

# Pitfalls in Global Warming Policy-Making: Reneging as an Alternative of Action

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Received: October 20, 2016      Accepted: November 2, 2016      Online Published: November 16, 2016  
doi:10.22158/wjssr.v3n4p551      URL: <http://dx.doi.org/10.22158/wjssr.v3n4p551>

## **Abstract**

*The coincidence of the COP22 conference in Morocco and the election victory of Donald Trump is indeed a contradiction. The UN needs quickly to begin making the implementation of the COP21 Agreement goals operational—a gigantic management task for this century. But the USA may be the first nation to go at the Achilles heel of the entire COP21 project, namely reneging. Here, I list some of the major pitfalls with the endeavours of the United Nations Framework Convention on Climate Change (UNFCCC), which has not taken the lessons from the social sciences about coordination failures into account.*

## **Keywords**

*UNFCCC, energy-emission conundrum, reneging, policy-making pitfalls*

## **1. Introduction**

The focus in the international conferences, like the COP22 meeting, has been 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 21st century by various measures, like for instance carbon capture. Yet, by neglecting some highly relevant social science models, the COP21 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?

## **2. Enigma**

Key issues in the global climate change debate include *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 on 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 be made about decarbonisation.

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 gap*: policies however appealing are bound to fail when put in practice, as no policy is self-implementable (Pressman & 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 CO<sub>2</sub>:s up until 2030 with 40 per cent (Goal II);
- c) Achieve more or 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 decentralised decarbonisation à la COP21? To discuss decarbonisation feasibility along the three goals—Goal I, Goal II and Goal III—one needs to take into account the restrictions on human action and interaction in social systems, spelled out in economic theory and game theory.

### 3. Energy

The basic theoretical effort to model the greenhouse gases, especially CO<sub>2</sub>:s, in terms of a so-called identity is the deterministic Kaya equation. The Kaya identity, “ $I = PAT$ ”—model type, describes environmental (I)mpact against the (P)opulation, (A)ffluence and (T)echnology. Technology covers energy use per unit of GDP as well as carbon emissions per unit of energy consumed (Kaya & Yokobori, 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 CO<sub>2</sub>:s make up about 70 per cent, one must theorize the increase in CO<sub>2</sub>:s over time (longitudinally) and its variation among countries (cross-sectionally). As a matter of fact, CO<sub>2</sub>:s have very strong mundane conditions in human needs and social system prerequisites. Besides the breeding 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*:

(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<sub>2</sub> per TeraWatt 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:  $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_tX_t + u$

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>

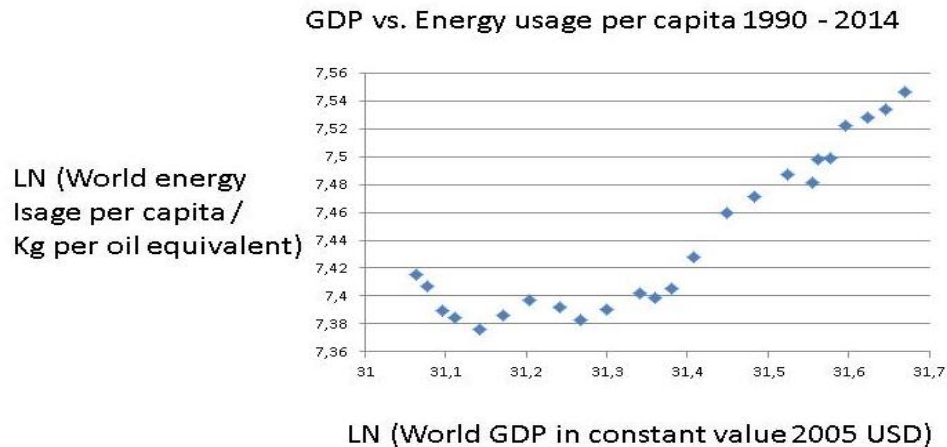
Thus, using the Kaya model for empirical research on global warming, the following anthropogenic conditions would affect positively carbon emissions:

(E3) CO<sub>2</sub>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)  $k_1 = 0,68, k_2 = 0,85, k_3 = 0,95, k_4 = 0,25; R^2 = 0,895$ .

Note:  $LN CO_2 = k_1 * LN (GDP/Capita) + k_2 * (\text{dummy for Energy Intensity}) + k_3 * (LN Population) + k_4 * (\text{dummy for Fossil Fuels/all})$  Dummy for fossils 1 if more than 80 % fossil fuels; k<sub>4</sub> not significantly proven to be non-zero, all others are (N = 59).

The Kaya model findings show that total CO<sub>2</sub>s go with larger total GDP. To make the dilemma of energy versus emissions even worse, 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)**

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 GHG:s or CO<sub>2</sub>:s are still increasing (Goal I) and what the basic structure of the energy mix is (Goal II). Thus, I suggest:

<GDP-GHG(CO<sub>2</sub>) 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 CO<sub>2</sub>:s, whereas the other concepts targets the role of fossil fuels and wood coal like charcoal.

