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RESEARCH ARTICLE

SOUTH ASIA CONFRONTING ITS GREATEST CHALLENGE: CATCHING-UP BUT OVER-HEATING

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ABSTRACT

South East Asia is poised to become the next set of Asian miracles. But they face a terrible threat from the environment, as global warming picks up speed. Can these almost 2 billion work and find food and water, if temperature rises more than 2-3 degrees? Can peasants survive? And how to generate enough electricity for housing?Without massive financial assistance, there will occur widespread reneging on the COP21 objectives (Goal I-III).The system of United Nations Climate Change Conferences, yearly conferences held in the framework of the United Nations Framework Convention on Climate Change (UNFCCC), does not offer an organization that is up to the coordination tasks involved in halting climate change.

INTRODUCTION

It is true that climate change and its implications are given much more attention now, after the COP_{21} Agreement in Paris. There are almost weekly conferences about global warming and the debate is intense all over the globe. This is a positive, but one must point out the exclusive focus upon natural science and technological issues, which actually bypasses the thorny problems of international governance and the coordination of states. The social science aspects of global warming policy-making will be pointed out in this article. This is a problematic by itself that reduces the likelihood of successful implementation of the goals of the COP_{21} Agreement (Goal I, Goal II and Goal III in global decarbonistion).

Global warming uncertainties

It is quite understandable that the focus in all the international conferences, some of which are now speaking of COP_{22} meetings, is upon the natural science issues in climate change. They deal with how dangerous the global warming process could be as well as the feasibility of halting this trend in the 21rdt century by various measures, like for instance carbon capture. Yet, by neglecting some very relevant social science models, the COP_{21} approach of decarbonisation will run into major difficulties, already in the next decade. Can really international governance together with states coordination deliver policies and will they be implemented in a decentralized approach? This question is most relevant, even when the natural sciences and technology arrives at conclusive answers to the major issues in climate change.

It seems to me that the key issues in the global climate change debate concerns inter alia the following:

1. What more precisely is the link between the amount of carbon in the atmosphere and the rise of temperature, in sea and n land? Is it a linear or non-linear link? Thresholds? Reversibility?
2. How and when will rising temperatures in sea and at land affect basic environmental aspects, like the ice layers and the frozen waters as well as glaciers?
3. How much carbon will be stocked in the atmosphere in this century, given alternative scenarios of emissions and natural carbon uptake? How dangerous could increasing GHG:s like methane be?
4. Is it at all feasible to accomplish massive decarbonisation of the air by means of carbon sequestration at what costs?

Having full knowledge about all these issues would improve much upon the theories of global warming and would be extremely useful in practice when policies are to me made about decarbonisation.

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Yet, they do not comprise the implications of lessons of the social sciences for global governance, coordination and policy making. The crux of the matter is what I call the *Wildavsky hiatus*: policies however appealing are bound to fail when put in practice, as no policy is self-implementable (Pressman and Wildavsky, 1973, 1984). To grasp the feasibility of the COP21 project and its three goals of decarbonisation, one must understand the implementation deficit and the coordination failures. I will spell out these concepts here in relation to the COP21 framework, and its three objectives, namely:

a) Halting the increase in carbon emission up to 2020 (Goal I);
b) Reducing CO2:s up until 2030 with 40 per cent (Goal II);
c) Achieve more less total decarbonisation until 2075 (Goal III).

It is up to the governments of the countries to implement these goals with rather weak overview from international governance but with the promise of assistance from a huge Super Fund. What, then, are the *INCENTIVES* involved in decentralized decarbonisation a la COP21? To discuss decarbonisation feasibility along the three goals – Goal I, Goal II and Goal III – one need to take into account the restrictions on human action and interaction in social systems, spelled out in economic theory and game theory

