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Global Coordination against Global Warning: "Catch-up" Countries against Affluent Countries

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Abstract

The UNFCCC has delivered the COP21 project as the main response to climate change, promising radical decarbonisation of the country economies in the world. A promise is merely a verbal commitment ex ante, whereas the outcomes of policy-making and government coordination inform about the actual matters of fact ex post. Scholars now fear that there will be reneging or defection in the COP21 games to be started now with a long time frame into the next half of this century. Thus, world famous Stern (2016) asks what we are waiting for, given his stern warnings already in 2007. And Conca (2015) suggests that environmentalism and climate change becomes the chief task for the United Nations, on par with peace, security, human rights and development. Star economist Sachs (2015a, b, c) promotes the idea of linking anti-global warming policies with general Sustainable Development (SDGs), including anti-poverty policies. Yet, they bypass fundamentals: climate change is driven by Juggernaut forces, namely the links between GDP, energy consumption and greenhouse gases involving the economic struggle between the haves and have-nots. The challenges in implementing the COP21 goals (I+III) are formidable.

Keywords

COP21 Treaty, Super Fund, coordination problematic, emerging versus mature economies, energy, GHG:s, CO2:s, Stern, Sachs

I. Introduction

To understand the debates within the UNCCC conferences and the call for a Super Fund, one must separate between catch-up countries on the one hand and mature economies on the other hand. They face entirely different conditions for implementing the COP21 goals:

- GOAL 1: Halting the increase in CO2:s by 2020;
- GOAL 2: Reducing CO2:s by some 40 per cent;
- GOAL 3: Complete or near total decarbonisation by 2075.

How radical these goals are appears from Table 1:

Table 1. Energy Consumption 2015 (Million Tonnes of Oil Equivalent)

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
	13147.3	100.0

Source: BP Statistical Review of World Energy 2016.

The consequences of implementing the COP21 objectives are very different for the two sets of countries studies here, if indeed decarbonasation is at all implementable. The more a country has passed its "take-off" stage (Rustow, 1960, hunting the "catch-up" option of strategy (Barro, 1991, 1993, 1995), the larger the energy emissions, GHG:s or CO2:s. Similarly, the more the country in its "catch-up" strategy relies upon fossil fuels, especially coal, the larger the impact upon CO2:s.

Kaya's model—see Appendix I explains total CO2:s by means of the huge country factors, such as GDP and population as well as energy mix. This is all about total emissions, which makes a set of 10-15 countries mainly responsible for the energy-emission conundrum, with some 70 per cent of CO2:s. If one adds global transportation on sea and in air, one arrives at almost 80 per cent of aggregate emissions. Of course, these are the countries whose governments should conduct anti global warming policies, not an unwiedly set of 200 countries, running up transaction costs.

However, taking emissions per capita into account and speaking of fair contributions to halt climate change alters the debate fundamentally. The high per capita emissions are to be foumd with the rich countries, i.e., the mature economies and the Gulf States as well as the newly rich Asian Tigers. They should take their fair share of the burden, even if huge poor nations pollute more.

In principle, there are three ways for rich countries to do more than poor countries within the COP21 project of decarbonisation:

- Cut GHG:s or CO2:s proportionally more than COP21 Goals;
- Pay for the Super Fund;

- Start mega projects for sucking up ex ante or storing ex post CO2:s.

These matters are absolutely key in the coming implementation of the COP21 objectives, where the poor and emerging economies will insist upon financial and other assistance, especially from the Super Fund, promised in the Treaty and to be found in a policy outline by Stern in 2007.

2. Juggernaut Restaints upon Climate Change Policies

The foremost expert of the economics of climate change, Stern (2016) states that the governments of the states of the world must NOW recognize that time is running out for achieving the modest goal of 2 degrees increase in global temperature. In this perspective of policy urgency, Conca's (2015) inquiry into the role of environmental policy-making in the entire UN System since its creation is telling. Conca underlines three decision influencing factors that complicate and often derail UN decision-making from a Pareto optimal outcome. He speaks of: i) bureaucratic-organisation autonomy; ii) discursive framework; and iii) path dependency policies. The image is that the Great Powers in the G20, responsible for much of CO2:s, play the policy-making of climate change and global environment to fit their self-centered interests by moving issues and proposals around, from body to body, like the UNFCCC, UNEP and UNDP.

Behind the inertia in anti-global policy-making, one encounters at least three links that restrain what can be done.

2.1 GDP—Energy

The level of energy consumption accounts for much of country affluence. Poor countries possess little energy, whereas rich countries have abundant access, while emerging economies need ever more energy to develop rapidly, see Figure 1:

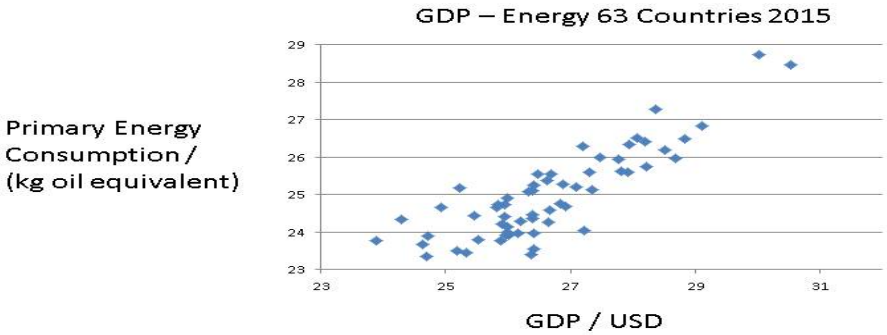


Figure 1. GDP Link to Energy: y = 0.7728x; R^2 = 0.74

All the governments in the world speak all the time about promoting economic growth or socio-economic development. But it requires more of energy. And the sty lised projections speak about massive amount of new energy during this century. Could all of it come from renewable, at the same time as lots of fossil fuels have to be phased out? Hardly! Now, the consumption of energy is the main

factor in the anthropogenesis emissions of greenhouse gases, especially CO2:s. Figure 2 identifies an almost linear relationship between energy consumption and CO2>s.