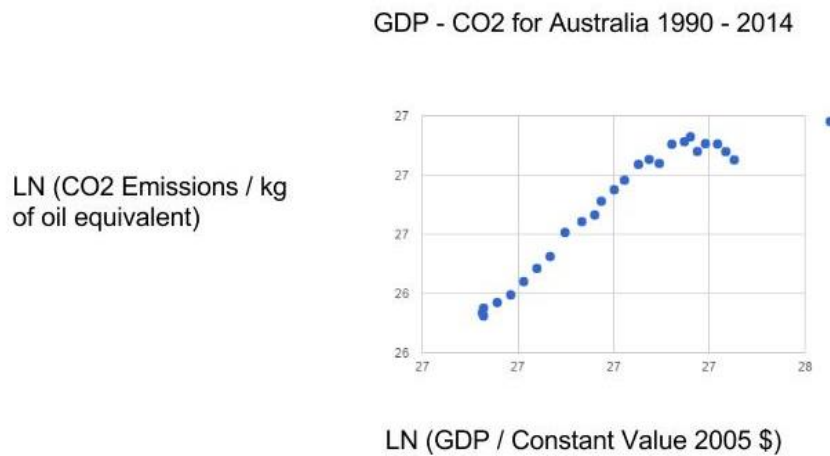
The difference between global warming concern and general environmentalism appears clearly in the evaluation of atomic power. For reducing climate change, nuclear power is vital, but for environmentalism atomic power remains a threat. From a short-term perspective, the global warming concerns should 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.

I will analyse a few important countries in a comparative. 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<sub>2</sub>: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.

### 3.1 Pitfall 1: Economic Growth: Australia

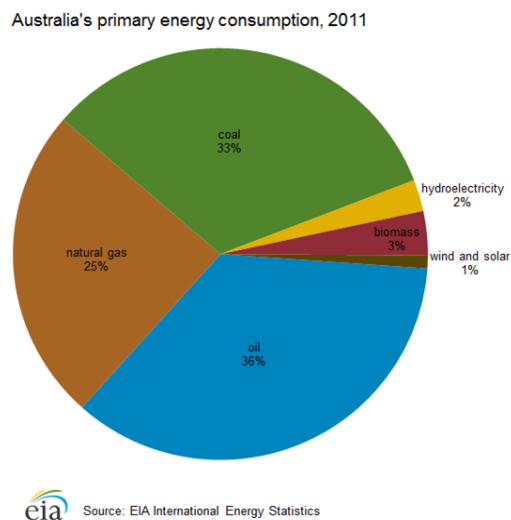
When one goes beyond the EU, one finds only two cases of declining GDP-COP curve: Australia and Japan. Japan has for a long time substituted coal for atomic power, although recently with a crucial set. But Australia has always been the country of fossil fuels, exporting coal and iron in huge amounts.

However, it has reached its CO<sub>2</sub> peak recently (Figure 2).



**Figure 2. Australia**

Exports Australia has been extremely dependent upon fossil fuels, domestically and in. Cutting back its coal dependency will allow the country to halt its CO<sub>2</sub> emissions, while moving to renewables. The fossil fuel dependency of Australia is simply stunning (Figure 3).



**Figure 3. 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 CO<sub>2</sub>s only if economic growth is not hurt. It remains to be seen how Australia tackles Goal I and Goal II. Former

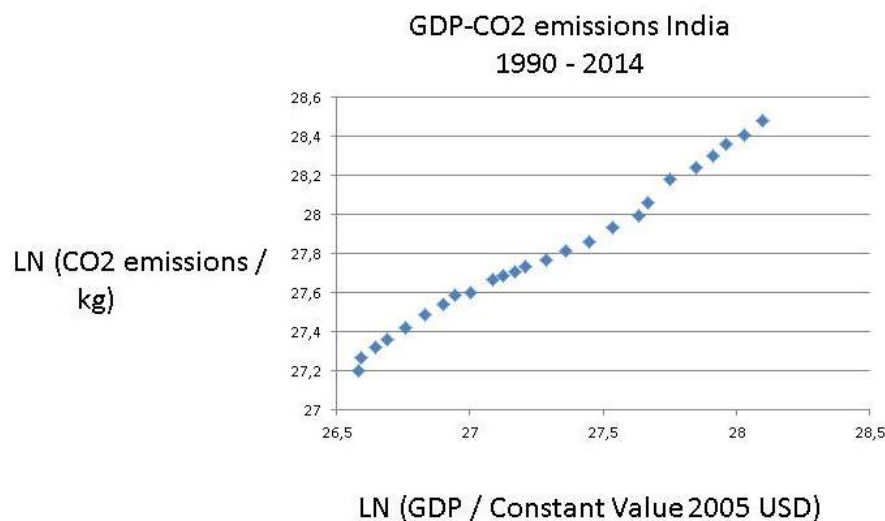
premier Abbott expressed an Australian preference: first growth, second decarbonisation.