The economy and climate change: Kaya's Model

The basic theoretical effort to model the greenhouse gases, especially CO2:s, in terms of a so-calledidentity is the deterministic Kaya equation. The Kaya identity, "I = PAT" – model type, describes environmental (I)mpactagainst the (P)opulation, (A)ffluence and (T)echnology. Technology covers energy use per unit of GDP as well as carbon emissions per unit of energy consumed (Kaya and *Yokoburi*, 1997). In theories of climate change, the focus is upon so-called anthropogenic causes of global warming through the release of greenhouse gases (GHG). To halt the growth of the GHG:s, of which CO2:s make up about 70 per cent, one must theorize the increase in CO2:s over time (longitudinally) and its variation among countries (cross-sectionally). As a matter of fact, CO2:s have very strong mundane conditions in human needs and social system prerequisites. Besides the breading of living species, like Homo sapiens for instance, energy consumption plays a major role. As energy is the capacity to do work, it is absolutely vital for the economy in a wide sense, covering both the official and the unofficial sides of the economic system of a country. 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*: (E 1) 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 TeraWatt year*." (http://climatemodels.uchicago.edu/kaya/kaya.doc.html)

Concerning the equation (E 1), 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 anthropegenic 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 data from some 59 countries. I make an empirical estimation of this probabilistic Kaya model - the cross-sectional test for 2014:

(E4) k1= 0,68 k2=0,85 k3=0,95 k4=0,25; R2 = o.895.

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)

We show in Figure 1 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.

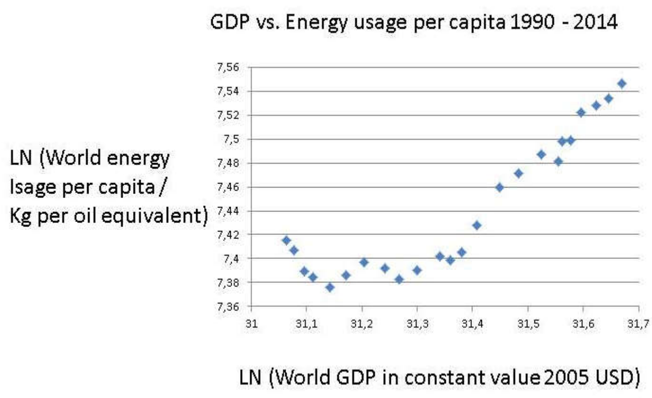


Figure 1. GDP against energy per person (all countries)

The implications of Figure 1 for the South Asian countries will be spelled out below. They need massive energy to end their 2000 year record of dismal poverty.

Framework of analysis

We need to model this energy-emission dilemma for the countries of the COP21 project. To understand the predicament of Third World countries, we need to know whether GHC:s or CO_2:s are still increasing (Goal I) and what the basic structure of the energy mix is (Goal II). Thus, I suggest: <GDP-GHG(CO_2) link, energy mix>, as a model of the decarbonisation feasibility in some Third World countries, to be analysed below, following the so-called ”Kaya” model. The first concept taps the feasibility of Goal I: halting the growth of GHG:s or CO2:s, whereas the other concepts targets the role of fossil fuels and wood coal like charcoal. The difference between global warming concern and general environmentalism appears clearly in the evaluation of atomic power. For reducing climate change, nuclear power is vital, but for environmentalism atomic power remains a threat. From a short-term perspective, the global warming concerns should trump the fear of radioactive dissemination, as global warming will hit mankind much sooner. In the Third World, nuclear power plants are increasing in number, whereas in the mature economies their number is being reduced. New nuclear technology is much safer, why also advanced countries should use this option, like for instance the UK.

