International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

The COP23: Can Decarbonisation Policies Work?

Jan-Erik Lane[1], Florent Dieterlen[2]
[1]Fellow with Public Policy Institute, BELGRADE; Address: 10 Charles Humbert, 1205 Geneva; 559 A, 3rd Floor, Thuya Street, 9th Quarter, Yangon, Myanmar
[2]Independent Scholar in Geneva
Email address: [1]janeklane@googlemail.com

***Abstract*—** *A few days before the start of the UN global environment reunion COP23 (6-13 November 2017) in Bonn, the major study Climate Science Special Report: Fourth National Climate Assessment (USGCRP, 2017): was published in Washington. It examines the global warming problematic from the point of view of the US and the world, based upon years of research by a large group of US scholars. It definitively recommends a combination of national and international policy-making to halt temperature rise, despite the fact that the US government is negative. It renders an impressive list of climate change impacts upon the US territory and points decisively at human causes. We must then ask: Can decarbonisation policies be implemented or managed? The COP23 by the UNFCCC reflects upon the very same problem.*

***Keywords*—** *USGCRP, 2017, CO2s: energy- GDP, Methane, Anti-global warming policy-making and implementation, the electricity revolution, determinism.*

I. INTRODUCTION

Heat is energy. And energy is the capacity to do work. Work implies activities like storms, hurricanes and typhoons, huge waves and large inundations, rising water and sea levels, extreme dryness and huge forest fires, massive rainfalls and mudslides, etc. This is the natural science perspective on global warming, derived from thermodynamics. The USGCRP presents the following dismal summary:

"Global climate is projected to continue to change over this century and beyond. The magnitude of climate change beyond the next few decades will depend primarily on the amount of greenhouse (heat-trapping) gases emitted globally and on the remaining uncertainty in the sensitivity of Earth's climate to those emissions (*very high confidence*). With significant reductions in the emissions of greenhouse gases, the global annually averaged temperature rise could be limited to 3.6°F (2°C) or less. Without major reductions in these emissions, the increase in annual average global temperatures relative to preindustrial times could reach 9°F (5°C) or more by the end of this century." (USGCRP, 2017: page 15):

Thus, the climate change span is only from 2 degrees Celsius to 5degrees Celsius, as after that global warming eliminates mankind deterministically – probably a definitive Stephen Hawking's point of irreversibility.

The problem of determinism is a fascinating one, comprising two entirely different kinds of determinism, viz. nature's determinism on the one hand and social determinism on the other hand. Hawking is reflecting upon natural determinism, the global warming process becoming unstoppable. Strong determinism is to be found in the scientific ideals of classical mechanics and physics, modelled on the image of the movement of billiard balls. Today, strong determinism has to compete with probabilities modelling and even chaos theory in the natural sciences.

But how about determinism in the social sciences? Is global warming inevitable for economic reasons, as a few deterministic theories in the social sciences speak of? Or does mankind face a real choice, as the UNFCCC hopes with its 2016 Paris Treaty on decarbonisation?

II. GREENHOUSE GASES (GHG)

Although Nature is resilient, it can only absorb so much of greenhouse gases (GHG). There are several types of GHGs, but the UNFCCC has concentrated upon the carbon dioxide particles (CO2s). They are considered responsible for the human induced temperature rise that is global warming. Figure 1 depicts the recent strong increases in GHCs and CO2s, causing the climate change phenomenon.

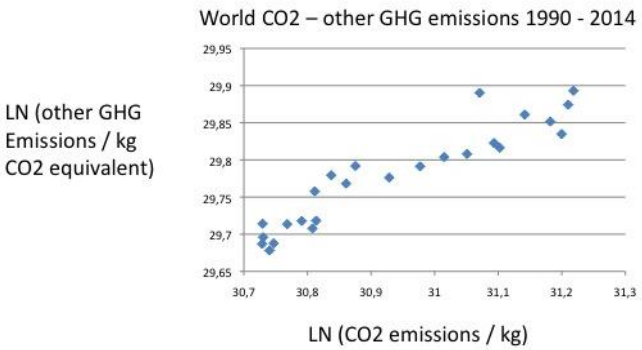


Fig. 1. Greenhouse gases 1990 - 2014: CO2 and other GHGs

CO2s constitute the largest part of the GHCs. They are now stalling, not increasing any longer globally. But halting the increase in CO2s is far from enough to halt global warming. As long as the countries in the world have large positive outflows of CO2s, the risks of climate change augment. Consider further the immense CO2s from global transportations, which still increases with all the new flights and airports.

