The International Journal of Social Sciences and Humanities Invention 4(7): 3625-3635, 2017
DOI: 10.18535/ijsshi/v4i7.09 **ICV 2015: 45.28**
ISSN: 2349-2031

Research Article

ASIA'A GLOBAL WARMING PROBLEM

Jan-Erik lane

Fellow with Public Policy Institute, Belgrade; Address: 10 Charles Humbert, 1205 Geneva; 559 A, 3rd Floor, Thuya Street, 9th Quarter, Yangon. Myanmar

Abstract: The islands state of Fiji is sponsoring the UNFCCC meeting in Bonn this autumn in order to underline that the COP mechanism must deliver concrete results in stemming climate change, now visible in the Pacific. The successful Asian economies may wish to share the concern of their Pacific neighbours, as global warming could have devastating effects upon South Asia, South East and East Asia, not to speak of Australia and New Zealand. The energy-environment conundrum now hits this part of the world with some 50% of global economic output and more than half the CO2 emissions. Time is running out for the necessary transition: decarbonisation. Asian miracles ow possess adequate economic management skills, but what is often lacking is GREEN management.

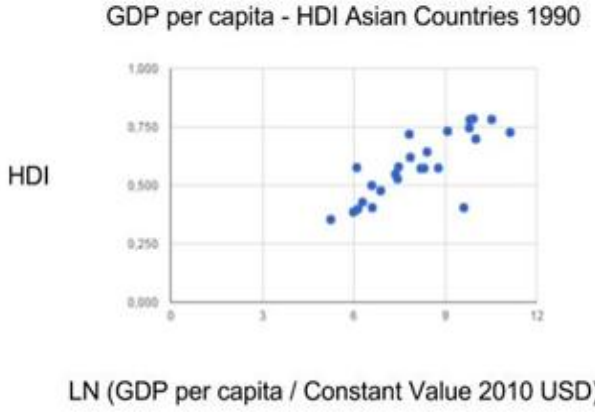
Keywords: Asia plus Australia and New Zealand, emissions, energy, solar power plant transition, Ouarzazate size.

1. INTRODUCTION

The political economy of Asian and Oceanic countries has focused upon one value the recent decades, namely economic growth, South and wealth. It is a liberal economic miracle a la Hayek – the blessings of open economies, export orientation and market liberalization, i.e. laissez-faire (Barry, 1982; Hayek, 1991). Despite all talk about market socialism, crony capitalism, state capitalism, South Asia, South East Asia, East Asia as well as Oceania and Central Asian giant Kazahkstan along the Silk Road stand for much of capitalism dynamics today. As the great but underestimated French economist J.B. Say stated: Supply creates demand, which entails that this part of the world has seen living standards markedly improved.

Consider the GDP-HDI interaction in 1990 in Figure 1.

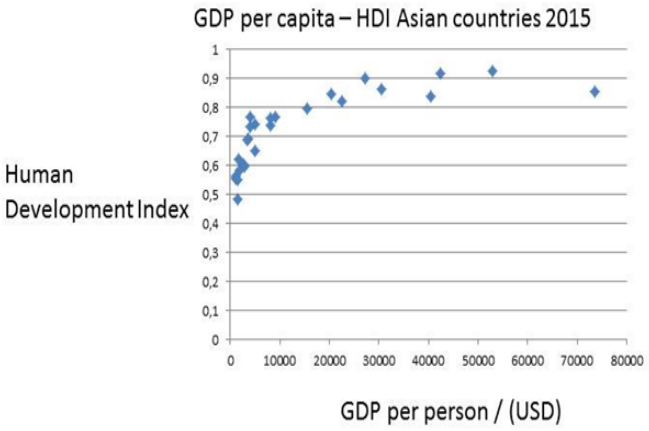
FIGURE 1. GDP-HDI for Asia 1990



Sources: GDP per capita: World Bank Data Indicators; UNDP Human Development Index.

Then look at the GDP-HDI interaction for 2015! All values move up and right, creating not only more billionaires than in Europe but also reducing abject poverty considerably. Figure 2 shows the economic success in Asia.

FIGURE 2. GDP-HDI for Asia 2015



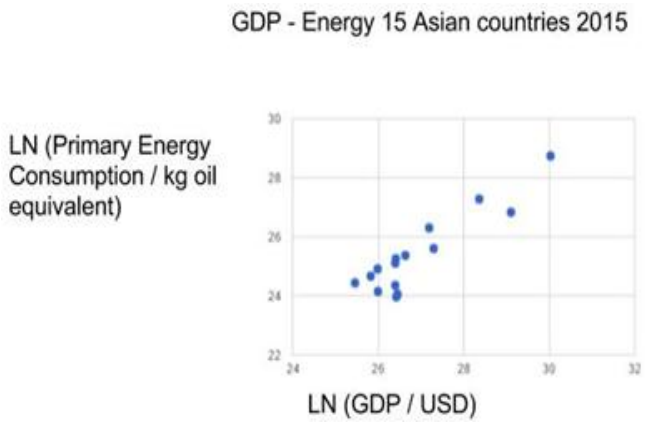
Quite substantial improvements, especially in human living conditions or HDI, are noticeable.

II. THE ASIAN ENERGY-EMISSION CONUNDRUM

The Asian economic expansion has been based upon fossil fuels and wood coal, meaning that Asia is the largest CO2 polluter on the globe, especially the countries of China, India, Indonesia and Japan as well as South Korea. Let me pin down the links between GDP, energy and emissions for Asia in 2015.

Energy consumption means affluence, as the richer a country the more energy it needs. Figure 4 shows the energy explosion for Asia, and standard prediction speak of a 30-50 % increase in coming decades.

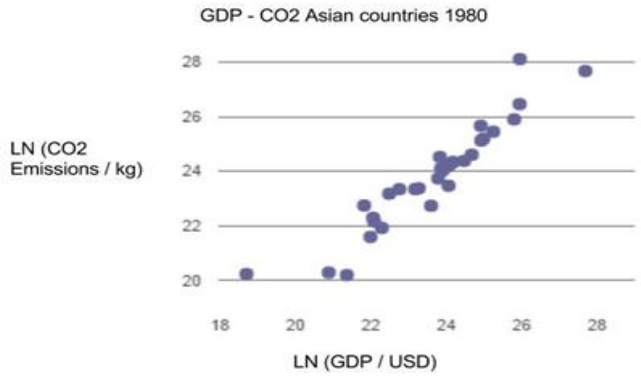
FIGURE 3. Energy consumption and GDP



As Asia delivers almost 50 % of global output, it is now responsible for almost 50% of CO2:s. The economies of Asia constitute vibrant markets that have economic freedom and are mainly with a rather high degree of openness. Though capitalism in Asia is often named "crony", it delivers both output and affluence, according to Say's law.