### 3.2 Pitfall 2: Huge Scale Poverty

For the poor nations in Asia with huge population holds that they cannot by themselves accomplish the objectives of COP21: Goal I: reverse current CO<sub>2</sub> trend, Goal II: reduce by 40 per cent the CO<sub>2</sub>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.

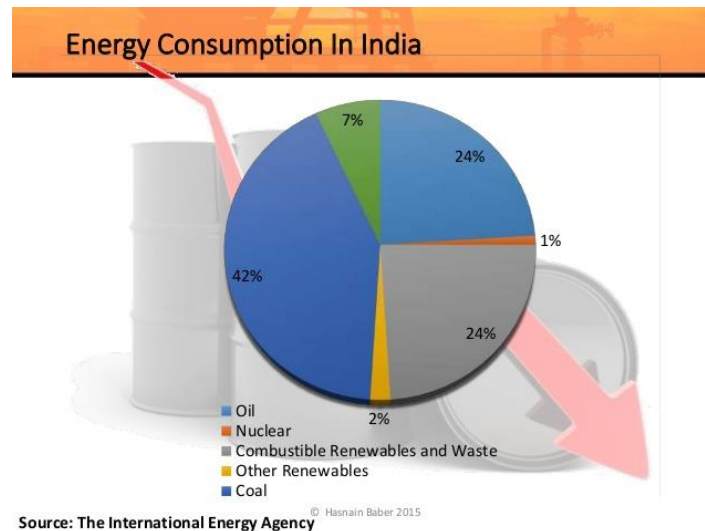
#### India

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 4 shows the massive carbon emissions, following its economic development.



**Figure 4. India's Link GDP-CO<sub>2</sub>:  $y = 0,77x + 6,79$ ;  $R^2 = 0,99$**

India needs cheap energy for its industries, transportation and heating (Figure 4) 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.

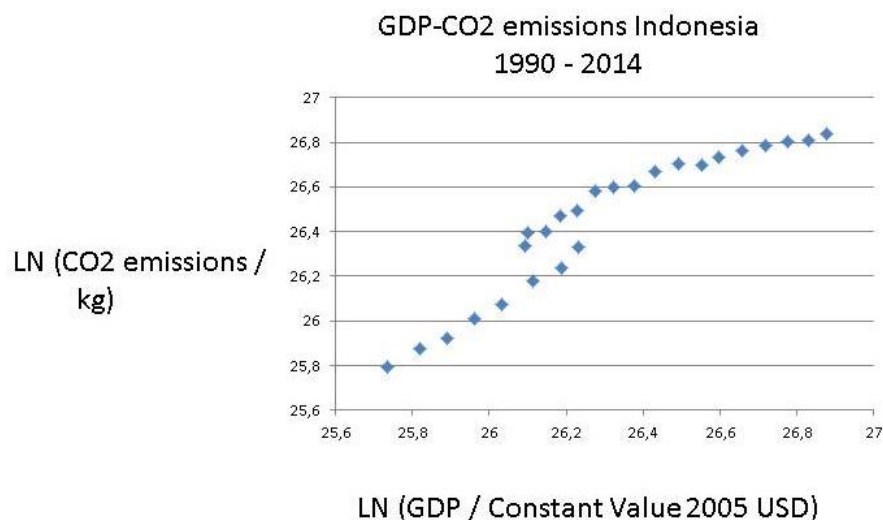


**Figure 5. Energy Consumption in India**

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.

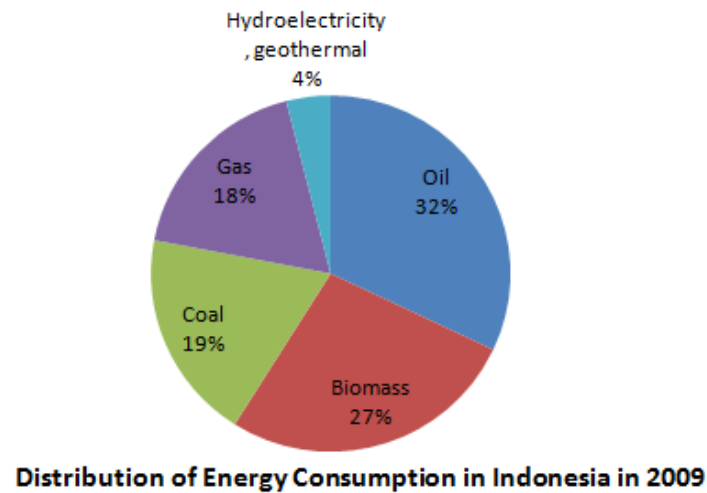
### Indonesia

We turn to another Asian heavy-weight: Indonesia—now the fourth largest emitter of GHG:s in the world (Figure 6).