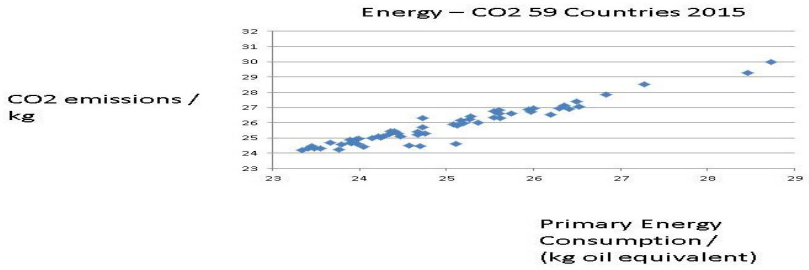


Figure 2. Energy Link to Emissions of CO2: y = 1.0226x; R² = 0.9331

Thus, the conclusion from Figures 1 and 2 is undeniable, namely that GDP increases have effects upon emissions, see Figure 3:

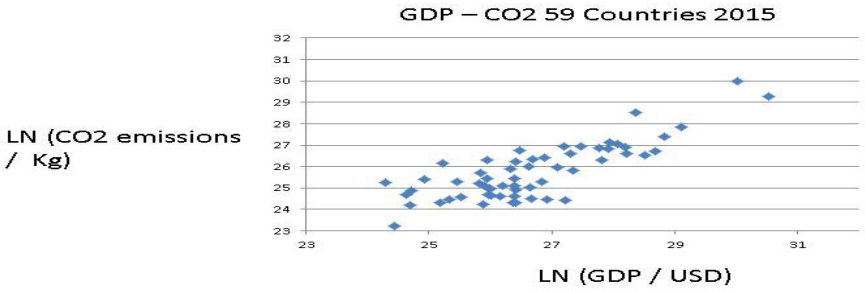


Figure 3. GDP Link to CO2;s: y = 0.793x; R² = 0.6594

Below, I will examine a few countries from the point of view of these three *Juggernaut* links. The chosen countries play a major role in the global warming debate, as the huge populous countries—the G20—are responsible for almost 80 per cent of emissions. If they could coordinate an adequate response, one would not need the cumbersome UNCCC and its transaction costs heavy conferences.

If indeed energy is the missing link between GDP and emissions, then we expect to find increasing emissions in rapidly expansing economies, driven by the consumption of more and more energy resources. Similarly, one would expect decreasing emissions in countries where energy consumption has stalled. The type of energy used must also be taken into account, as nations with considerable renewable energy sources or atomic power would have less emissions.

3. Take-off Economies: Super Fund Compensation

I will examine the development of totalenergy in a few countries during the recent decades to get a grip upon this driving factor in the global warming process, speaking of anthropogenic causes of climate change. These countries constitute the heavy polluters, whem it comes to aggregates.

India

Energy consumption in India is planned to augment over the coming decade, as the ambition is to provide electricity to the whole population. Some 300 million people are today without electric power, and the population of India is growing fast. Mass poverty is the only outcome of this imbalance between total energy and total population, where India is heading for becoming the largest country in the world soon population wise. Thus, we may expect that Figure 4 will show more of an upward trend in the decade to come.

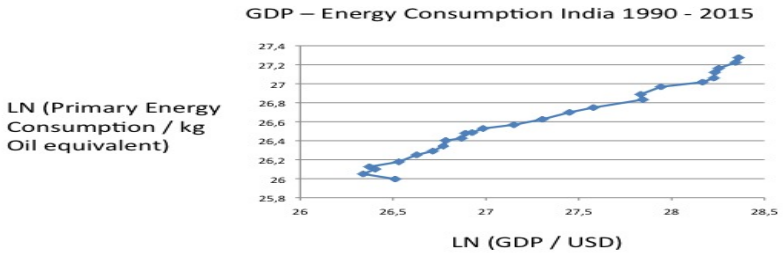


Figure 4. India: y = 0.55x; R² = 0.98

Besides burning lots of fossil fuels, Indian housholds rely much upon wood coal in its various forms, uch as charcoal, peat and dung. Wood coal is detrimental to people and the environment. As wood coal releases CO2:s, the use of biomass is typically defended by the argument that it also stores CO2, meaning that biomass would be basically carbon neutral. However, this argument completely bypasses that wood coal in poor nations is conducive to deforestation and desertification, which is what happens on a large scale in India. Figure 5 shows the constant increase in emissions.

India will certainly appeal to the same problematic, namely per capita or aggregate emissions. The country is more negative than China to cut GHG emissions, as it is in an earlier stage of industrialization and urbanization. Figure 5 shows the close connection between carbon emissions and GDP for this giant nation.

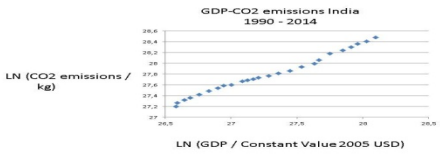


Figure 5. India: Link between GDP and CO2: y = 0.77x + 6.79; R² = 0.99

India needs cheap energy for its industries, transportation and heating as well as electrification. From where will it come? India has water power and nuclear energy, but relies most upon coal, oil and gas as

power source. It has strong ambitions for the future expansion of energy, but how is it to be generated, the world asks. India actually has one of the smallest numbers for energy per capita, although it produces much energy totally. In its energy mix traditional renewables—wood, charcoal and dung-play a bigger role than in for instance China.

Indonesia

Indonesia has rapidly moved up as a major consumer of energy in the early 21rst decade, refelcting growimh political stability and a strong effort to catch-up with the other Asian miracles. It has definitely passed its "take-off" point, but interestingly itsenormous consumption of energy has not been accompanied by high real economic growth in most recent years (Figure 6).