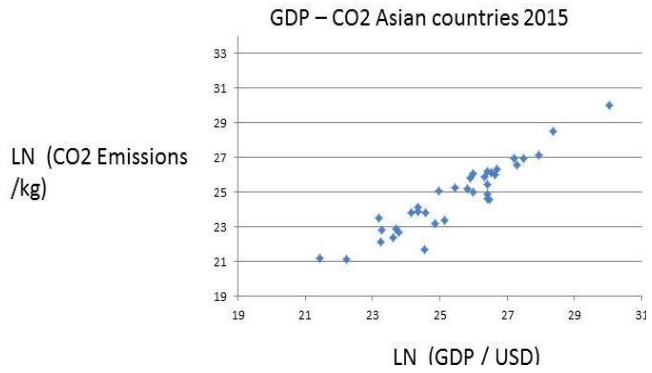
Affluence is high is several Asian countries and Australia. South Asia is different, lagging behind but developing fast now. The drawback is the huge increase in CO2 emissions. The anthopogenic emissions of greenhouse gases are driven mainly by the need for energy in a wide sense in human social systems of various kinds. Figure 4 shows the GDP-emissions link 1980.

FIGURE 4. GDP-emissions in Asia 1980



25 years later when the economic miracle has had its phenomelan run, the emissions in Asia have climbed to much higher levels – see Figure 5.

FIGURE 5. GDP and emission of CO2 in 2015: y = 1,051x , R^2 = 0,886



Sources: World Bank national accounts data, and OECD National Accounts data files; EDGARv4.3.2, 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).

III. DANGERS AND RATIONAL EXPECTATIONS

The Asian countries now face the conditions for implementing the COP21 goals:

a) Halting the increase in CO2:s by 2020 – GOAL I;

b) Reducing CO2:s by some 40 per cent - GOAL II;

c) Complete or near total decarbonisation by 2075 – GOAL III.

Decarbonisation is the policy promise to undo these "dismal" links by making GDP and energy consumption rely upon carbon neutral energy resources, like modern renewables and atomic energy. Thus, the upward sloping CO2 curves must be reversed and start sloping downward. Thus, each nation and its government and private sector as well as third sector partners have to develop their specific policy to promote the goals of COP21: rapid decarbonisation.

The damages from climate change are visible in Asia now:

a) Land losses along the costs (Bangladesh, the Philippines));
b) Too high temperatures for men and women to work outside (India);
c) Food production decline (Pakistan, Sri Lanka);
d) Fish harvest decrease (China, Malaysia Pacific);
e) Droughts and starvation (Pakistan, India, Bangladesh);
f) Lack of fresh water supply (India);
g) Drying up of rivers (India, China);
h) Ocean acidification and species extinction (Australia);
i) Highly volatile climate with tremendous damages (Sri Lanka, Thailand, the Philippines, Malaysia);
j) Deforestation (Indonesia).

Among the dangers loom worse much 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. The vibrant Asian market economies and their bourses have not yet developed rational expectations about the future damages.

IV. COP21 GOAL I: Are CO2s declining in Asian Countries?

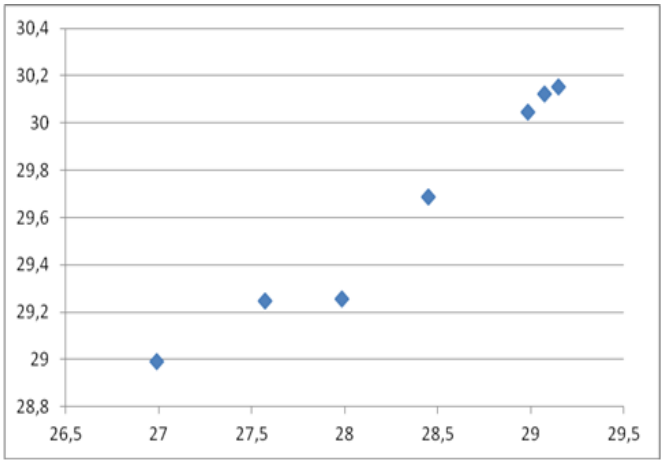
Each country faces its peculiar CO2 problematic depending upon what energy sources it has come to rely upon. Below I make a short overview of country predicaments and pose questions about the implications of the COP21 Treaty for policy-making in the coming decades.

China

China has recently made great strides towards halting its increasing CO2 emissions. Thus, solar, wind and atomic power plants have shot up the last years, but China has to do much more in the form of energy transformation. China was a developing country until yesterday. Now new and bigger cars and aircrafts are multiplying in new extravagant airports.

One finds almost always that the emissions of GHG:s or CO2:s follows economic development closely in Third World countries. The basic explanation is population growth and GDP growth – more people and higher life style demands. Take the case of China, whose emissions are the largest in the world, totally speaking (Figure 6).

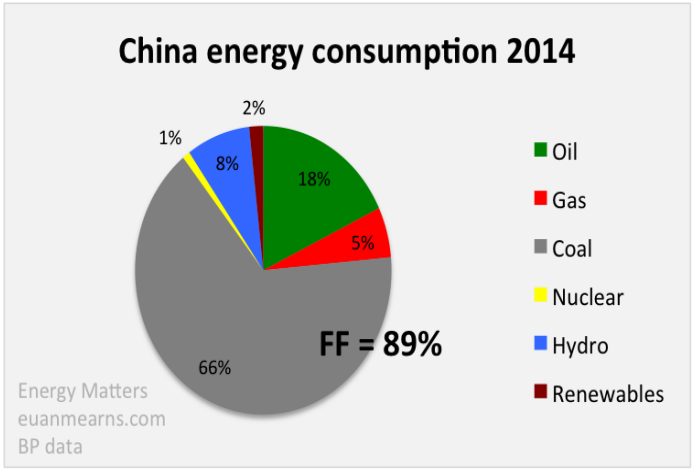
FIGURE 6. CHINA: LN (GHG / Kg CO2 eq and LN (GDP / Constant Value 2005 USD)



Note: GHG = y-axis, GDP = x-axis

The sharp increase in GHG:s in China reflects not only the immensely rapid industrialization and urbanization of the last 30 years, but also its problematic energy mix (Figure 7).

FIGURE 7.

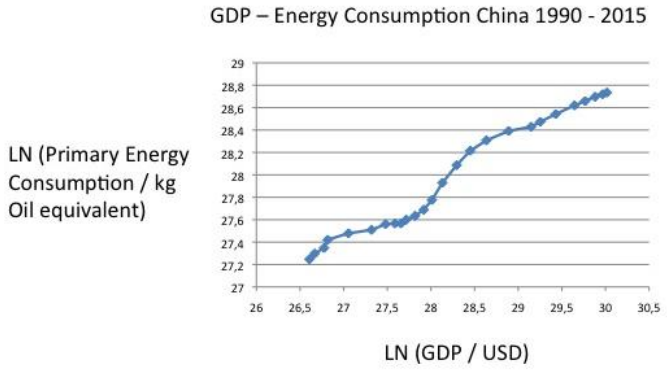


Almost 70 per cent of the energy consumption comes from the burning of coal with an additional 20 per cent from other fossil fuels. The role of nuclear, hydro and other renewable energy sources is small indeed, despite new investments. This makes China very vulnerable to demands for cutting GHG emissions: other energy sources or massive installation of highly improved filters?

It should be pointed out that several small countries have much higher emissions per capita than China. This raises the enormously difficult problematic of fair cuts of emissions. Should the largest polluters per capita cut most or the biggest aggregate polluters? At the COP21 meeting, this issue was resolved by the creation of a Super Fund to assist energy transition and environment protection in developing counties, as proposed by economist Stern (2007). Will it really be set up with 100 billion dollars per year to spend n energy transformation? Or will some countries renege, like for instance Trump's USA?