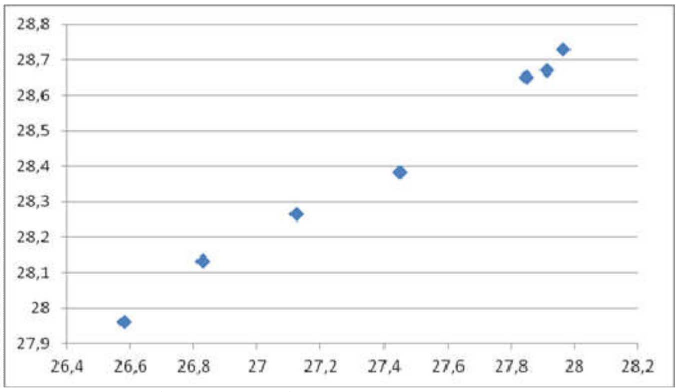
The tragedy of South Asia

Just because there is an agreement it does not entail it will be respected. Even if respecting the promises made is the best strategy for all partners to the dal, each individual has an incentive to renege upon the agreement. In two-person game theory, a few much discussed models portray coordination failures, and they are applicable to governments as well as international governance. If, as shown above with the Kaya model, decarbonisatin may be costly, hurting economic development, then perhaps a country may simply go its own way, leaving it up to the other(s) to handle the externalities in global warming. Why make costly contributions to collective action? Remember that small countries do not matter much (N-1 problematic) and huge countries would have to share the benefits with all others (I/N problematic). The interaction between nations and their governments can be of two kinds: zero sum game or variable sum game. Halting the climate change process constitutes a Pareto optimal goal for all participants with means of collective action, coordination either by themselves or with a third party, an international governance body like that of the UNFCCC. However, coordination may fail to reach a set of Pareto optimal outcomes, as the choice participants. I will analyse a few important countries in a comparative fashion so that they can be compared systematically. Two diagrams will be presented for each country, related to the research approach above. First, the COP21 Goal I will be tapped by looking at the curve between GDP and CO_2:s (GHG:s), whether is rising or declining and whether it slopes outward or inward. Second, the COP21 Goal II is enquired into, as the energy consumption mix is portrayed: the more reliance upon fossil fuels and charcoal, the more costly the energy transition. What matters in both diagrams are both absolute and relative numbers. Thus, the coal share of energy resources may go down, but if total energy consumed is up, emissions will remain at a high level.

A set of countries with huge population at a low level income per person will find the COP_{21} objectives too exigent. They have to plan for more of energy in order to strengthen economic development against widespread poverty amidst string population growth. These countries can only promote Goal I and Goal II, if supported by the Super Fund.

India

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 2 shows the close connection between emissions and GDP for this giant nation.



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

Figure 2. India: LN (GHG / Kg CO2 eq and LN (GDP / Constant Value 2005 USD)

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. Figure 5 shows its energy mix where renewables play a bigger role than in for instance China.

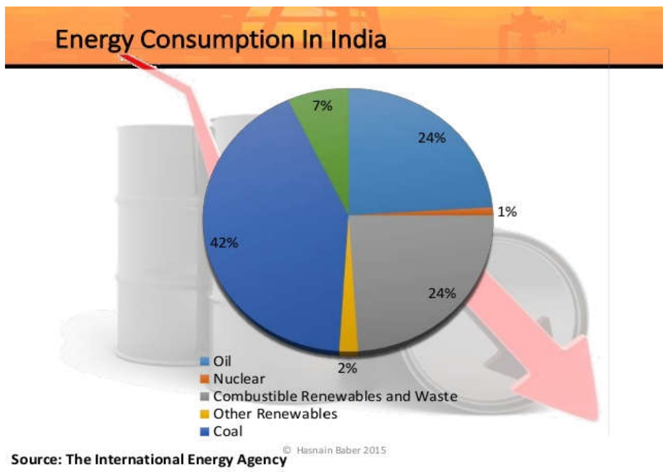


Figure 3. India’s energy mix

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. Former minister and public intellectual Ramesh (2015) admits that India will need coal (stone and wood) for a long time in order to catch-up decently.

But the country suffers from global warming that may reduce access to water from drinking and hydro power stations.

Pakistan

The same upward trend for emissions holds for another major developing country with huge population, namely Pakistan (Figure 4).

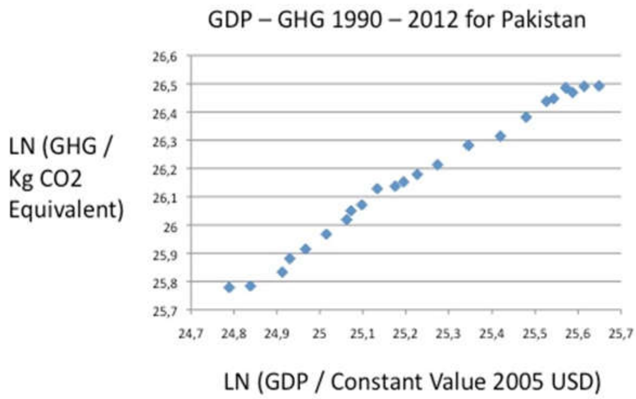


Figure 3. Pakistan: LN (GHG / Kg CO2 eq and LN (GDP / Constant Value 2005 USD)

The amount of GHG emissions is rather large for Pakistan, viewed on aggregate. Pakistan is mainly reliant upon fossil fuels (Figure 5).