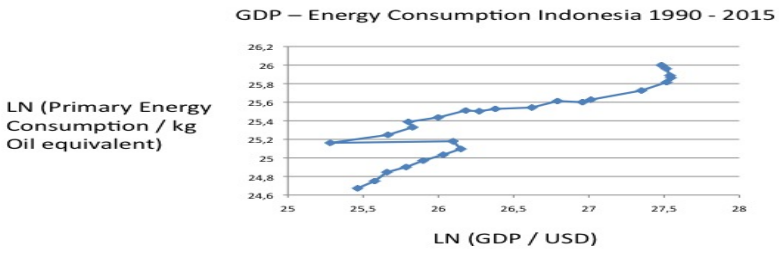


Figure 6. Indonesia: y = 0.46x;R² = 0.79

The inward and upward sloping curve for Indonesia must be of concern to the elite in the country, because Indonesia has become a major contributor to CO2 emissions. If economic growth stalls due to inflation, then how to defend the enormous emissions?

The bad CO2 emissions stem partly from the burning of rain forests and adjacent land on Kalimantan and Sumatra, which the government is to weak to control. The illegal fires affect other neighbouring countries but little is done to stop them. The search for more land for agriculture, especially soya planations, drives the externality. Emissions even outpace energy consumption.

One may guess correctly that countries that try hard to "*catch-up*" will have increasing emissions. This was true of India. Let us look at three more examples, like, e.g., giant Indonesia—now the fourth largest emitter of GHG:s in the world (Figure 7).

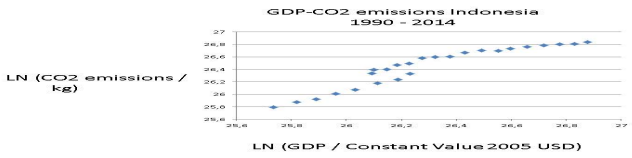


Figure 7. Indonesia: GDP-CO2 Link: y = 0.95x + 1.58; R² = 0.89

Indonesia is a coming giant, both economically and sadly in terms of pollution. Figure 7 reminds of the upward trend for China and India. However, matters are even worse for Indonesia, as the burning of the rain forest on Kalimantan and Sumatra augments the GHG emissions very much. Only 4 per cent comes from hydro power with 70 per cent from fossil fuels and the remaining 27 per cent from biomass, which alas also pollutes.

4. "Catch-up" Economies: Growth Trumps Environment

Besides the above countries, one must mention Russia and Brazil with heavy emissions and an ambition not to lag behind. Yet, their energy consumption curves are somewhat erratic, reflecting the lack of both economic and political stability in these two nations. We start with Number 1: China.

China

In a uniquely rapid economic development over a few decades, China has moved from the Third World to the First World with stunningly new giant cities cropping up and modern infrastructure being introduced to its old cities, relying upon the market (Hayek, 1991). With economic growth rates hovering around 10 per cent, China is no longer a poor nation. The trick has been to employ market incentives, resorting to a massive mobilisation of energy, partly imported from Australia among others. Figure 1 has the colossal step forward towards a mature economy.

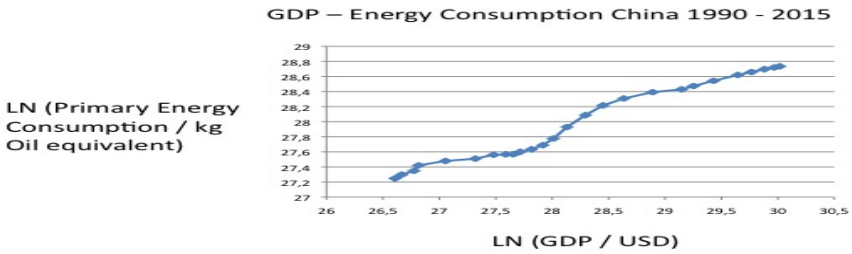


Figure 8. Energy and GDP in China: y = 0.46x; R^2 = 0.97

China has multiplied its energy usage several times over, drawing upon internal and external resources, mainly fossil fuels. It used to rely upon internal oil and natural gas, but now it is a major global importer. Its exports are gigantic to the US and the EU, and it is tying other Third World countries into patterns of cooperation, or some would say dominance economically, like African nations and Pakistan. However, the price is not only overall environmental deterioration but also the world's largest CO2 emissions (Figure 9).

A few nations do not depend upon any foreign assistance, because they are highly developed technologically and can draw upon own substantial financial resources. One may find that the emissions of GHG:s follows economic development closely in many countries. The basic explanation is population growth and GDP growth—more people and higher life style demands. Take the case of China, whose CO2 emissions are the largest in the world, totally speaking. China was a Third World

country up until yesterday.

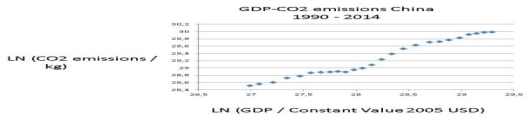


Figure 9. China: GDP-CO2 Link: y = 0.70x; R² = 0.97

The sharp increase in CO2:s in China reflects not only the immensely rapid industrialization and urbanization of the last 30 years, but also its problematic energy mix with around 90 per cent of energy consumption coming from fossil fuels.

Russia

Concerning emissions, Russia comes very high, reflecting noy only its past but also its economy geared towards natural resources. In terms of energy, Russia is on an upwards trend, although it use more in the 1990s before the "dirty" industries were dismantlled. Figure 10 has the erratic GDP-energy link for this country.