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. With economic growth rates hovering around 10 per cent, China is no longer a poor nation. The trick has been to employ market incentives a la Hayek (1991), resorting to a massive mobilisation of energy, partly imported from Australia among others. Figure 8 has the colossal step in terms of GDP and energy towards a mature economy.

FIGURE 8. Energy and GDP: $y = 0,46x$; $R^2 = 0,97$



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.

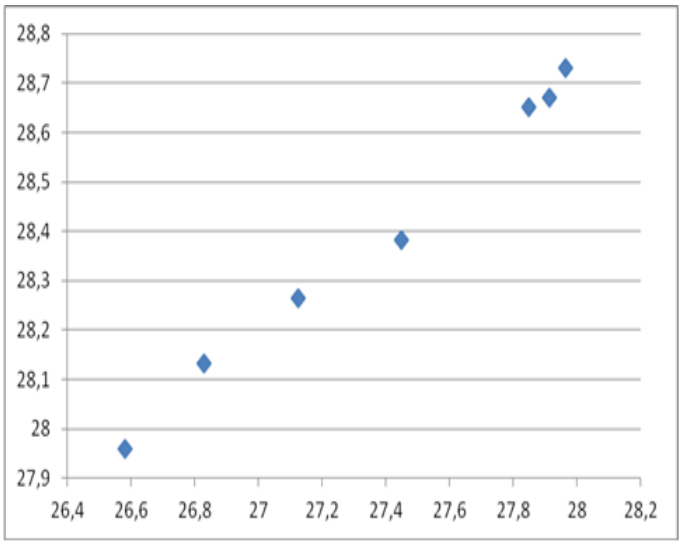
India

India will appeal to the same fairness problematic as other Third World nations, namely low per capita emissions in the Third World against huge aggregate emissions. The country is even more negative than China to cut GHG or CO2 emissions, as it is in an earlier stage of industrialization and urbanization. India relies upon wood coal in a massive way, like central Africa. It has been claimed that wood coal is carbon neutral, but in reality it leads to deforestation and desertification on a huge scale.

Figure 9 shows the close connection between emissions and

GDP for this giant nation.

FIGURE 9. INDIA: LN (GHG / Kg CO2 eq and LN (GDP / Constant Value 2005 USD)

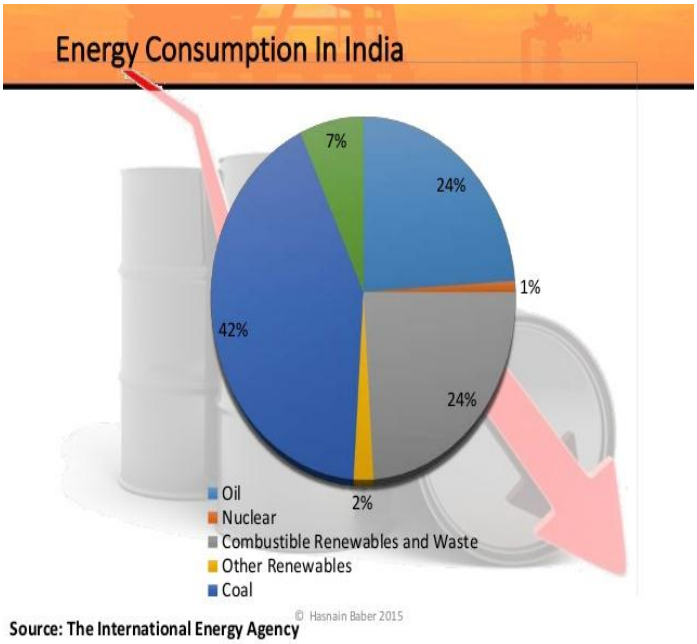


Note: GHG = y-axis, GDP = x-axis

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. Public intellectual and former minister Ramesh (2015) admits openly that India cannot do without stone coal fired power stations for socio-economic development reasons. In addition, India relies massively upon wood coal.

Figure 10 shows its energy mix where renewables play a bigger role than in China.

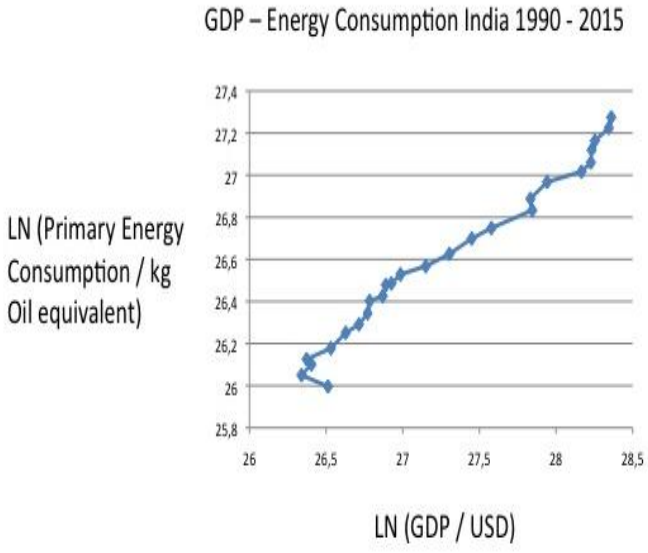
FIGURE 10. Energy consumption in India



India needs especially electricity, as 300 million inhabitants lack access to it. The country is heavily dependent upon fossil fuels (70 per cent), although to a less extent than China. Electricity can be generated by hydro power and nuclear power, both of which India employs. Yet, global warming reduces the capacity of hydro power and nuclear power meets with political resistance. Interestingly, India uses much biomass and waste for electricity production, which does not always reduce GHG emissions. India's energy policy will be closely watched by other governments and NGO:s after 2018.

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 povertyis 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.

FIGURE 11. India: GDP-energy link: y = 0,55x ;R^2 = 0,98

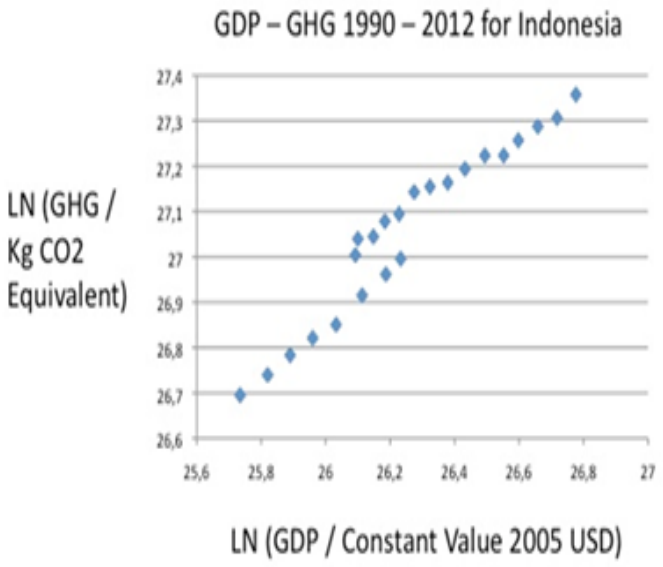


Besides burning lots of fossil fuels, Indian housholds rely much upon wood coal in its various forms, uch as charcoal, peat and dung. Wood coal is detrimental to people and the environment. As wood coal releases CO2:s, the use of biomass is typically defended by the argument that it also stores CO2, 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..