**Figure 6. Indonesia's Link GDP-CO2:  $y = 0,95x + 1,58$ ;  $R^2 = 0,89$**

Indonesia is a coming giant, both economically and sadly in terms of pollution. Figure 6 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 7 presents the energy mix for this huge country in terms of population and territory.



**Figure 7. Indonesian Energy**

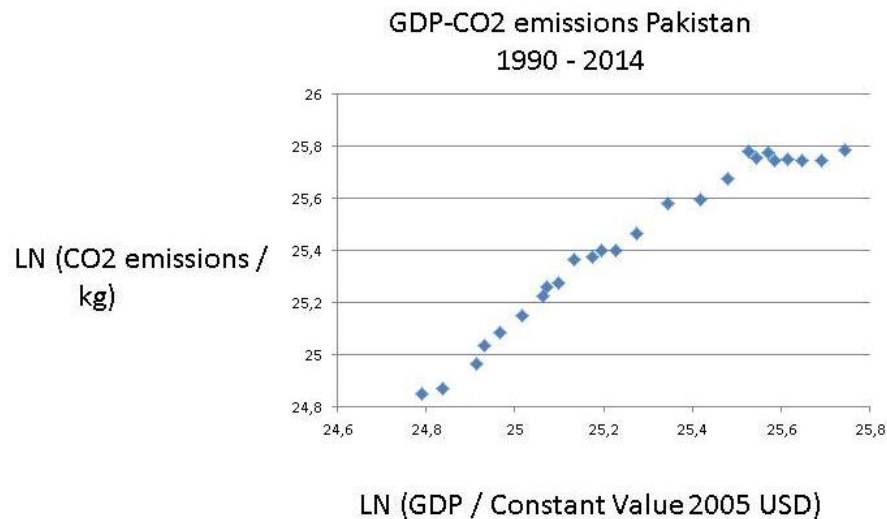
*Note.* <http://www.missrifka.com/energy-issue/recent-energy-status-in-indonesia.html>

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.

### **Pakistan**

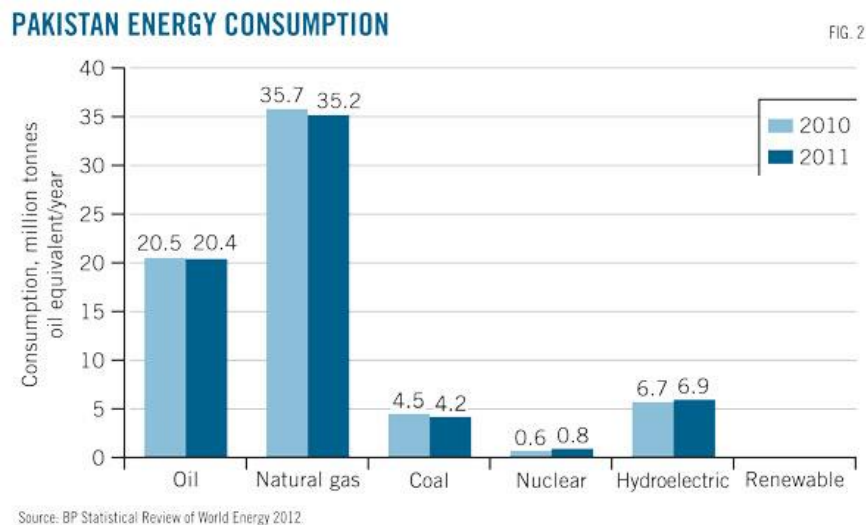
The same upward trend for emissions holds for another major developing country with huge population, namely Pakistan (Figure 8).





**Figure 8. Link GDP-CO<sub>2</sub> for Pakistan:  $y = 1,05x - 0,98$ ;  $R^2 = 0,96$**

The amount of GHG emissions is rather large for Pakistan, viewed on aggregate. Pakistan is mainly reliant upon fossil fuels (Figure 9).