Yet, methane emissions are now becoming more frequent and important for global warming. Finally, we have the Nitrous Oxide and very small amounts of F-gases. Methane and F-gases are more powerful in preventing sun radiation to exit the Planet, but they are not as long lasting as the CO2s. The oceans swallow much CO2s, but this leads to acidification.

Jan-Erik Lane and Florent Dieterlen, "THE COP23: Can Decarbonisation Policies Work?," *International Research Journal of Advanced Engineering and Science*, Volume 2, Issue 4, pp. 162-167, 2017.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Thus, we have several greenhouse gases, but the two biggest are the CO2s and methane. The UNFCCC has concentrated upon halting and reducing carbon dioxide, but now we are about to face a methane threat. Table 1 shows that methane is growing faster than CO2.The international data sources on greenhouse gases render CO2 numbers much more accurately and timely than methane and overall GHG numbers.

TABLE 1. GHC minus CO2s

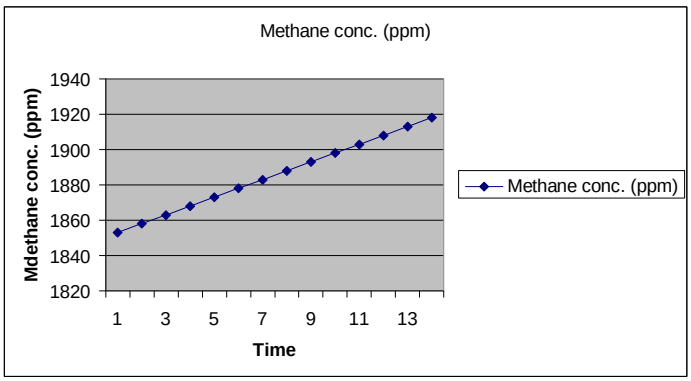
Year	GHG other than CO2 / Tton
1990	15,56
1995	15,20
2000	14,74
2005	17,20
2010	17,05
2011	18,47
2012	18,97

Source: EDGARv4.2FT2012, European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research (EDGAR), release version 4.2

As methane concentrations are on the increase, we shall use the methane concentration curve from mid-2013 to beginning of 2017 issued by NOAA ESRL https://www.esrl.noaa.gov/gmd/ccgg/trends_ch4/, gently suggested by Dlugokencky and Kuniyuki.

From this very simple equation, one can estimate the approximate the temperature rise due by methane and multiply it by 25. It will be valid for close future, but will probably be underestimated for farther future, where it will probably closer to an exponential.

Diagram 1.



Methane's effect is a big worry. We quote again from USGCRP, 2017:

"Rising Alaskan permafrost temperatures are causing permafrost to thaw and become more discontinuous; this process releases additional carbon dioxide and methane resulting in additional warming (*high confidence*). The overall magnitude of the permafrost-carbon feedback is uncertain (Ch.2); however, it is clear that these emissions have the potential to compromise the ability to limit global temperature increases."

USGCRP, 2017: 29

III. GHG AND GLOBAL WARMING RISKS

The logic of global warming is that the more of GHGs, the higher the probability of climate change goes. At what point global warming becomes deterministic is open to debate, where some scholars argue that we are far from the point of irreversibility, while others like Hawking and Neil deGrasse Tyson affirm a clear risk of irreversibility in the future., as it could come before an increase of 5 degrees Celsius.

One may attempt to calculate exactly how increases in greenhouse gases impact upon temperature augmentations. Take the case of CO2s, where a most complicated mathematical formula is employed: T = Tc + Tn, where T is temperature, Tc is the cumulative net contribution to temperature from CO2 and Tn the normal temperature. Moreover, the general formula reads: dT = λ*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/m2]), 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 el al, 1998): Formula: 0.87 x 5.35 x ln(C/280). Figure 2 shows how CO2 emissions may raise temperature to 4-5 degrees, which would be Hawking's worst case scenario.