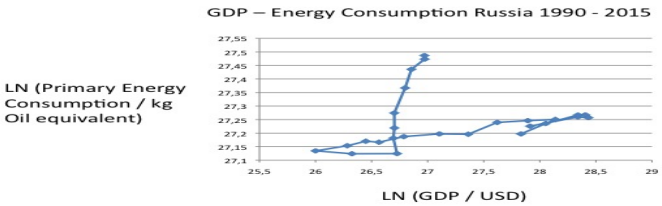


Figure 10. Russia: y = 0.024x; R² = 0.036

The statistics for Russia is erratic, but recently the trend is up. The country could never fulfill the three decarbonisation goals above. It runs on fossil fuels to 90 per cent. Russia has accepted that its hope for a major industrialization failed, concentrating its ambitions on the hope of being a global resources based economy. Energy wise, Russia is a fossil fuel country that, when faced with the implications of decarbonisation a la CO21 will renege. Its global power ambitions can only be promoted by the employment of its fossil fuels. When challenged in the future, it falls back on its energy rich economy. The emissions curve shows the changes in energy consumption (Figure 11).

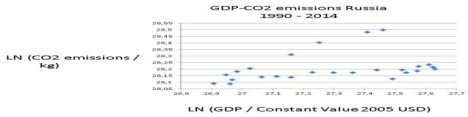


Figure 11. Russia: y = 0.14x + 24.3; R^2 = 0.11

We find a sharp reduction in CO2:s for Russia, which is a major polluter. It reflects the de-industrialisation of the Soviet Union. No countries treated their environments as badly as the Communist regimes. But Figure 11 also shows that emissions are no longer falling.

Brazil

As the largest economy in South America with a swelling population, Brazil is in need of energy resources. It may tap several domestic sources like oil and gas, ethanol and hydro power. The energy needs increase rapidly when there is positive economic growth (Figure 12)

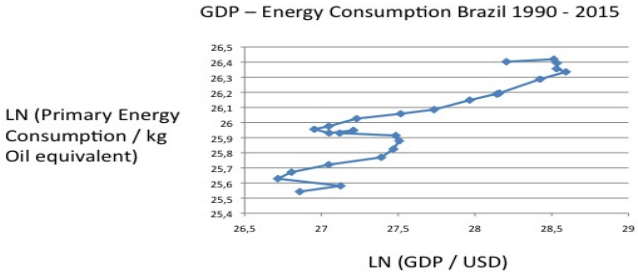


Figure 12. Brazil GDP-Energy: y = 0.37x; R^2 = 0.81

Brazil employs the most biomass in the world—ethanol, but the emissions stay at a very high level, which is a reminder that even modern renewables may lead to CO2:s. One advantage for Brazil is its large component of hydro power, but the overall picture for the largest Latin American country is not wholly promising, when it comes to reduction of emissions. Will it accomplish GOAL I—maybe! But hardly GOAL II.

Two caveats may be emphasized: Global warming reduces the potential for hydro power—water scarcity, and Brazil has very little nuclear power. There are plans for mega hydro projects in the Amazon basin, but Brazil has first and foremost to come to terms with the extensive deforestation of this huge rain forest, contributing a lot to global warming. And other nations are involved here.

Biomass and waste only contribute to decarbonisation when there is a sequence of harvesting and build-up of new carbon consuming entities. When the rain forest is cut down once and for all, or poisonous waste burnt, then there is carbonization. Brazil pollutes a lot (Figure 13).

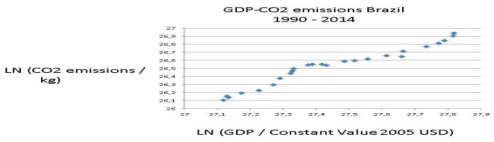


Figure 13. Brazil GDP-CO2: y = 1.03x - 1.7; R^2 = 0.95

I believe most "*emerging economies*" will rely much upon fossil fuels, like the examples above. One finds no example of declining GDG-CO2 (GHG) links in Latin American nations, nor in Africa or Asia, meaning that COP21 management will struggle to get GOAL I implemented. Again the Super Fund may be invoked.

Mexico

One would expect to find huge CO2 emissions in this large emerging economy with lots of oil production. Countries like the Gulf States have massive CO2:s because they drill and refine oil and natural gas. For Mexico holds the following situation (Figure 14).

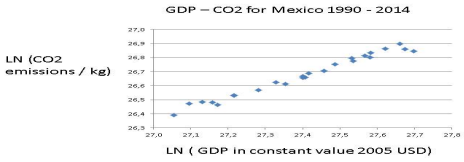


Figure 14. GDP-CO2 in Mexico: y = 0.77x; R^2 = 0.98

The close link between economic development and CO2 is discernible in the data, but the emissions growth seems to stagnate in the last years. This is of course a promising sign, whether it is the start of a COP21 inspired 40% reduction in CO2:s remains to be seen. I doubt so, but let us inquire into the energy mix of this huge country that is of enormous economic importance to both North and South America (Figure 15).

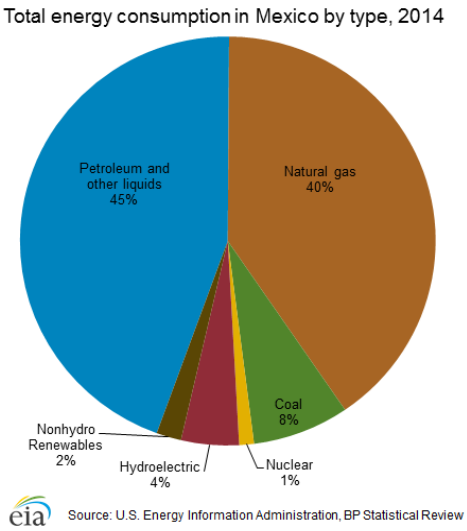


Figure 15. Energy Mix for Mexico

Few countries are so deependent upon fossil fuels as Mexico. One find the same patter with some of the Gulf States. The Mexican government must start now to reduce this dependency, by for instance eliminating coal and bringing down petreoleum, instead betting upon solar, wind and nuclear power. Mexico will face severe difficulties with the 40% reduction target in COP21. It has a fast growing population with many in poverty and an expanding industry sucking electricity. Can economic growth and decarbonisation go together here?