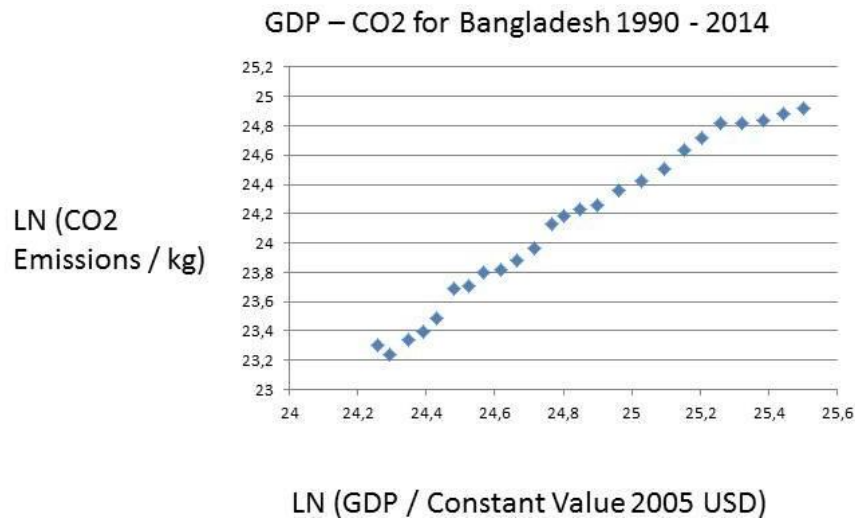


**Figure 9. Energy Consumption in Pakistan**

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

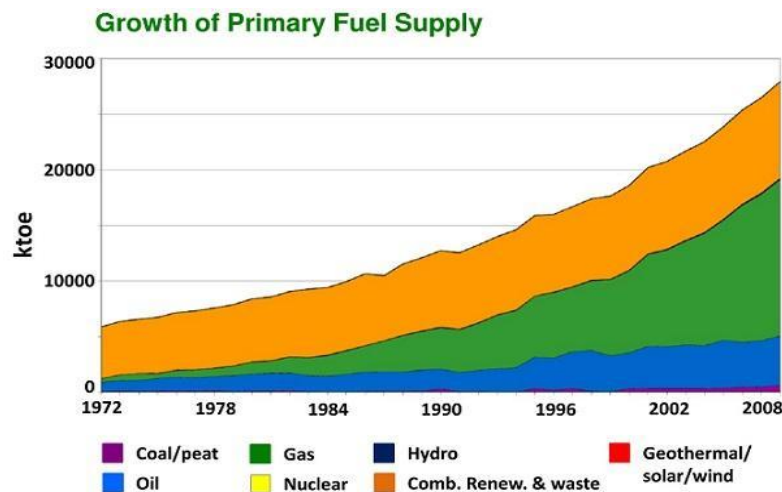
### Bangladesh

Moving on to another giant nation in South Asia, Bangladesh, we find an entirely different set of conditions for implementing COP21. Figure 10 shows that the major GHG of CO<sub>2</sub>s follows economic development closely.



**Figure 10. Bangladesh's GDP-CO<sub>2</sub> Link ( $y = 1,43x$ ;  $R^2 = 0,98$ )**

Yet energy consumption is based on a different energy mix, compared with for instance India. Figure 11 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.

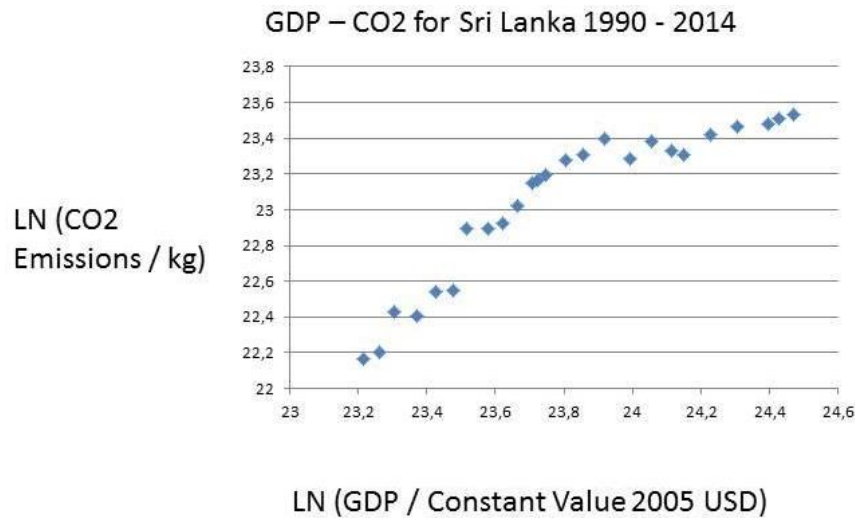


**Figure 11. Energy Mix in Bangladesh**

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

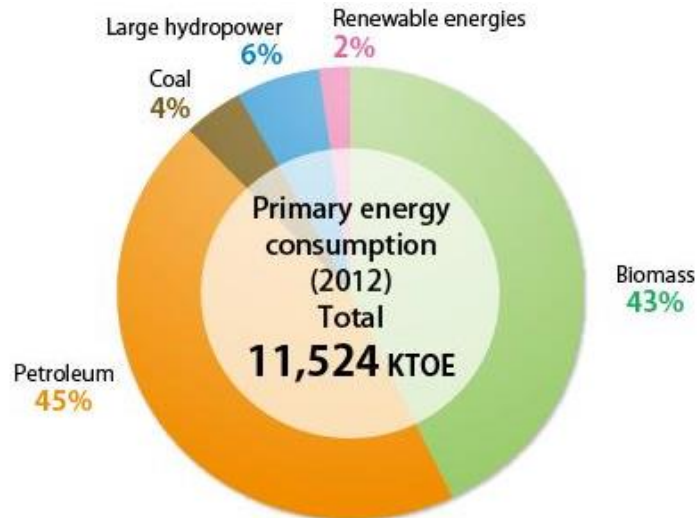
### Sri Lanka

When examining small but populous Sri Lanka, one sees again the strong connection between GDP and CO<sub>2</sub>s—see Figure 12. It seems that the CO<sub>2</sub>s was halted in their expansion for some time, but now they increase again.