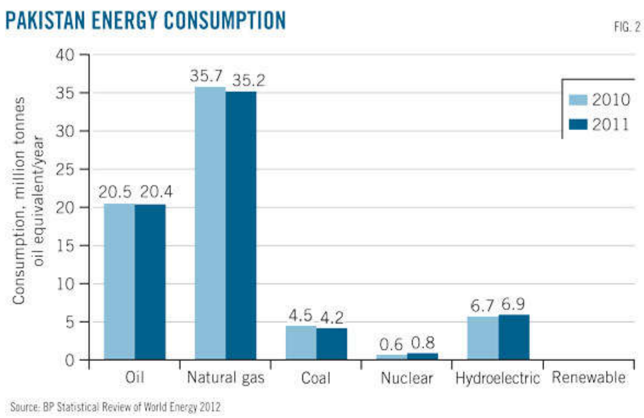


Figure 5. Energy consumption in Pakistan

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

Bangladesh

Moving on to another giant nation in South Asia, Bangladesh, we find an entirely different set of conditions for implementing COP21. Figure 6 shows that the major GHC of CO2:s follows economic development closely.

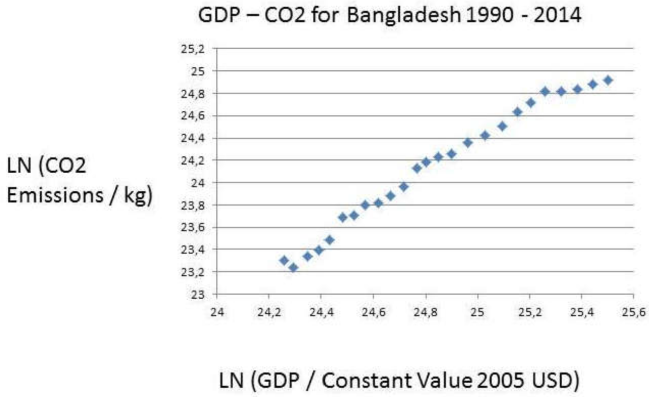
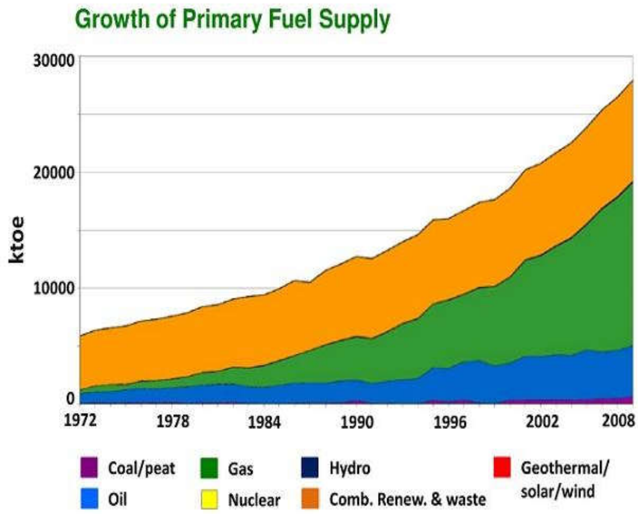


Figure 6. Bangladesh's GDP-CO@ link (y = 1,43x, R² = 0,98)

Yet energy consumption is based on a different energy mix, compared with for instance India. Figure 7 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.



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

Figure 11. Energy mix in Bangladesh

Sri Lanka

When examining small but populous Sri Lanka, one sees again the strong connection between GDP and CO_2:s – see Figure 8. It seems that the CO_2:s was halted in their expansion for some time, but now they increase again.

In this island state, the dominant energy source is traditional renewables, which leads to deforestation and CO_2 emissions on a large scale (Figure 9). It has been argued that the forest will grow up again, eating the carbon emissions. But it is mainly wishful thinking, as climate change and draughts make forest rehabilitation difficult.