Mexico employs fossil fuels for rapid economic development. Actually, the country had its "take-off stage" decades ago (Rustow, 1960). But eonomic development has been volatile often. Now Mexico is an emerging economy with a clear catch-up strategy (Barro 1991, 1993, 1995). But its link between GDP and energy, portrayed in Figure 16 is too dependent upon oil and gas. Why not solar energy?

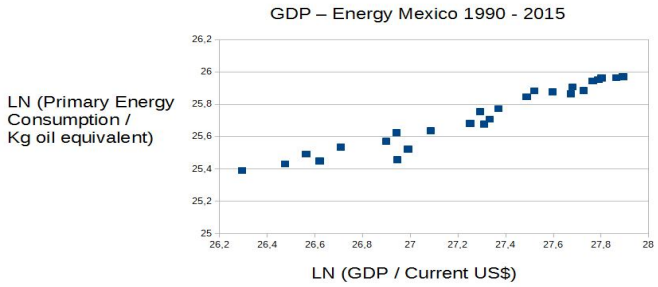


Figure 16. Mexico's GDP-Energy Link: y = 0.399x; R2=0.945

It is true that Mexico has started many solar power plants, more than, e.g., Argentina, but will the country also close than plants for fossil fuels?

Saudi Arabia

The upward sloping curve for GDP and CO2:s is characteristic for the oil and natural gas producing

countries. Some of them have already caught up, but remains committed to keep expanding their wealth, like giant Saudi Arabia (Figure 17).

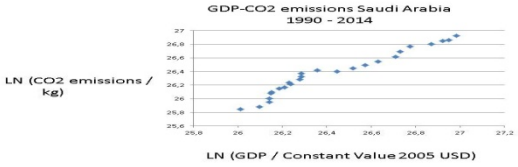


Figure 17. Saudia Arabia's GDP-Emissions: y = 1.03x - 0.77; R² = 0.95

Saudi Arabia consumes much energy to maintain its flamboyant life-style (Figure 18). It remains to be seen if the present economic difficulties of the country results in more of energy efficiency or a turn to renewables.

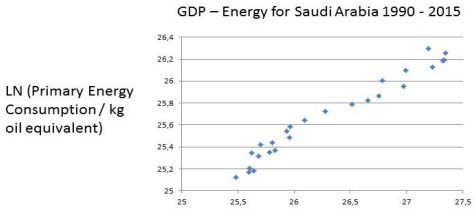


Figure 18. Energy-GDP in Saudi Arabia: y = 0.56x; R² = 0.96

The drop in the oil price during 2016 has hurt Saudi Arabia badly, as it is now considering a new economic policy to maintain its affluence. Does it have enough resources for decarbonisation according to the COP21 scheme? As long as the oil price stays low, the incentives for decarbonisation must be weak.

The above countries are responsible for a huge part of the CO2 emissions. As they pursue the "catch-up" strategy in relation to the advanced capitalist countries, they are not very eagre to take on the burden for global decarbonisation, especially if it hurts economic development. They would demand compensation from the promised Super Fund.

5. Mature Economies: The Defection Temptation

Only mature economies have the opposite curve for GDP and energy or emissions. This is due to two different factors. On the one hand, several of these countries have recently experienced close to zero economic growth, or at least meagre growth rates. On the other hand, some of them have been anxious to move away from the dirtiest energy source, i.e., coal. However, reductions in this of natios do not cancel out increases in the first set above. Let us look at a few mature economies that deliver much

emissions.

USA

Energy consumption is almost as high in the US as in China, despite a much smaller population, meaning that per capita energy consumption is the highest in the world, outside of the Gulf States where Qatar is on top. Energy and affluence is basically the same, viz capacity to do work.

Figure 19 indicates that the upwards trend has recent stalled. This may be due to the financial recession starting in 2007-2008, but it may also be related to the ongoing energy transformation in the US, away from fossil fuels that deliver some 85 per cent of US energy consumption.

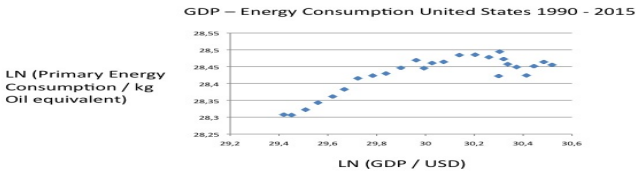


Figure 19. US: Energy and GDP: y = 0.46x; R² = 0.97

The plans of the EIA and EPA for future energy needs in the US include a heavy augmentation, but one cannot tell whether it will come about from renewables or fossil fuels like fracking. The market for energy is somewhat bewildering in the country with the start of oil and natural gas exports again as well as the shut down of a few atomic power plants. Yet, fracking is not environmental friendly. Lots of solar plants are coming up, but their efficiency is low compared with nuclear plants. Figure 20 shows that carbon emissions have peaked for the US.

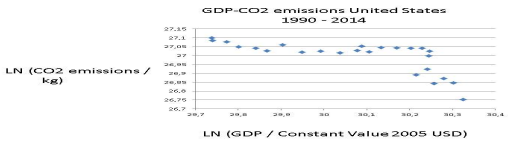


Figure 20. The US: y = -0.32x + 36.7; R² = 0.49

Recently, the level of CO2 emission has been reduced significantly in the US. It reflects partly the economic crisis that began 2007, but the entire energy pattern is undergoing change, from coal towards modern renewables. Yet, the US remains the second largest polluter in the world. This CO2 reduction reflects that the US can draw upon a mixed bag of energies. Including nuclear and hydro power, with solar power expanding rapidly.