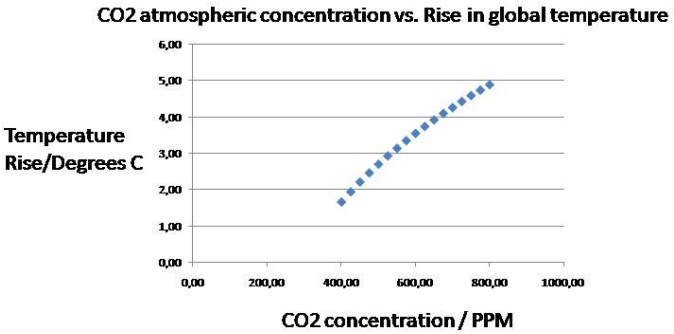


Fig. 2. CO2s and temperature rise in Celsius.

No one knows where the critical temperature rise occurs, i.e. from which Celsius degree global warming becomes "irreversible", to use Stephen Hawking's expression. It could be as low as + 2 Celsius or as high as +5 Celsius. Figure 2 only takes CO2s into account and leaves the now rising methane emissions out.

Moving now and up to 2030, according to the COP21's GOAL II for decarbonisation would eliminate Hawking irreversibility Time has come for halting and reducing CO2 emissions by real implementation and not utopian dreams of a sustainable economy (Sachs, 2015). There is nothing to wait for any longer (Stern, 2015), as the COP23 must set up the promised Super Fund. No time for politicking in the UN any longer (Conca, 2015; Vogler, 2016). Yet, could socio-economic determinism drive mankind to take proper action according to the COP21 Treaty?

We are not yet at the point of irreversibility, meaning there are still a few degrees of freedom for government policy-making and international governance. The plans of the UNFCCC must be implemented by all nations: Goal I: halting

Jan-Erik Lane and Florent Dieterlen, "THE COP23: Can Decarbonisation Policies Work?," *International Research Journal of Advanced Engineering and Science*, Volume 2, Issue 4, pp. 162-167, 2017.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

CO2 growth, Goal II: reducing CO2s until 2030 and Goal III: near complete decarbonisation by 2075.

IV. Socio-Economic Causes of Climate Change

Energy constitutes the basics in the anthropogenic greenhouse gases emissions. It generates not only survival but also affluence and wealth, being vital to both poor and rich countries. If energy consumption is reduced, there will be global economic recessions and mass poverty as well as unemployment. But Planet Earth consumes too much energy from one major source: burning fossil fuels. All forms of energy be measured, and these measures are translatable into each other – a major scientific achievement. One may employ some standard sources on energy consumption and what is immediately obvious is the immensely huge numbers involved – see Table 2.

TABLE 2. Energy consumption 2015 (Million Tons of oil equivalent).

	Total	%
Fossil fuels	11306,4	86,0
Oil	4331,3	32,9
Natural Gas	3135,2	23,8
Coal	3839,9	29,2
Renewables	1257,8	9,6
Hydroelectric	892,9	6,8
Others	364,9	2,8
Nuclear power	583,1	4,4
Total	13147,3	100,0

Source: BP Statistical Review of World Energy 2016

Table 2 holds the answer to why CO2 and GHG emissions have become the global headache number 1. Energy for humans and their social systems come to an average of 90% from burning fossil fuels: stone and wood coal, oil and gas. And people do that all over the world, though to very different degrees from 100% to less than 50% of all energy consumption, because it is necessary for affluence and survival. The enormous expansion in the energy consumption of fossil fuels has allowed the world to take on many new inhabitants, as well as reducing poverty in the Third World and much enhancing affluence and wealth in the First world.

First, we underline that CO2 emissions are closely connected with energy consumption, globally speaking. And the projections for future energy augmentation in the 21st century are enormous, especially for Asia (EIA, BP, and IEA). Figure 3 shows how things have developed since 1990.

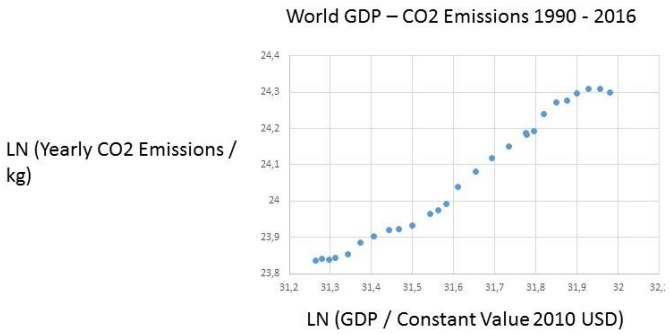


Fig. 3. Global GDP-CO2 link: $y = 0,7498x$, $R^2 = 0,9801$.

Second, we show in Figure 4 that GDP increase 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.