Indonesia

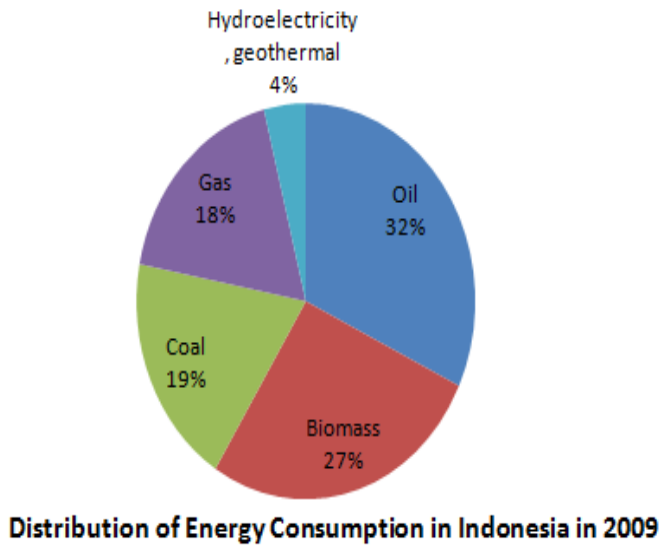
One may guess correctly that countries that try hard to "*catch-up*" will have increasing emissions. This was true of China and India. Let us look at a few more examples, like e.g. giant Indonesia – now the fourth largest emitter of GHG:s in the world (Figure 12).

FIGURE 12. INDONESIA: LN (GHG / Kg CO2 eq and LN (GDP / Constant Value 2005 USD)



Indonesia is a coming giant, both economically and sadly in terms of pollution. Figure 12 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 augments the GHG emissions very much.

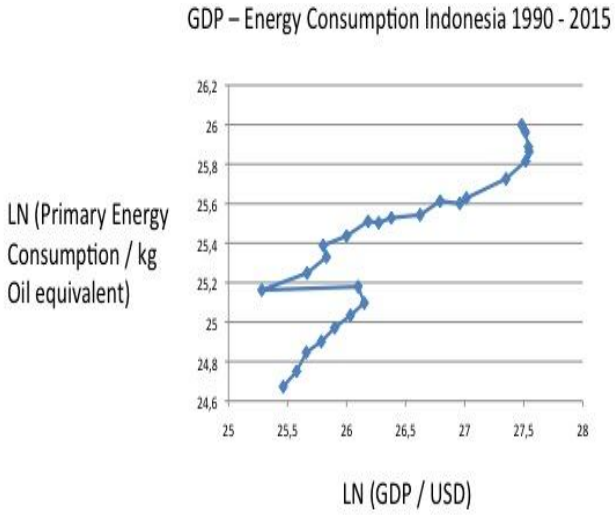
FIGURE: 13. Energy in Indonesia (http://missrifka.com/energy-issue/recent-energy-status-in-indonesia.html)



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.

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 (Rostow, 1960), but interestingly its enormous consumption of energy has not been accompanied by high real economic growth in most recent years (Figure 14).

FIGURE 14. Indonesia: GDP-energy link: y = 0,46x ;R^2 = 0,79

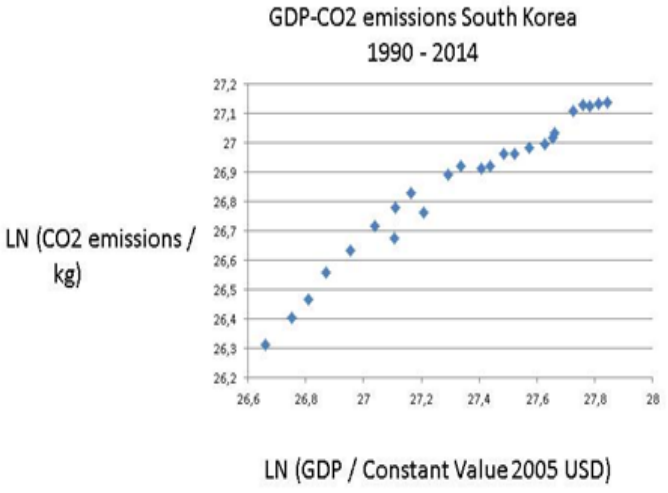


The inward and upward sloping curve for Indonesia must be of concern to the elite in the country, because Indonesia has become a major contributor to CO2 emissions. If economic growth stalls due to inflation, then how to defend the enormous emissions?

South Korea

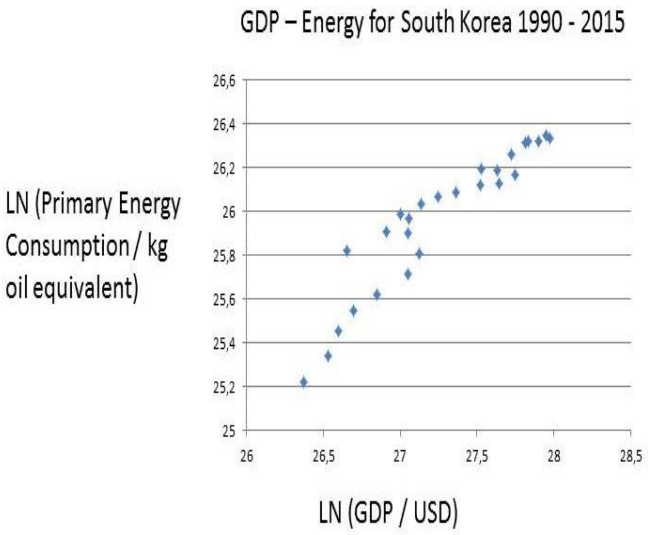
A major industrial country in East Asia is South Korea with an advanced economy and large population. It deviates from the pattern of mature economies to display a slowing down in the CO2:s(Figure 15).

FIGURE 15. South Korea: GDP=CO2 link: y = 0,65x + 9,19; R^2 = 0,96



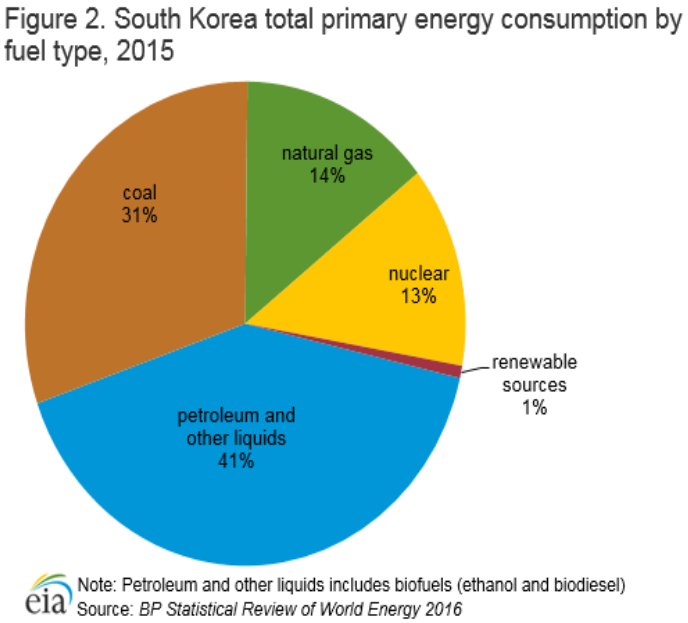
Lacking much hydro power, South Korea has turned to fossil fuels for energy purposes, almost up to 90 per cent. Now, it builds nuclear plants, but South Korea needs to move aggressively into solar power to reverse trends. It differs from China only in the reliance upon nuclear power, where the country 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 16)

FIGURE 16. GDP-energy for South Korea: y = 0,622x; R^2 = 0,88



South Korea is of course a mature economy, but it still pursues an aggressive catch-up strategy (Barro, 1991, 1993, 1995) with strong claims in electronics and nuclear power technology besides shipping and car industry. Figure 18 displays its fossil fuel dependency.