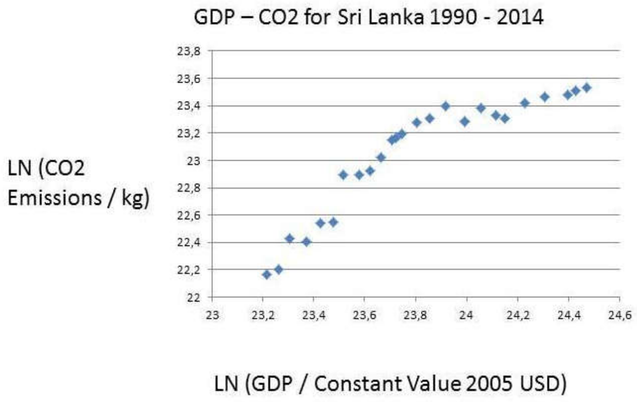
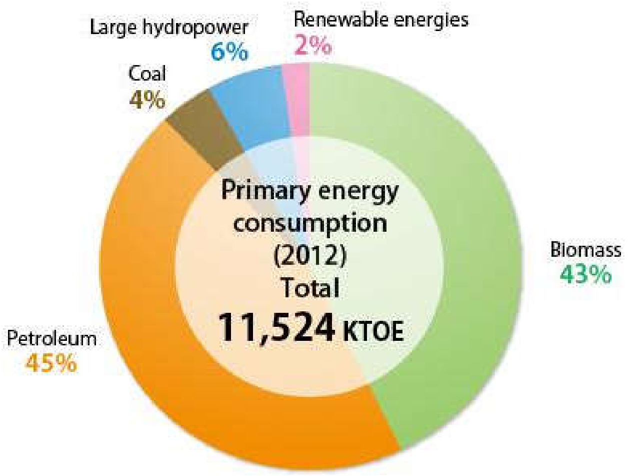


Figure 8. Sri Lanka (y = 1,03x, R^2 = 0,84)



Source: Primary energy consumption in Sri Lanka (2012); http://www.info.energy.gov.lk/

Figure 9. Sri Lanka's energy consumption

For the poor nations in Asia with huge population holds that they cannot by themselves accomplish the objectives of COP21: Goal I: reverse current CO2 trend, Goal II: reduce by 40 per cent the CO2:s by 2030 and Goal III: full decarbonisation by 2075. As a matter of fact, they will need massive financial assistance from the Super Fund, which has still not been founded. Yet, this requires that the COP21 or CO22 sets up a management structure to assist these countries involving project evaluation, policy execution and implementation, control of financial flows and outcome assessment – a gigantic task with many pitfalls involved

The precarious neighbours of South Asia

Indonesia

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 10). Indonesia is a coming giant, both economically and sadly in terms of pollution. Figure 10 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. Figure 11 presents the energy mix for this huge country in terms of population and territory.

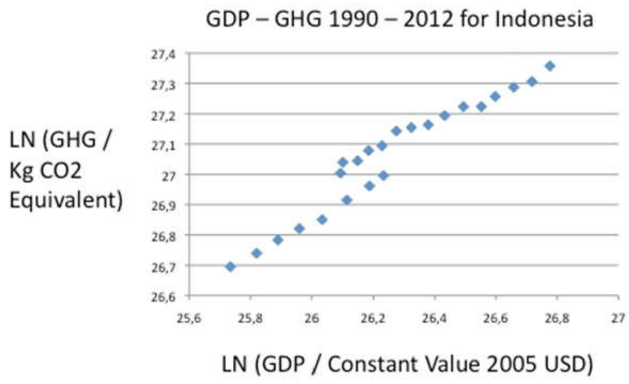


Figure 10. Indonesia: LN (GHG / Kg CO2 eq and LN (GDP / Constant Value 2005 USD)

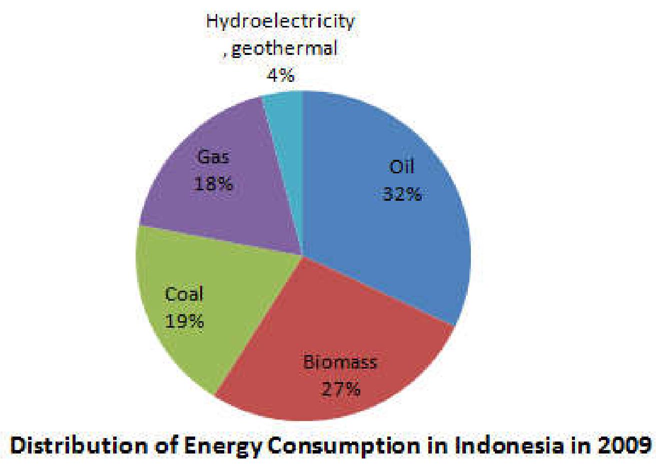


Figure 11. Indonesian energy(http://missrifka.com/energy-issue/recent-energy-status-in-indonesia.html)

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.