**Figure 12. Sri Lanka ( $y = 1,03x$ ;  $R^2 = 0,84$ )**

In this island state, the dominant energy source is traditional renewables, which leads to deforestation and CO<sub>2</sub> emissions on a large scale (Figure 13). 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 13. Sri Lanka's Energy Consumption**

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

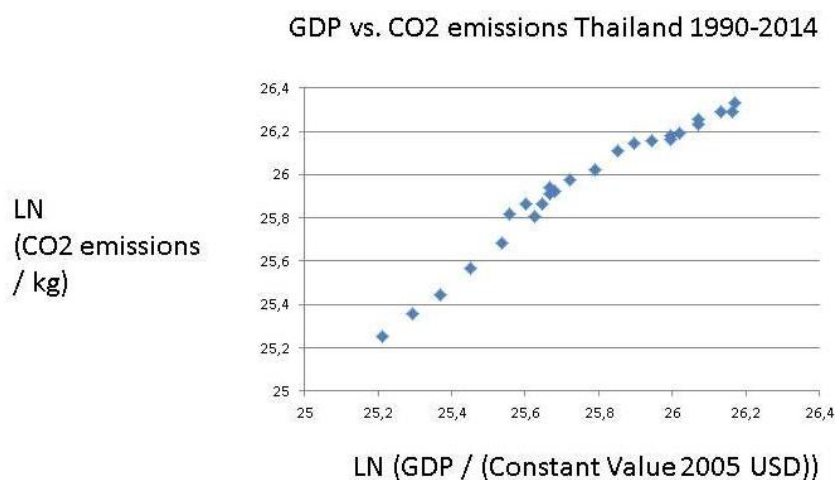
The COP21 or CO22 must urgently set up a management structure to assist these countries involving project evaluation, policy execution and implementation, control of financial flows and outcome assessment—a gigantic task with many pitfalls involved.

### 3.3 Pitfall 4: Catch-Up

One may guess correctly that countries that try hard to “catch-up” will have increasing emissions. This was true of Indonesia and India. Let us look at a few more examples from Asia—*l’usine du monde*, e.g., Thailand and Malaysia.

A medium income country with a not too large population can innovate, thus promoting decarbonisation by itself. But it may accomplish a more radical change with support from the Super fund, which entails extensive bargaining between the country and international governance bodies. Is a Pareto optimal outcome achievable, making Goal I and Goal II realities as outcomes?

Figure 14 begins with Thailand that has become a rapidly developing country with increasing affluence and is besides furnishing large scale tourism a major car producer inter alia.



**Figure 14. 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 15 shows the energy mix of this dynamic country, economically.

Total energy consumption in Thailand, by type (2010)

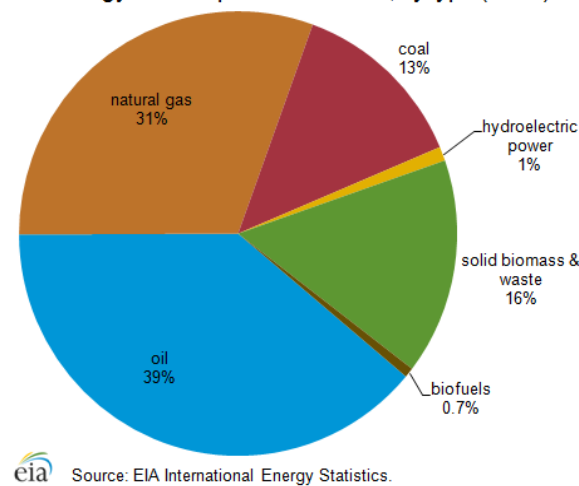
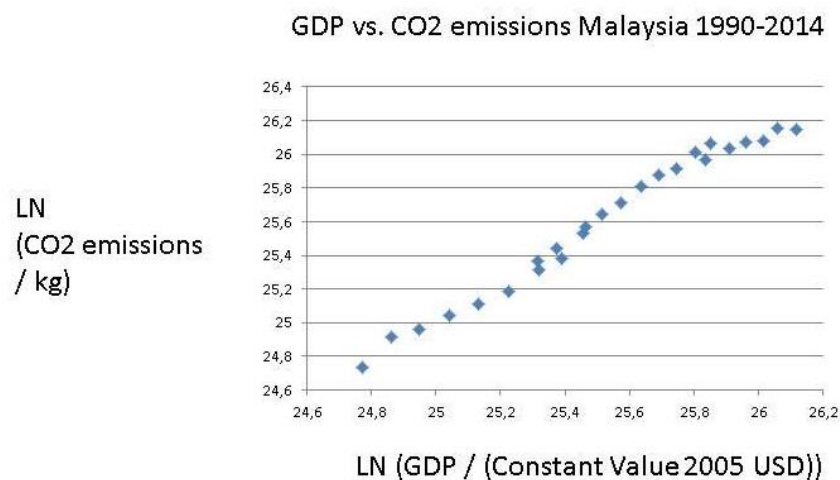


Figure 15. Energy Mix for Thailand

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.