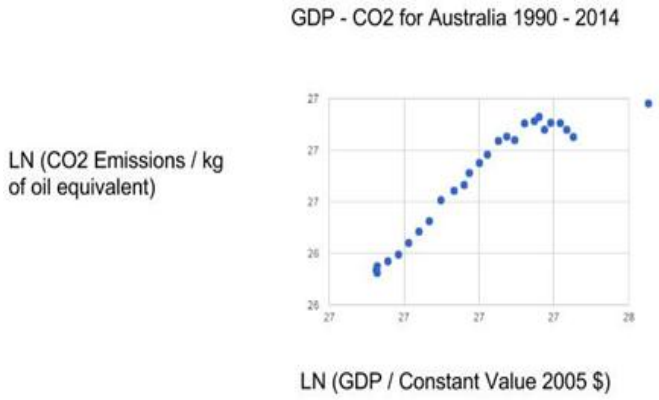
FIGURE 17. Energy mix in South Korea



Australia

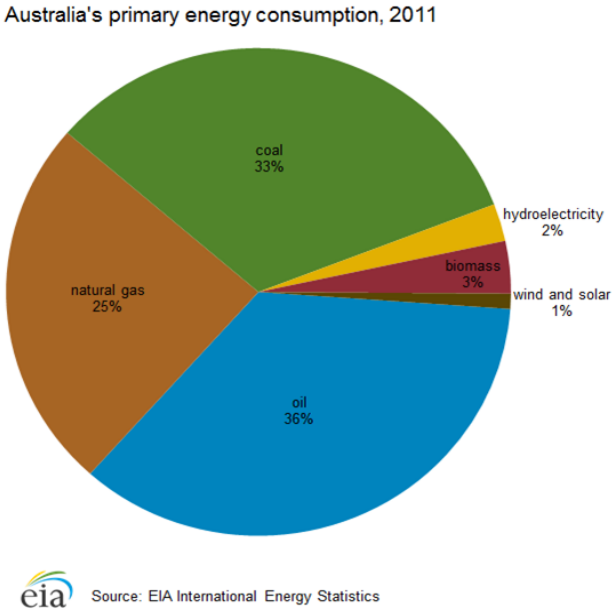
When one goes beyond the EU, one finds only two cases of declining GDP-COP curve: Australia and Japan. Japan has for a long time substituted coal for atomic power, although recently with a crucial set back. But Australia has always been the country of fossil fuels, exporting coal and iron in huge amounts. However, it has reached its CO2 peak recently (Figure 18).

FIGURE 18. 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 (Figure 19).

FIGURE 19. Energy mix in Australia



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.

COP21 GOAL II: Is CO2 REDUCTION FEASIBLE?

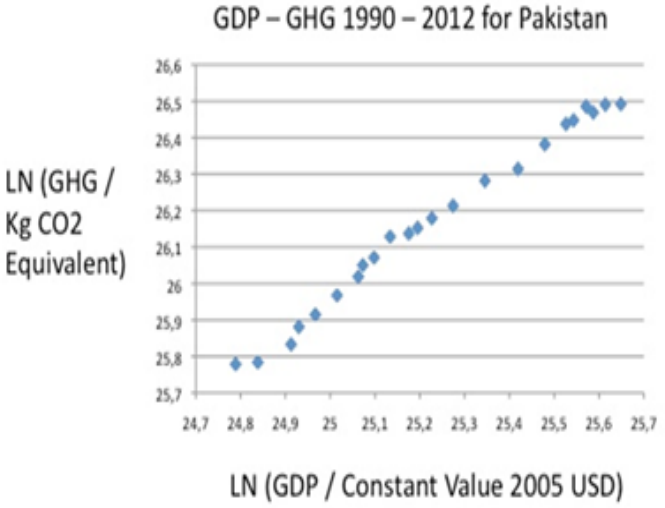
With exception of Japan and Australia, CO2 emissions curves are either rising or planning out. This is not in agreement with COP21 GOAL I. Now consider the relevance of COP21 GOAL II for some Asian countries. Can they accomplish a 30-40 per cent reduction in CO2 emissions up to 2030?

Pakistan and Bangladesh: Early victims of global warming

The same upward trend for emissions, uncovered above, holds for another major developing country with huge population, namely Pakistan (Figure 20).

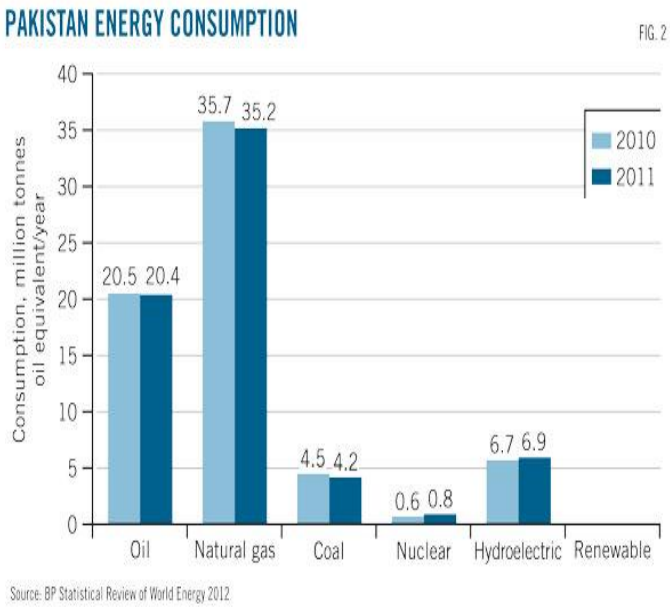
FIGURE 20. PAKISTAN: LN (GHG / Kg CO2 eq and LN

(GDP / Constant Value 2005 USD)



The amount of GHG emissions is rather large for Pakistan, viewed as aggregate. Pakistan is mainly reliant upon fossil fuels (Figure 21).