Iran

Countries may rely upon petroleum and gas mainly – see Iran (Figure 12). CO2 emissions have generally followed economic development in this giant country, although there seems to be a planning out recently, perhaps due to the international sanctions against its economy.

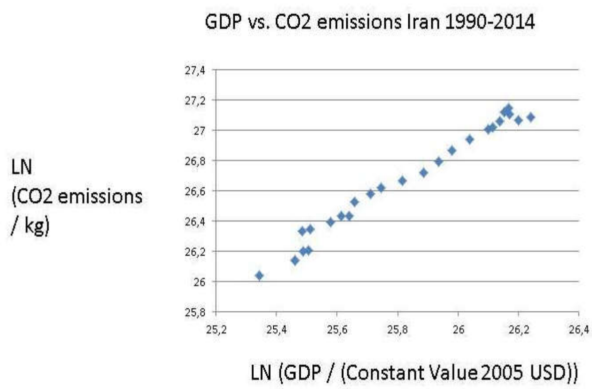


Figure 12. Iran: GDP-CO_2 link (y = 1,2229x - 4,91; R^2 = 0,98)

Iran is together with Russia and Qatar the largest owner of natural gas deposits. But despite using coal in very small amounts, its CO2 emissions are high. Natural gas pollute less than oil and coal, but if released unburned it is very dangerous as a greenhouse gas. Iran relies upon its enormous resources of gas and oil (Figure 13).

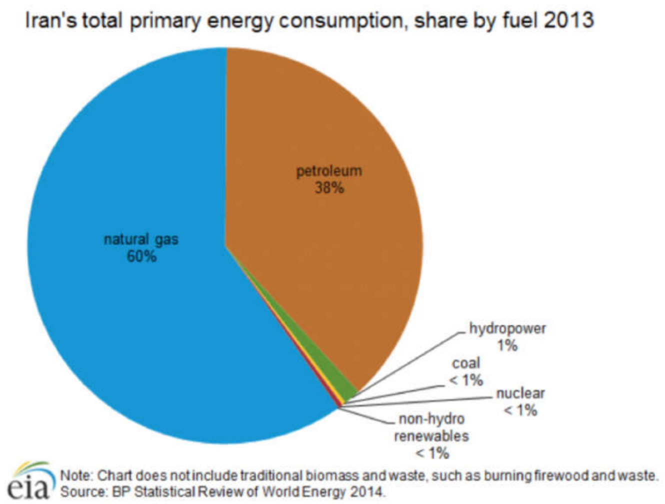
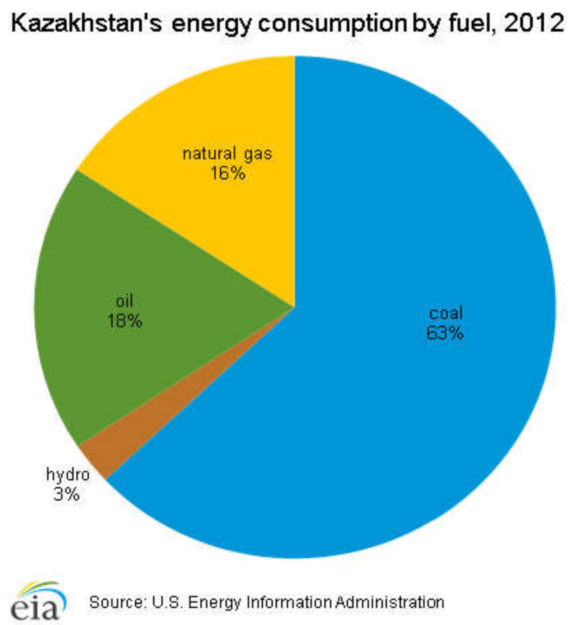


Figure 13. Iran: Energy mix

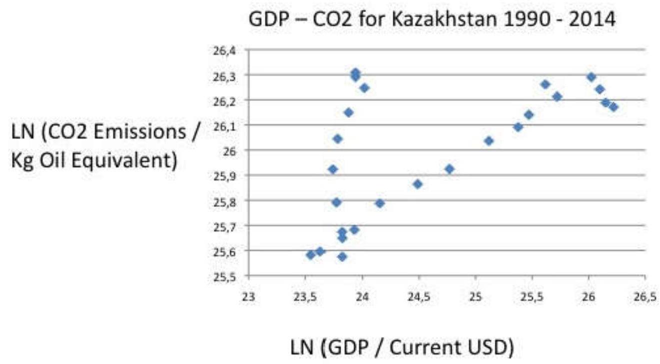
Iran needs foreign exchange to pay for all its imports of goods and services. Using nuclear power at home and exporting more oil and gas would no doubt be profitable for the country.And it would also help Iran with the COP21 goals achievement.

