantic plants needed for 40% reduction
Canada	30	230	300
Mexico	25	120	200
Argentina	none[ii]	0	80
Peru	none[ii]	0	15
Uruguay	none[ii]	0	3
Chile	35	25	30

Note. ii) No absolute target.

It has been researched how much a climate of Canadian type impacts upon solar power efficiency. In any case, Canada will need backs ups for its many solar power parks, like gas power stations. Mexico has a very favourable situation for solar power, but it will need financing from the Super Fund, promised in COP21 Treaty. In Latin America, solar power in the future, especially as water shortages may be expected. Chile can manage their quota, but Argentine needs the Super Fund for sure.

Conclusion

The entire UNFCCC runs with a basic insufficiency, making it too weak to respond to the climate change challenge that could bring about a worst case scenario for mankind.Scholars have shown that the UN climate decision-making is highly manipulated by self-interests from the major powers (Conca, 2015; Vogler, 2016). The ideas of using climate change policy-making to solve other problems like poverty, global redistribution of wealth and stopping general environment degradation make matters just more complicated, resulting in massive transaction costs.

A strong warning for growing methane emissions will end this paper. Consider Table 4.

Table 4
GHC Minus CO_2s

Year	GHG other than CO_2/ton
1990	15.56
1995	15.20
2000	14.74
2005	17.20
2010	17.05
2011	18.47
2012	18.97

Methane is 25 times more powerful as greenhouse gas. When now these emissions increase, global temperature will rise even more and quickly.

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