FIGURE 21. Energy mix in Pakistan

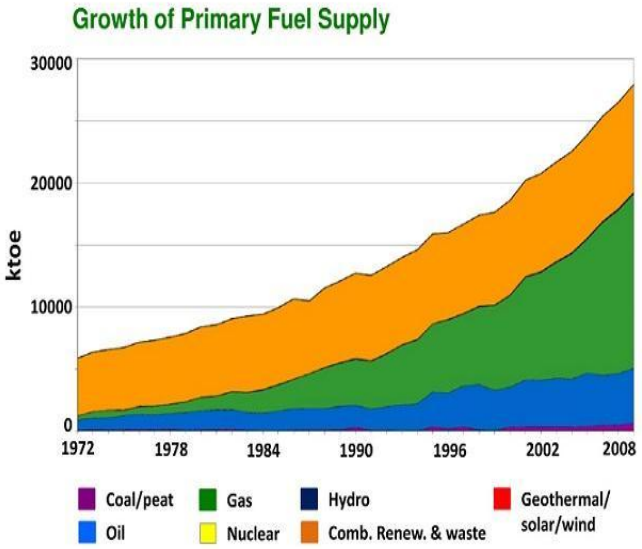


''''

But Pakistan employs a considerable portion of hydropower – 13 per cent – and a minor portion of nuclear power, which is a positive.

Moving on to another giant nation in South Asia, Bangladesh, we find an entirely different set of conditions for implementing COP21. In Bangladesh like in all South Asian countries, the GHC:s or CO2:s follows economic development closely. Yet energy consumption in this very poor nation is based on a different energy mix, compared with for instance India. Figure 22 pins down the large role of traditional renewables like wood, charcoal and dung as well as the heavy contribution of oil and gas. Bangladesh needs external support for developing modern renewables, like solar, wind and geo-thermal power sources.

FIGURE 22. Bangladesh: energy mix



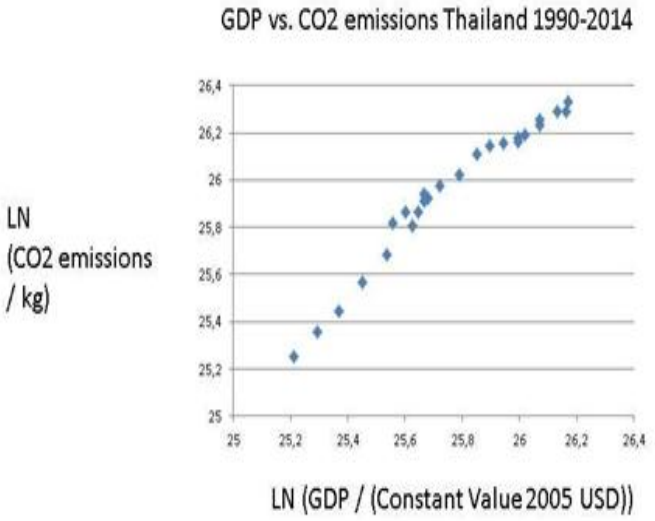
Source: Energy Scenario in Bangladesh from 1972-2008 (Orange: Biomass, Green: Gas, Blue: Oil)

I believe most countries "taking-off" in Rostow's (1960) terminologywill rely much upon fossil fuels, like the examples above. It can be pointed out that 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 implement.

Thailand and Malaysia

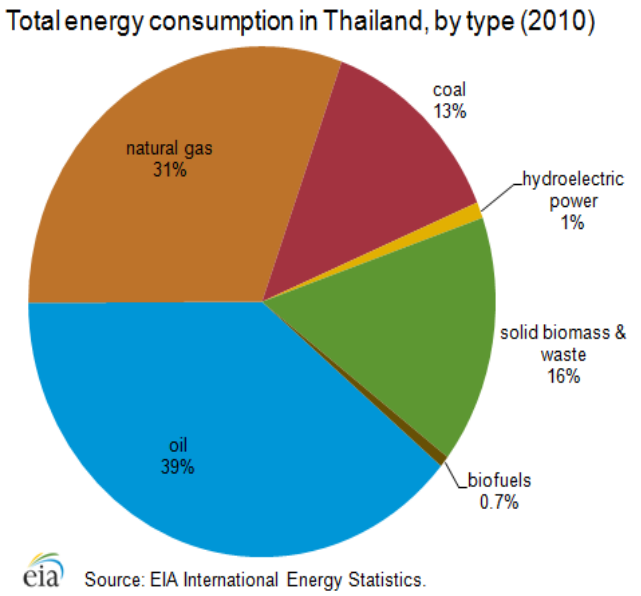
Thailand as become a rapidly developing country with increasing affluence and is besides furnishing large scale tourism a major car producer *inter alia*.

FIGURE 22. Thailand ($y = 1{,}07x$, $R^2 = 0{,}96$)



The CO2 emissions in Thailand are quite high, reflecting the economic advances in South East Asia. The trend is up and up. Can it be reversed without serious economic impact? Figure 23 shows the energy mix of this dynamic country, economically.

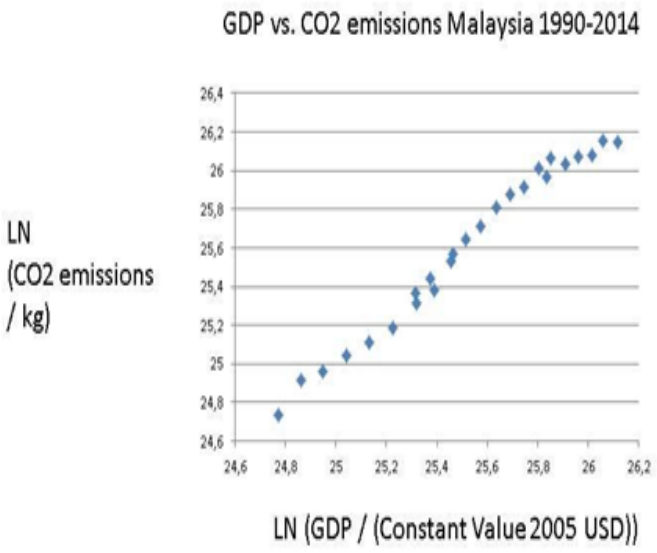
FIGURE 23. Thailand's energy mix



The reliance upon fossil fuels is high, or over 80% of energy consumption coming from the burning of coal, oil and natural gas. Hydro power is marginal, but bio-energy plays a major role, but it is really not carbon neutral. Thailand needs to come up with far-reaching reforms of its energy sector in order to comply with COP21 objectives.

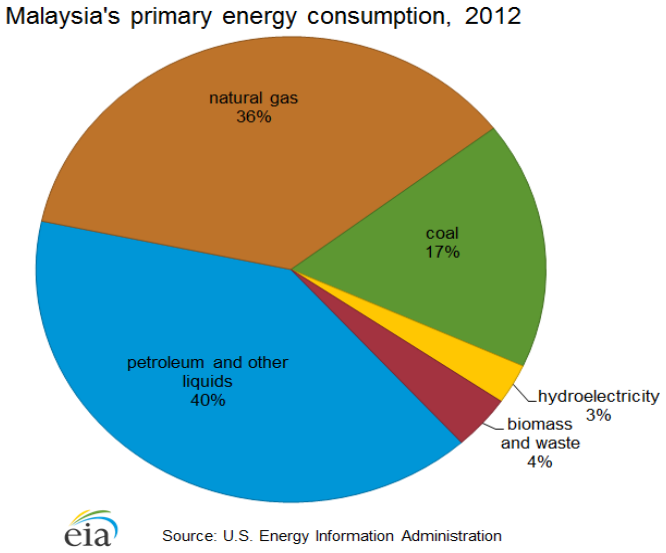
The overall situation – fossil fuels dependency – is the same for Malaysia as for Thailand. And the CO2:s are high, following the GDP trend (Figure 24).