### Malaysia

The overall situation—fossil fuels dependency—is the same for Malaysia as for Thailand. And the CO<sub>2</sub>s are high, following the GDP trend (Figure 16).

Figure 16. Malaysia ( $y = 1,13x$ ;  $R^2 = 0,98$ )

Yet, Malaysia employs energy of a very mixed bag (Figure 17), 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.

Malaysia's primary energy consumption, 2012

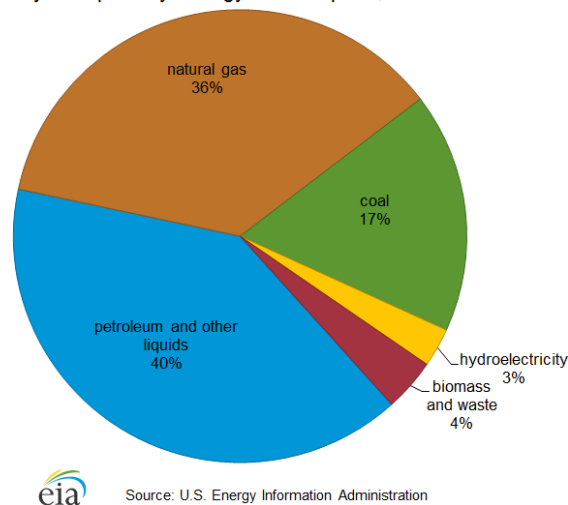


Figure 17. Energy Consumption in Malaysia

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

#### 3.4 Pitfall 5: Oil Producing Countries Burn: Iran

Countries may rely upon petroleum and gas mainly—see Iran (Figure 18). CO<sub>2</sub> 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.

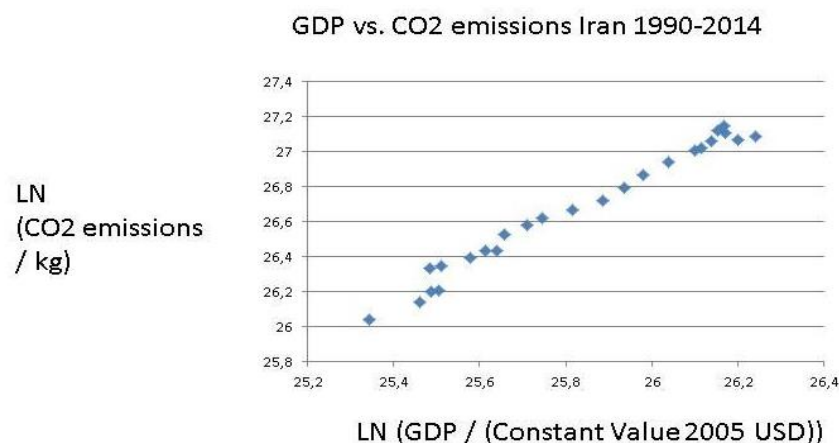
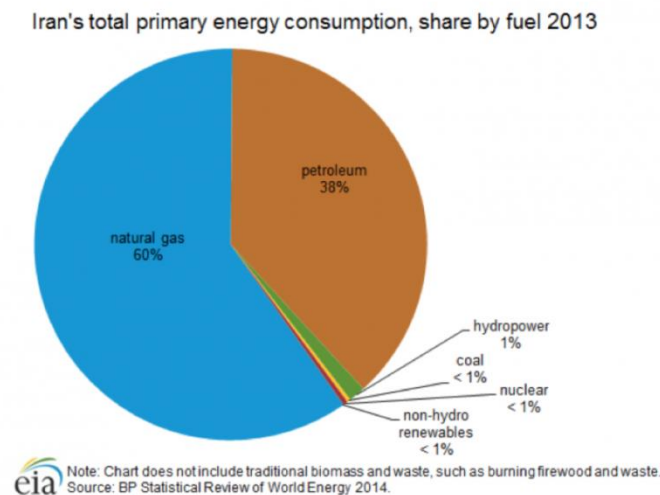


Figure 18. Iran: GDP-CO<sub>2</sub> Link ( $y = 1,2229x - 4,91$ ;  $R^2 = 0,98$ )

Iran is together with Russia and Qatar the largest owner of natural gas deposits. But despite using coal in very small amounts, its CO<sub>2</sub> 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 19).