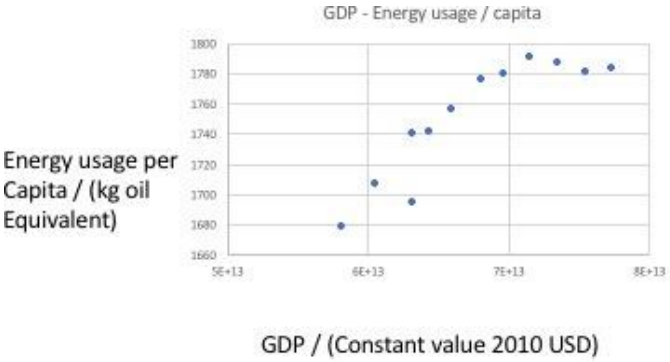


Fig. 4. GDP against energy per person, 2005-2016.
Source: World Bank Data Indicators, data.worldbank.org
BP Statistical Review of World Energy 2017

The *energy-emissions conundrum entails*: GDP growth being unstoppable requires massive amounts of energy that results in GHC:s. The only way out of this dilemma is that renewables become so large and effective in a short period of time that decarbonisation becomes feasible, in accordance with the three goals of COP21 Treaty.

Decarbonisation puts pressure on countries. Not only do they have to engage in a fundamental energy transformation, but they are also supposed to contribute to the so-called Super Fund. It will assist poor and emerging economies with a yearly budget of some 100 billion $. Both the energy changes and the funding set up an ocean prisoners' dilemma game where defection will be very temptation. Governments may renege upon their obligations in several ways, with delays or refusal to pay. If self-seeking dominates the implementation of the COP21 Treaty\y, social determinism may push mankind to the limit where nature's determinism takes over, i.e. the point of irreversibility.

Most nations plan to increase their energy supply in the coming decades, at the same time as they have to comply with decarbonisation. Since energy is so vital for socio-economic development and economic growth, countries that fail to do both may engage in reneging. Managing the decarbonisation process according to the COP21 Treaty involves an enormous set of challenges, both technologically and funding-wise. Thus, we have:

i) The logic of the PD game will show up time and again during the whole decarbonisation process. When countries have difficulties meeting their obligations they defect with impunity. Small countries are tempted by the N-1 problematic, meaning that their defection does not count for much. On the other hand, big nations are tempted by the 1/N problematic, meaning that they have to share with others their costly contributions to the common good. Only the management of selective incentives can halt reneging.
ii) The coming COP23 conference must start setting up the administrative machinery for implementing the COP21

Jan-Erik Lane and Florent Dieterlen, "THE COP23: Can Decarbonisation Policies Work?," *International Research Journal of Advanced Engineering and Science*, Volume 2, Issue 4, pp. 162-167, 2017.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

goals. It will be very difficult, given the promise of a yearly support of 100 million $ to poor and emerging economies. All kinds of opportunistic strategies are relevant: black-mailing, cheating with information, corruption, embezzlement, - all forms of PD defection. At the end of the day, socio-economic development and economic growth trump environmentalism, most of the time. Halting climate change will be acceptable to several countries, if it does not reduce economic affluence.

V. Anti-Global Warming Policy-Making

Among the alternatives of action in decarbonisation, one may mention: atomic power, b) carbon capture, c) biomass, d) wind power, e) geo-thermal power and f) solar power as well as hydro power. Some countries comply today with COP21's Goal I: halt the increase in CO2s. But several nations still augment their CO2s. Only one country would today fulfil COP21's Goal II: 30 % reduction of CO2s, namely Uruguay. All the other nations must now develop management plans for implementing the COP21 Treaty.

It is to the COP23 to inform about how national anti-global warming planning is to be combined with international governance and UN oversight. Countries that hope for funding from the Super Fund will certainly face international control of implementation and outcomes. Some countries may now renege, because they do not wish to pay into the Super Fund, like the US under Trump. Other countries may defect, because they want more support for energy transition, like perhaps India. Finally, a few countries may simply just pretend to support COP21, like Australia.

Countries pursue different decarbonisation policies. Some increase nuclear power, but others decrease this source, strangely enough. Caron capture or sequestration has been tried, but it is very costly and unsafe, Biomass has become popular, but it still leaves some CO2. Traditional biomass is worse than natural gas. Volcanic countries increase geo-thermal power of course. Wind power has expanded, but it still needs state subsidies. Coal should be eliminated as soon as possible, but a few countries build new coal-fired plants.