FIGURE 24. Malaysia GDP-CO2 ($y = 1{,}13x$; $R^2 = 0{,}98$)



Malaysia employs energy of a very mixed bag (Figure 25), but still its emissions augment in line with economic development. There may be a planning out of the growth trend in emissions recently, but Malaysia use very little of carbon neutral energy sources. There is hydro power, but the country must move to solar and wind power rapidly.

FIGURE 25. Energy in Malaysia



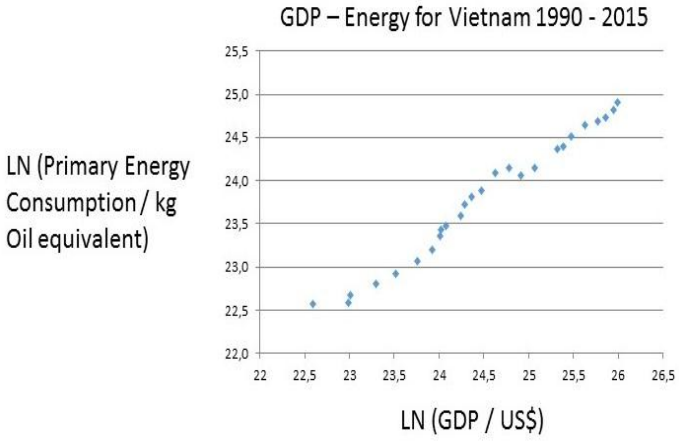
Renewables are not a major element in the energy consumption mix of Malaysia, as fossil fuels dominate, but not coal luckily.

Vietnam and the Philippines

To further substantiate the argument about the CO2-energy conundrum that countries all over the world face, we may look at two populous nations in Asia with quickly expanding economies: Vietnam and the Philippines. They have both upward sloping trends for emissions, energy consumption and GDP, as the Kaya model entails.

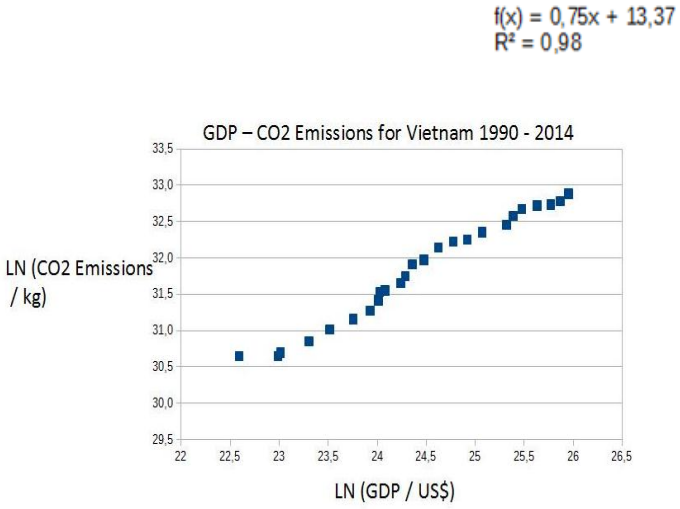
Vietnam is now the perhaps most dynamic economy in Asia, after years of socialism and a planned economy. Such fast economic growth requires one thing especially, namely energy (Figure 26).

FIGURE 26. Vietnam: GDP and energy ($y = 0{,}74x$; $R^2 = 0{,}98$)



The benefits of such an strong economic development is of course raising affluence and diminishing poverty. But the costs involve much more emissions (Figure 27).

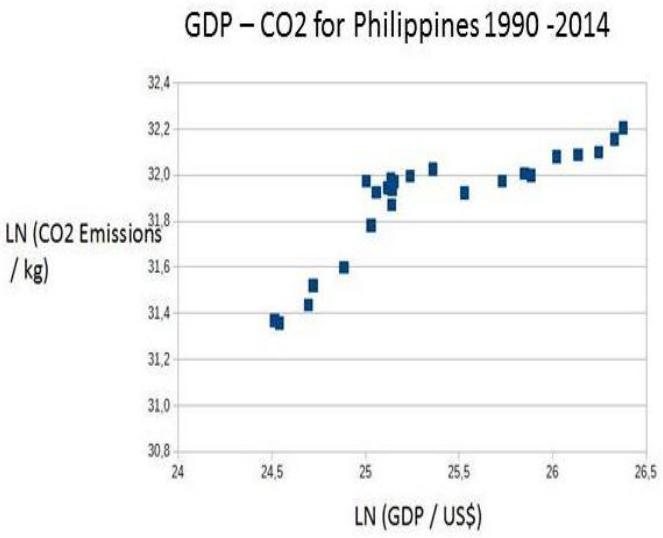
FIGURE 27. GDP and emissions for Vietnam



How Vietnam is to change in order to promote the COP21 goals, Goal I and Goal II) within a short period of some 10 years, given the ambition to maintain raid economic growth, is very difficult to understand. Can really renewables do the trick? It is a highly relevant policy question, despite the massive employment of hydro power in this country.

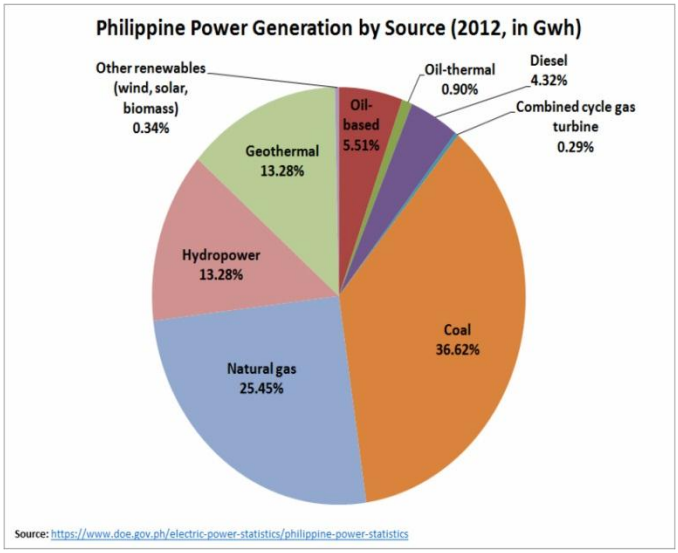
Giant nation the Philippines is very interesting, as they claim that they can handle the implementation of the COP21 goals. This may simply be rhetoric, which is just another form of reneging upon promises. Consider first the upward sloping trend in Figure 28.

FIGURE 28. The Philippines



The energy profile of the Philippines is actually more positive than several of the countries above, including a huge part of geo-thermal energy. Yet, fossil fuels dominate to a high 70 per cent, as in other populous and rapidly developing nations.