The US is still heavily dependent upon fossil fuels, as some 85 per cent comes therefrom, the US facing a challenge of reaching GOAL II. What is changing is the shale rock innovation, as more and more of energy is produced within the US, allowing even for considerable export of petroleum. The *shake oil*

and gas revolution may though not promote decarbonisation. Further reduction of CO2:s may meet with firm resistance from the Republican House of Congress, which may oppose the COP21 Agreement, like president Trump. However, solar power should be attractive in many US states, both in micro use in households and large plant use.

Not only coal consumption is being decreased but also atomic power is cut back, as it cannot compete with energy from shale rock. Yet, when solar and wind power falters, natural gas enters the picture. Solar plants take enormous amounts of space. Energy policy-making is most active in Washington, involving a complex system of tax deductions and returns.

The advent of shale oil and gas has changed the entire energy markets, lowering the price of oil most substantially. This implies not only that there will be no Hubbert peak oil for the world, but also that switching to renewable energy source will be extremely expensive, relatively speaking compared with shale oil and gas. When petroleum is abundant, then investments in carbon neutral power sources may be non-lucrative and require massive state subsidies.

Energy is extremely vital to the entire US society, including for its superpower position. When further reductions in CO2:s threaten vital national interests, the US like other nations will no doubt employ fossil fuel. This is what the new President-elect and his administration plan at least.

Canada

One should not take for granted that mature economies reduce their carbon imprint. It is true that CO2:s are falling in some First World countries due to energy efficiency reforms, the shift away from coal and improved petrol efficiency with cars. Yet, also these economies need more energy all the time—see for instance Canada as well as South Korea.

Now, we look at energy giant Canada. Its policies on oil and oil sands as well as natural gas will affect the whole COP21 project. Figure 21 shows that emissions are NOT going down as in other mature economies.

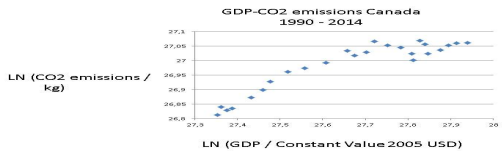


Figure 21. GDP-Emission in Canada: y = 0.41x + 15.7; R^2 = 0.85

Although Canada has a mixed energy consumption pattern with considerable hydro power, it still relies much upon fossil fuels, up to 65 per cent. And its energy needs follow its economic growth curve (Figure 22).

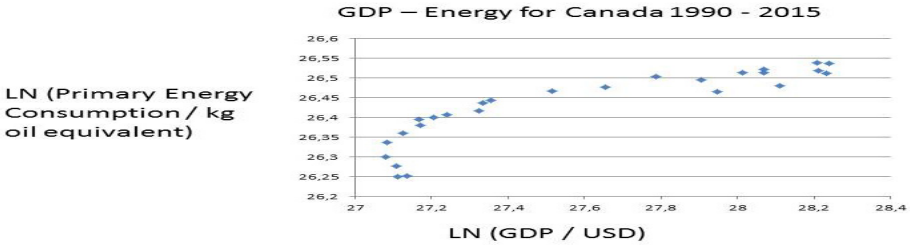


Figure 22. Canada's GDP-Energy Link: y = 0.18x; R² = 0.77

It cannot be excluded that the energy needs of advanced economies become so essential that they renege upon the COP21 objectives.

South Korea

A major industrial country in East Asia is South Korea with an advanced economy and large population. It deviates from the pattern of mature economies to display a slowing down in the CO2:s (Figure 23).

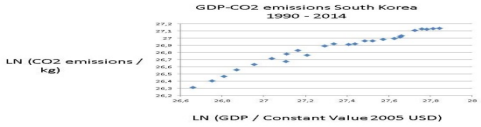


Figure 23. South Korea: GDP=CO2 Link: y = 0.65x + 9.19; R² = 0.96

Lacking much hydro power, South Korea has turned to fossil fuels for energy purposes, almost up to 90 per cent. Now, it builds nuclear plants, but South Korea needs to move aggressively into solar power to reverse trends. It differs from China only in the reliance upon nuclear power, where the country is a world leader in plant constructions. Reducing its GHG emissions, South Korea will have to rely much more upon modern renewable energy sources, as well as reducing coal and oil for imported gas or LNGs. Its appetite for energy is not slowing down (Figure 24).

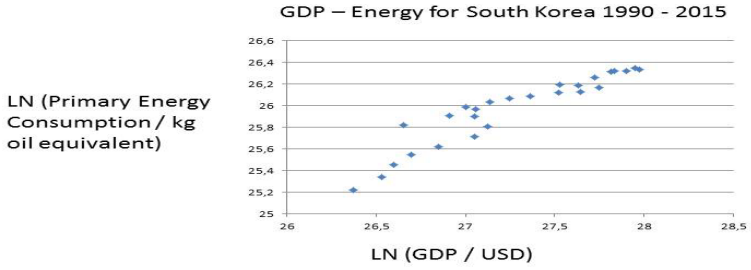


Figure 24. GDP-Energy for South Korea: y = 0.622x; R² = 0.88

South Korea is of course a mature economy, but it still pursues an aggressive catch-up strategy with

strong claims in electronics and nuclear power technology besides shipping and car industry.

Japan

Japan has a huge energy consumption, but it hovers from year to year, reflecting not only the stagnation of the economy but also the occurrence of natural disasters. Japan has been forced to increase fossil fuel imports to compensate for the close down of several nuclear plants (Figure 25).