Kazakhstan

Here we have a nation very much occupied with the catch-up strategy. It wants to copy the Asian miracles, moving to affluence in a few decades, using its immense fossil energy resources (Figure 14).



However, this energy consumption leads to enormous emissions (Figure 15). The stunning economic development, including the great project of a modern Silk Roan from China to Germany through Kazakhstan implies that the CO21 goals cannot be accomplished here. Catch-up and huge infrastructure trumps climate change.



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 14).

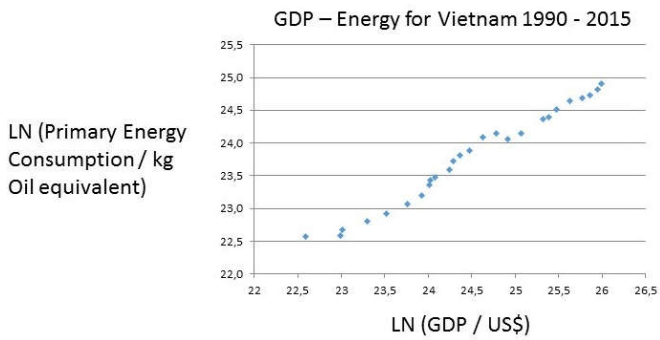


Figure 14. Vietnam: GDP and energy (y = 0,74x; R^2 = 0,98)

The benefits of such an strong economic development is of course raising affluence and diminishing poverty. But the costs involve much more emissions (Figure 15).

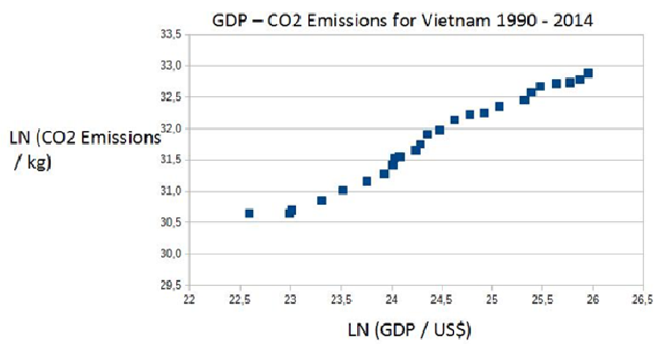


Figure 15. GDP and emissions for Vietnam

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 16.