The UNFCCC suggests a decentralized management strategy for decarbonisation. Reflecting the enormous differences in available energy resources in the member states of COP21 Treaty, as outlines in the Table 3 and Table 4 above, each government must develop a strategy for achieving Goal I, Goal II and Goal III, but under international governance oversight and hopefully economic support and technological assistance. The COP may wish to concentrate upon the following measures start credible decarbonisation:

1) Phasing out coal power plants; convincing a few countries like India and Australia not to build new ones;
2) Replace wood coal with natural gas – small or large scale, stopping deforestation and the use of charcoal in households in poor nations;
3) Stimulate the innovations in nuclear power, so that safe atomic may be utilized; there is no need to dismantle atomic power stations in Western Europe;
4) Massive construction of solar power and wind power plants in all countries, as well as stimulate small scale solar power;
5) Turn some countries away from massive dam constructions towards solar power parks, like Brazil and India, as the environmental damages are too big;
6) Help some countries maintain their forests;
7) Abstain from expensive and unsafe carbon sequestration techniques in favour of electricity: solar power and electrical vehicles.

The promise of financial support – Super Fund –has to be clarified about both funding and budgeting. A management structure has to be introduced for oversight of the entire decarbonisation process. As the emission of methane increases, the reduction of CO2s is all the more important, if irreversibility is to be avoided with a margin.

VI. Solar Power

How big changes are needed if countries would rely upon solar power parks? Let us offer a model example, based only upon solar power parks.

Consider now Table 3, 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 CO2 emissions?

TABLE 3. Big CO_2 polluters: Number of Ouarzazate plants necessary in 2030 for COP21's GOAL II: (Note: 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[i]	2100	3200
China	none[ii]	0	3300
EU28	41 - 42	2300	2300
India	none[ii]	0	600
Japan	26	460	700
Brazil	43	180	170
Indonesia	29	120	170
Canada	30	230	300
Mexico	25	120	200
Australia	26 – 28	130	190
Russia	none[iii]	0	940
Canada	30	230	300
Mexico	25	120	200
France	37[v]	210	220
Italy	35[v]	230	270

Notes:

1) The United States has pulled out of the deal; 2) No absolute target; 3) Pledge is above current level, no reduction; 4) Upper limit dependent on receiving financial support; 5) EU joint pledge of 40 % compared to 1990

If countries rely much upon water or geo-thermal power or atomic power, the number in Table 1 will be reduced. Table 1 displays the dependency upon fossil fuels that may go over 90%in some countries. Each country energy predicament is

Jan-Erik Lane and Florent Dieterlen, "THE COP23: Can Decarbonisation Policies Work?," *International Research Journal of Advanced Engineering and Science*, Volume 2, Issue 4, pp. 162-167, 2017.

both situation dependent and path dependent, reflecting natural resources and past policies/

The key question is: Can so much solar power be constructed in some 10 years? If not, Hawking may be right. Thus, the COP23 should decide to embark upon an energy transformation of this colossal size. Solar power investments will have to take many things into account: energy mix, climate, access to land, energy storage facilities, etc. They are preferable to nuclear power, which pushes the pollution problem into the distant future with other kinds of dangers. Wind power is accused to being detrimental to bird life, like in Israel's Golan Heights. Geo-thermal power comes from volcanic power and sites.

It has been researched has much a climate of Canadian type impacts upon solar power efficiency. In any case, Canada will need backups for its many solar power parks, like gas power stations. Mexico has a very favourable situation for solar power, but will need financing from the Super Fund, promised in COP21 Treaty. In Latin America, solar power is the future, especially as water shortages from the Andes may be expected. Chile can manage their quota, but Argentine needs the Super Fund for sure. Uruguay has the best number globally, relying upon water and biomass. Table 4 has the data for the African and Asian scene with a few key countries, poor or medium income.

TABLE 4. Number of Ouarzazate plants necessary in 2030 for COP21's GOAL II: (Note: Average of 300 - 350 days of sunshine per year was used).