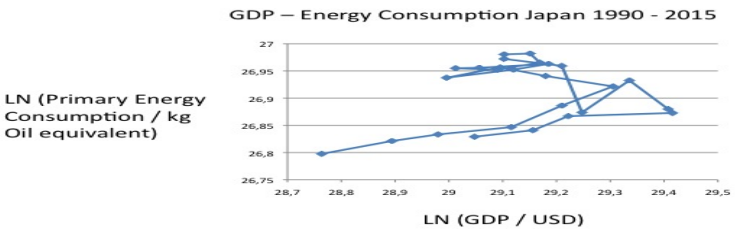


Figure 25. Japan Energy and GDP: y = 0.092x; R² = 0.056

It is hardly a daring guess that the nuclear plant disaster in Japan together with the decision to close most such power plants has further increased emissions, as the country now relies upon fossil fuels much more. Governments make plans, but they may not hold for unforeseen developments. Japan is today more dependent upon fossil fuels than earlier due to the debacle with its nuclear energy program. Is really solar, wind or atomic power realistic in Japan on the scale needed for massive decarbonisation? When forced, governments renege, i.e., they will turn back to the fossil fuels, as for them economic growth trumps the environment. After all, nations are brutally egoistic, at least according to standard teachings in international relations.

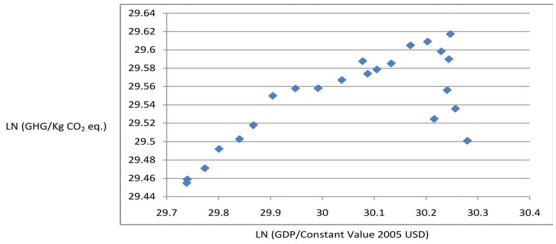


Figure 26. Japan's GDP-CO2 Link: y = 0.2648x; R² = 0.194

Australia

When one goes beyond the EU, one finds only two cases of declining GDP-COP curve: Australia and Japan. Japan has for a long time substituted coal for atomic power, although recently with a crucial set. But Australia has always been the country of fossil fuels, exporting coal and iron in huge amounts. However, it has reached its CO2 peak recently (Figure 27).

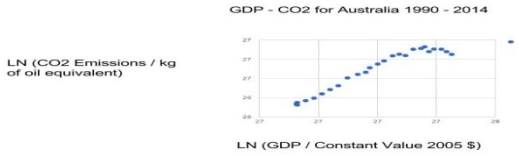
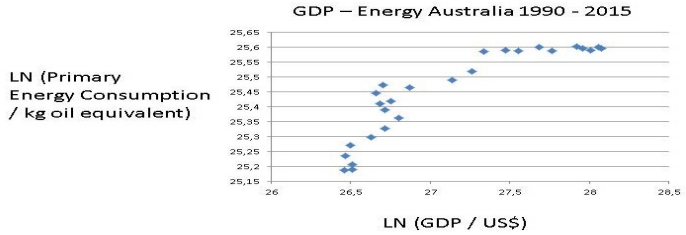


Figure 27. Australia's GDP-CO2 Link

Australia has been extremely dependent upon fossil fuels, domestically and in exports in Asia. Cutting back its coal dependency will allow the country to halt its CO2 emissions, while moving to renewables. The fossil fuel dependency of Australia is simply stunning, as is its need for energy to maintain a high quality of life (Figure 28).



Figrue 28. GDP-Energy in Australia: y = 0.2236x, R² = 0.7873

Australia has often been accused of fuelling climate change. These accusations appear to be vindicated in the Figure above that shows an extreme reliance upon fossil fuels. Add then all the export of raw materials! One prime minister of Australia has declared that the country will reduce CO2:s only if economic growth is not hurt. It remains to be seen how Australia tackles Goal I and Goal II, given its very one-sided energy mix (Figure 28).

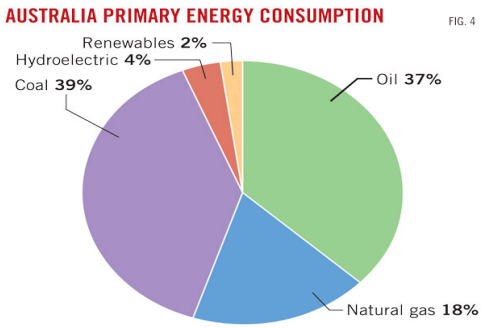


Figure 28. Australia's Energy Mix

Source: Ripple, R, D, "Australia emerging as top LNG supplier" m Oil and Gas Journal: 05/05/2014.

6. Dynamic Implementation Perspective

Anti-global warming policies have only a chance to succeed in implementation, if they clearly recognize that the energy problematic has two aspects:

a) Present challenge: Changing considerably the *present* pattern of energy consumption from fossil fuels and wood coal towards renewables and possibly atomic power + a most costly transformation to be implemented in a short time span of some 10 years.

b) Future challenge: Finding new energy sources for the *future* needs; population increase, rising expectations, economic growth, socio-economic development, poverty alleviation, armaments, public services, infrastructure, etc. A significant portion of this new energy must come from renewables and perhaps nuclear power.

The punch line is that the so + called developing world has signed on to these two major policies in an effort at global coordination, on the condition that the developed world fulfills the promise of the Super Fund, i.e., to transfer yearly $100 billion to the developing world. Otherwise, policy implementation will become a coordination failure. But will the rich countries or mature economies deliver upon the promises made in Paris 2015? They face multiple economic demands at home and redistribution is a set of politically sensitive issues.

Global coordination against climate change must avoid two mistakes that would make the COP21 project opaque, namely:

c) Avoid mixing global warming with all other developmental issues: The UN has listed some 15 major policy areas in socio-economic development for the next decade, where climate change is merely one of these issues—the Sustainable Development Goals (SDG:s). This approach severely underestimate the fundamental importance of global warming for mankind.

d) Avoid promising "*sustainable*" economics (Sachs, 2015): The word "sustainability" is used as a magic term in proposals for anti-climate change policy-making, but it has no specific meaning.

The Macmillan Dictionary mentions the following synonyms: "continuous, forever, permanent", but nothing is permanent in economic life or in the global environment, characterized by change, evolution and volatility. Take the idea of a Hubbert peak oil, which all believed in for decades until the sudden arrival of shale oil and gas. Or imagine the methane threat from the warming up of the immense permafrost.

The task in the COP21 project is to decarbonise the economy and society, nothing else. To achieve that the Super Fund must be established to assist the developing countries and the developed world must abstain from defecting upon the COP21 objectives.