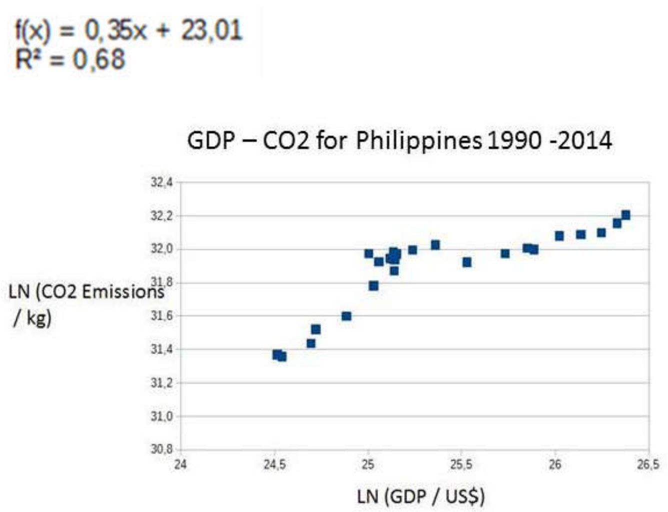


Figure 16. The Philippines

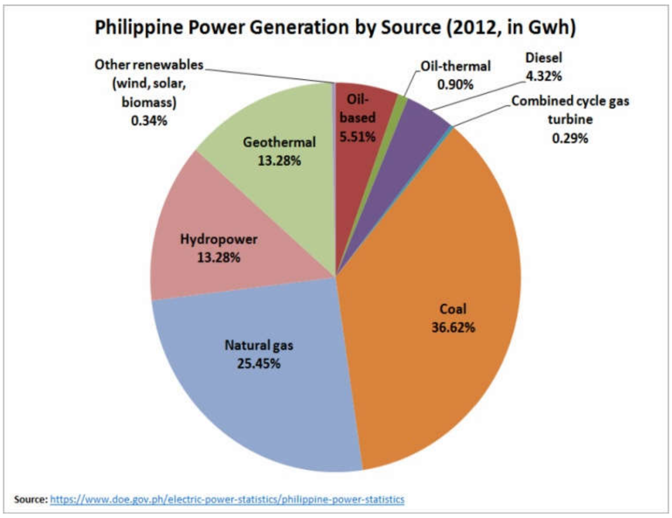
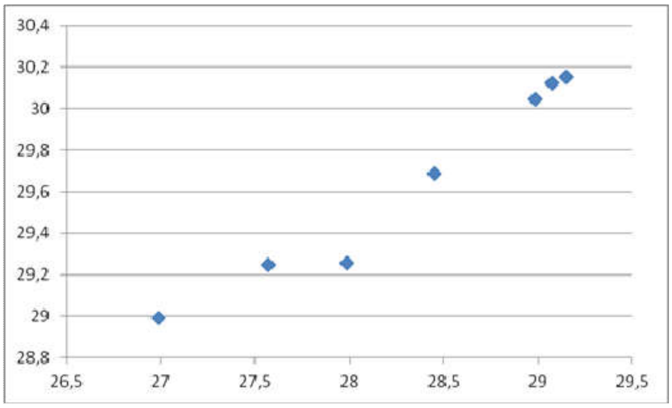


Figure 17. Energy mix in the Philippines

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. The Philippines definitely needs help from the Super Fund. The caching-up countries all have increasing slopes for the GDP-CO_2 link, which entails profound difficulties to come for the accomplishment of Goal I in the CO_{21} project. In relation to the achievement of Goal II, 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. 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 emissions are the largest in the world, totally speaking (Figure 18). China was a Third World country up until yesterday.

China



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

Figure 18. CHINA: LN (GHG / Kg CO2 eq and LN (GDP / Constant Value 2005 USD)

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 19).

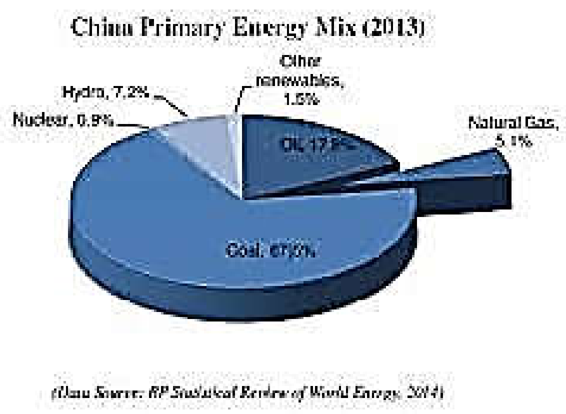


Figure 19. China's energy mix

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 COP21 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). But China can hardly ask for this form of foreign assistance. It is true that China energy consumption is changing with much more of renewables ad atomic plants. But so is also demand increasing with new and bigger cars all the time plus increased air traffic on huge new airports. Can

China really cut CO2:s with 40 per cent while supply almost 50 per cent more energy power, according to plan?

Conclusion

Ominously, all the countries analysed above have upward sloping GDP-CO_2(GHG) curves and rely much upon coal (stone and wood), oil and gas. South Asia and its neighbouring countries are engaged in a struggle for catch-up, meaning reducing the income and wealth gap to the mature economies in the world, just like the Asian miracles have achieved recently. But there is a cost to be paid, namely the environment in general and the carbon or GHG emissions in particular. The Kaya model entails that carbon emissions explode with GDP growth and population size. This is exactly the overall predicament of South Asia and its neighbours. If climate change goes out of hand, the consequences for these countries will be dramatic on the negative side. They must participate fully in the COP21 project, receiving massive support from the promised Super Fund.

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