Nation	Co2 reduction pledge / % of 2005 emissions	Number of gigantic solar plants needed (Ouarzazate)	Gigantic plants needed for 40 % reduction
World	N/A	N/A	16000
AFICA			
Algeria	7 - 22[iv]	8	50
Egypt	none[ii]	0	80
Ghana	15 – 45[iv]	1	3
Angola	35 – 50[iv]	6	7
Kenya	30[iv]	3	4
ASIA			
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:
1) The United States has pulled out of the deal; 2) No absolute target; 3) Pledge is above current level, no reduction; 4) Upper limit dependent on receiving financial support; 5) EU joint pledge of 40 % compared to 1990

Since Africa is poor, it does not use much energy like fossil fuels, except Maghreb as well as Egypt plus much polluting South Africa, which countries must make the energy transition as quickly as possible. The rest of Africa uses either wood coal, leading to deforestation, or water power. They can increase solar power without problems when helped financially. For a few Asian countries, the numbers are staggering, but can be fulfilled, if turned into the number ONE priority. Some of the poor nations need external financing and technical assistance.

VII. Conclusion

Thus far, we have seen no negative feedback links where negative outcomes of global warming are balanced out by other effects. Instead, what dominates are positive feedback links where negative effects reinforce ear other. It is also the case that climate change is negative for general environmental degradation.

One can only hope that this major study of the US and the planet ends the denial of the occurrence of climate change as well as silences those who argue that global warming poses no major threat, like e.g. Danish Bjorn Lomborg (2017, 2015). The determinism perspective from the natural sciences is now clearly set: "Human activities are now the dominant cause of the observed trends in climate. For that reason, future climate projections are based on scenarios of how human activities will continue to affect the climate over the remainder of this century and beyond .There remains significant uncertainty about future emissions due to changing economic, political, and demographic factors. "USGCRP:31.

Now, the interest is moved to socio-economic determinism: Can the combination of national planning and international UN governance accomplish decarbonisation? The entire UNFCCC mechanism runs two major risks of all *common pool clubs* (Ostrom, 1990):

a) Transaction costs explosion: With so many participants, having divergent interests, the COP23 may result in talk only and more verbal recommendations. If ideological notions like sustainable development, fairness and equity becomes major themes, then disagreement will kill the necessary start of COP21 Treaty implementation. Stern (2007, 2015) underestimates the impossibility of unanimity in large clubs with sovereign members.
b) PD gaming with constant defections: There will be so many opportunities for countries to raise objections, make additional claims, refuse support at last moment, and engage in protracted negotiations that reneging may kill the entire enterprise, simply by fatigue.
c) Socio-economic development priority: No country has yet stated that they are prepared to cut economic growth for climate protection reasons. Thus, Ramesh says that India must provide electricity to 300 million, even if it means coal fired plants.

References

SOURCES: ***Solar power***
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

CO2 Emission Reduction With Solar
http://www.solarmango.com/in/tools/solar-carbon-emission-reduction

GDP sources:
World Bank national accounts data - data.worldbank.org
OECD National Accounts data files

GHG and energy sources:

World Resources Institute CAIT Climate Data Explorer - cait.wri.org
EU Joint Research Centre Emission Database for Global Atmospheric Research - http://edgar.jrc.ec.europa.eu/overview.php
UN Framework Convention on Climate Change - http://unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3814.php
International Energy Agency. Paris.
Energy Information Administration. Washington, DC.
BP Energy Outlook 2016.
EU Emissions Database for Global Research EDGAR, http://edgar.jrc.ec.europa.eu/
World Bank Data Indicators, data.worldbank.org
British Petroleum Statistical Review of World Energy 2016

Literature

Conka, K. (2015) Un Unfinished Foundation. The United Nations and Global Environmental Governance. Oxford: OUP.

Dlugokencky and Kuniyuki
Kaya, Y., and Yokoburi, K. (1997) Environment, energy, and economy: Strategies for sustainability. Tokyo: United Nations University Press.
Lomborg, B. (2007) Cool It! New Yoek: Knopf.
Lomborg, B. (2015) "Impact of Current Climate Proposals", Toc,Volume 7, Issue 1: 109–118
Ostrom, E. (1990) Governing the Commons. Cambridge: Cambridge U.P.
Ramesh, J. (2015) Green Signals: Ecology, Growth and Democracy in India (2015). Oxford : Oxford University Press.

Sachs, J.D. (2015) The Age of Sustainable Development. New York: Columbia University Press.
Stern, N. (2007) The Economics of Climate Change. Oxford: OUP.

Stern, N. (2015) What are we waiting for? Cambridge, MA: MIT Press.
Vogler, J. (2016) Climate Change in World Politics. Basingstoke: MacmillanPalgrave
USGCRP, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 470 pp., doi: 10.7930/J0J964J6.

[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