FIGURE 29. Energy mix in the Philippines



The caching-up countries in dynamic Asian countries almost all have increasing slopes for the GDP-CO2 link, which entails profound difficulties to come for the accomplishment of Goal II in the COP21 global coordination project. One can say only note that tremendous investments have to be made by these countries in renewable energy and atomic plants, which they will find difficult to do.

VI. THE ONLY REMEDY: Renewables – solar plants OUARZAZATE Size

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 closing reactors while others construct new and hopefully safer ones. I here bypass wind power and thermal power for the sake of simplicity in calculations. But wind power is highly relevant and would substitute for solar power. Geo-thermal power is country specific. Actually, every country has its specificities when it comes to energy resources and energy consumption. Consider now Table 1, using the giant solar power station in Morocco as the benchmark, it asks: 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 very big CO2 emissions?

Table 1. Number of Ouarzazate type solar plants for decarbonisation GOAL II in 2030

Nation	**Co2 reduction pledge / % of 2005 emissions**	**Number of gigantic solar plants needed (Ouarzazate)**	**Gigantic plants needed for 40 % reduction**
China	none[1]	0	3330
Japan	26	460	700
South Korea	none[2]	0	280

[1] No concrete target
[2] Pledge falls above 2005 level

Thailand	20 - 25[3]	50	110
Malaysia	35 - 45[3]	70	80
Vietnam	8 -- 25[3]	10	50
India	none[1]	0	600
Pakistan	none[1]	0	70
Bangladesh	5 - 15[3]	2	20
Australia	26 - 28	19	100
New Zealand	30	15	20

Note: Average of 250 - 300 days of sunshine per year was used for China, Japan, South Korea and New Zealand, 300 - 350 days for the others.

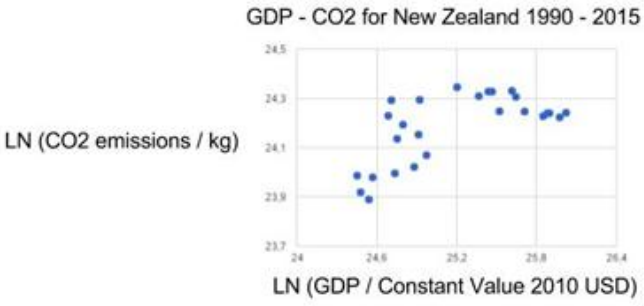
Sources: Paris 2015: Tracking country climate pledges. Carbon Brief, https://www.carbonbrief.org/paris-2015-tracking-country-climate-pledges**;** EDGAR v 4.3.2, European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research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

CO2 Emission Reduction With Solar

http://www.solarmango.com/in/tools/solar-carbon-emission-reduction

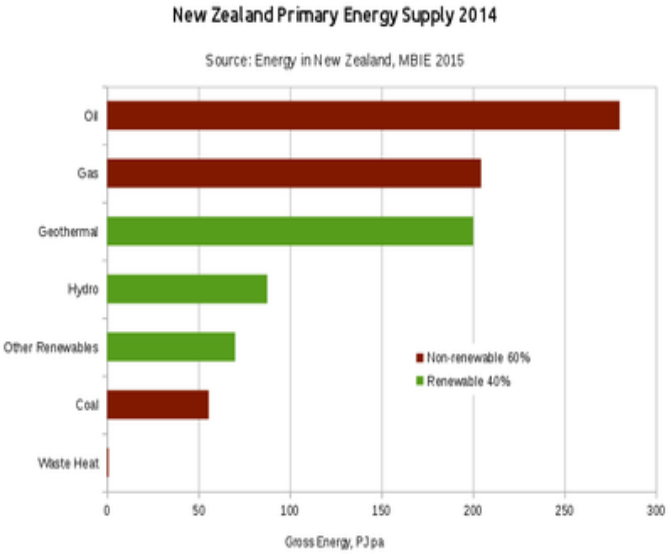
Considering the huge number of renewable energy parks in Table 1 *model calculations*, Asia and Oceania, Australia with New Zealand now face the enormous global warming challenge. Climate change will hit Asia and Oceania hard, if not perhaps unstoppable. They cannot wait for the COP21 framework to deliver, given the uncertainty about the US policy position now and in the future. However, they can take the initiative to start the decarbonisation process on their own. If China can launch the Silk Road initiative, then surely it can co-operate with other Asian countries and Australia to reduce the threats from climate change, which is more important than for instance the tiny islands in the South China Sea. Even tiny New Zealand must consider energy and CO2 emissions (Figure 30).

Figure 30. GDP-CO2 for New Zealand



Like several advanced economies, Japan, Germany, France, the UK, the CO2 curve for New Zealand has a small recent downward movement. This achieves COP21 GOAL I, but not COAL II. Even this small island country withlots of geo-thermal energy – see Figure 31 – must start energy transformation.

FIGURE 31. Energy mix in New Zealand



Not even this volcanic island can bypass Stephen Hawkins' warning: If global warming becomes irreversible, Mother Earth is turned into Venus.

REFERENCES

GDP sources:

World Bank national accounts data - data.worldbank.org
OECD National Accounts data files
World Bank Data Indicators;
UNDP Human Development Index

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

[3] Lower target unconditional, upper limit dependent on financial support

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/ - EDGARv4.3.2, 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 - The EDGARv4.3.2FT2015 emissions are calculated based on: 1) the energy balance statistics of IEA (2014) (Internet: http://www.oecd-ilibrary.org/energy/co2-emissions-from-fuel-combustion-2014_co2_fuel-2014-en) and IEA (2016) for China. 2) BP 2015 data of the BP Statistical Review of World Energy, (June 2016) (Internet: http://www.bp.com/en/global/corporate/about-bp/energy-economics/statisticalreview-of-world-energy.html). - Olivier, J.G.J., Janssens-Maenhout, G., Muntean, M. and Peters, J.A.H.W. (2016) Trends in global CO2 emissions: 2016 Report. European Commission, Joint Research Centre (JRC), Directorate C - Energy, Transport and Climate; PBL Netherlands Environmental Assessment Agency, The Hague. JRC103425, PBL2315, Trends in global CO2 emissions - 2016 report, November 2016.

World Bank Data Indicators, data.worldbank.org

British Petroleum Statistical Review of World Energy 2016Literature

Literature

Barro, Robert J. 1991. Economic Growth in a Cross Section of Countries. The Quarterly Journal of Economics, 106(2):407-443.

Barro, Robert J. and Xavier X. Sala-i-Martin. 1992. Convergence. Journal of Political Economy, 100(2):223-251.

Barro, Robert J. and Xavier X. Sala-i-Martin. 1995. Economic Growth. McGrow Hill.

Conca, K. (2015) An Unfinished-Foundation-. Oxford: OUP.

Hayek, F. (1991) Fatal Conceit. The errors of socialism. Chicago: University of Chicago Press.

Kaya, Y. & Yokoburi, K. (1997) Environment, energy, and economy: Strategies for sustainability. Tokyo: United Nations University Press.

Ramesh, J. (2015) Green Signals. Oxford: Oxford University Press.

Rostow, W. W. (1960). The Stages of Economic Growth: A Non-Communist Manifesto. Cambridge: Cambridge 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) Why Are We Waiting? The Logic, Urgency, and Promise of Tackling Climate Change. Cambridge, MA: MIT Press.