Nothing is permanent in the global warming parameters. Air transportation is a major polluter, but it just expands and expands. China builds huge new airports with lots of cement, while starting aircraft production at home. The enormous car markets around the world is also a major polluter, but it keeps

growing with larger engines in several cars. Turning to electricity cars just poses the embarrassing question: How to produce all that electricity? Burning fossil fuels or...!

The destruction of the remaining forests in the Amazon, Indonesia and Siberia as well as Africa is unstoppable due to illegal logging, need of land for agriculture and government policy-making like Brazil's search massive hydro power. The huge dam at *Belo Horisonte* may be followed by several more, make the Amazon into a series of cement barrages. Poor people engage in massive deforestation and desertification by taking to wood coal in India and Africa.

The entire COP21 may be disrupted or abandoned if military actions are started in for instance the South China Sea or Eastern Europe. Or the entire fossil fuel dependency could be lifted by major technological breakthroughs in fusion power. Nothing is sustainable or durable in social or ecological systems, not even in the Universe where energy is the central force.

7. Conclusion

Energy constitutes not just the driving forces in the Universe, but it is the central concern in the climate debate about global government coordination on policies towards anti-global warming. The access to energy explains a considerable portion of the differences in affluence between the rich countries on the one hand and the poor or rapidly developing countries on the other hand. If the implementation of the COP21 project about decarbonisation involves a cut back in energy consumption, then the so-called developing countries will renege. They have made huge promises about closing the gap to the rich countries, delivering lots of goods and services. Only the Super Fund can help resolve this conflict about development between mature and emerging economies.

The chief finding from the above comparative inquiry is that emerging economies are still on an upward sloping GDP-emissions curve, whereas some mature economies have decreasing GDP-emissions curves. Thus, from the point of view of the fulfillment of the COP21 goals, the late take-off economies need to start changing. But the energy demands are enormous, like in India where total electrification for 300 million cannot be done with coal (Ramesh, 2015). What the COP21 project entails for mature economies is that they cannot defect and return to an upward GDP-emissions curve. But a few rich countries like Japan, South Korea and the UEL, Kuwait and Qatar are still on the upward sloping GDP-emissions curve. And Canada as well as Australia may renege, whereas most EU countries are on the downward sloping GDP-emissions.

Is true that lots are done for reducing the fossil fuel dependency, especially coal, and cut back on the consumption of wood coal. Solar panel plants are erected just as wind power installation. Nuclear power is augmented in some countries, although decreased in others. Energy efficiency is improved, especially in electricity production. On may mention the huge solar power plant in Morocco: *Quarzazate*!

Yet, energy demand keeps rising, as the populations grow, life expectations increase and transportation explodes. At the same, tropical forests are decimated and the oceans become acidic. The *worsening*

factors appear to outpace the *improvement* factors in the anti-global warming struggle.

The policy approaches that try to integrate the anti-climate change policies with other less specific policy objectives like 17 sustainable developmental goal or the diffuse idea of a sustainable economic development are bound to result in coordination failure. Do not mix up general environmentalism or poverty reduction with decarbonisation!

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Appendix I.

The best model of carbon emissions to this day is the so-called Kaya model. It reads as follows in its standard equation version—*Kaya's identity*:

(E1) Kaya's identity projects future carbon emissions on changes in Population (in *billions*), economic activity as GDP per capita (in *thousands of $US(1990)/person year*), energy intensity in *Watt years/dollar*, and carbon intensity of energy as *Gton C as CO_2 per Tera Watt year*". (http://www.climatemodels.uchicago.edu/kaya/kaya.doc.html)

Concerning the equation (E1), it may seem premature to speak of a law or identity that explains carbon emissions completely, as if the Kaya identity is a deterministic natural law. It will not explain all the variation, as there is bound to be other factors that impact, at least to some extent. Thus, it is more proper to formulate it as a stochastic law-like proposition, where coefficients will be estimate using various data sets, without any assumption about stable universal parameters. Thus, we have this equation format for the Kaya probabilistic law-like proposition, as follows:

(E2) Multiple Regression: $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + ... + b_tX_t + u$

Note: Y = the variable that you are trying to predict (dependent variable); X = the variable that you are using to predict Y (independent variable); a = the intercept; b = the slope; u = the regression residual. (Note: http://www.investopedia.com/terms/r/regression.asp#ixzz4Mg4Eyugw)

Thus, using the Kaya model for empirical research on global warming, the following anthropogenic conditions would affect positively carbon emissions:

(E3) CO2:s = F(GDP/capita, Population, Energy intensity, Carbon intensity),

in a stochastic form with a residual variance, all to be estimated on most recently available data from some 59 countries.

I make two empirical estimations of this probabilistic Kaya model, one longitudinal for 1990-2014 as well as one cross-sectional for 2014.

Longitudinal Analysis

I make an empirical estimation of this probabilistic Kaya model—the longitudinal test for 1990-2014, World data 1990-2015: (E4) Ln CO2 = 0.62*LN Population + 1.28*LN(GDP/Capita) +

0,96*LN(Energy/GDP); R2 = .90.

a) Cross-Sectional Analysis

In a stochastic form with a residual variance, all to be estimated on data from some 59 countries, I make an empirical estimation of this probabilistic Kaya model - the cross-sectional test for 2014:

(E5) k1= 0.68, k2=0.85, k3=0.95, k4=0.25; R2 = .80.

Note: LN CO2 = k1*LN (GDP/Capita) + k2*(dummy for Energy Intensity) + k3*(LN Population) + k4*(dummy for Fossil Fuels/all) Dummy for fossils 1 if more than 80% fossil fuels; k4 not significantly proven to be non-zero, all others are (N = 59).

These two tests of the Kaya model show that the key factors in anthropogenic climate change are the size of the economy, energy consumption and the carbon content of energy.