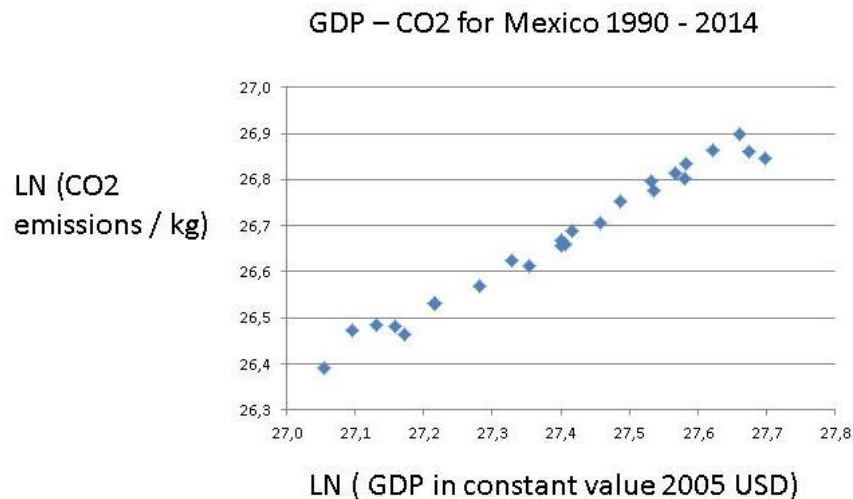


**Figure 19. Iran: Energy Mix**

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.

### **Mexico**

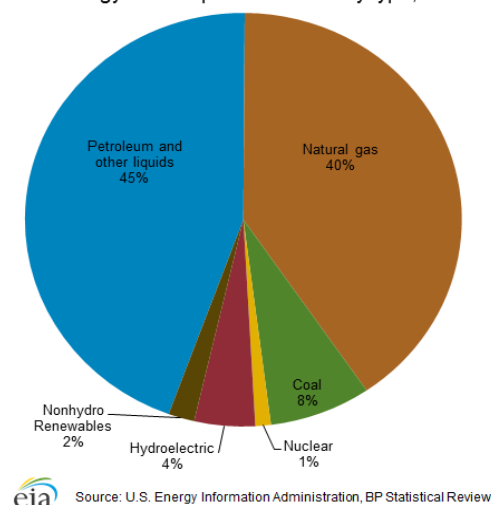
One would expect to find huge CO<sub>2</sub> emissions in this large emerging economy with lots of oil production. Countries like the Gulf States have massive CO<sub>2</sub>s because they drill and refine oil and natural gas. For Mexico holds the following situation (Figure 20).



**Figure 20. GDP-CO2 in Mexico:  $y = 0,77x$ ;  $R^2 = 0,98$**

The close link between economic development and CO2 is discernable 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 enquire into the energy mix of this huge country that is of enormous economic importance to both North and South America.

**Total energy consumption in Mexico by type, 2014**



**Figure 21. Energy Mix for Mexico**

Few countries are so dependent upon fossil fuels as Mexico. One find the same patter with the Gulf States. The Mexican government must start now to reduce this dependency, by for instance eliminating coal and bringing down petroleum, instead betting upon solar, wind and nuclear power. Mexico will



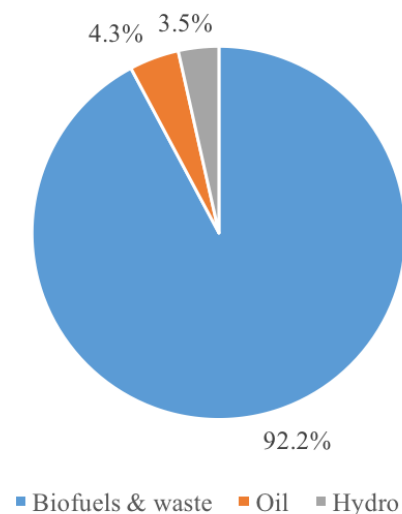
face severe difficulties with the 40% reduction target in COP21. It has a fast growing population with many in poverty and an expanding industry sucking electricity. Can economic growth and decarbonisation go together here?

### 3.5 Pitfall 6: Wood Coal in Extremely Poor Nations

Renewables should be preferred over non-renewables in the COP21 project. Yet, this statement must be strictly modified, as there are two fundamentally different renewables:

- Traditional renewables: wood, charcoal and dung. They are not carbon neutral. On the contrary, employing these renewables results in severe pollution, not only outside but also inside a household;
- New renewables: solar, wind, geo-thermal and wave energy that are indeed carbon neutral, at least at the stage of functioning.

In the poor African countries with about half the population in agriculture and small villages, traditional renewables constitute the major source of energy. Let us look at a giant nation in the centre of the African continent (Figure 22).



**Figure 22. DR Kongo**

*Source:* Democratic Republic of Congo—Energy Outlook, Kungliga Tekniska Hogskolan.

One notes how little of hydro power has been turned into electricity in Kongo, but economic development and political instability, civil war and anarchy do not go together normally. At the same, one may argue that an extensive build-up of hydro power stations would pose a severe challenge to the fragile environment in the centre of Africa. Kongo can now move directly to modern renewables like solar power.

This enormous reliance upon traditional renewables is to be found also in Angola and Nigeria, although both have access to both hydro power and fossil fuels. Figure 23 describes the energy mix for Angola.

Figure 1. Angola's primary energy consumption, 2012

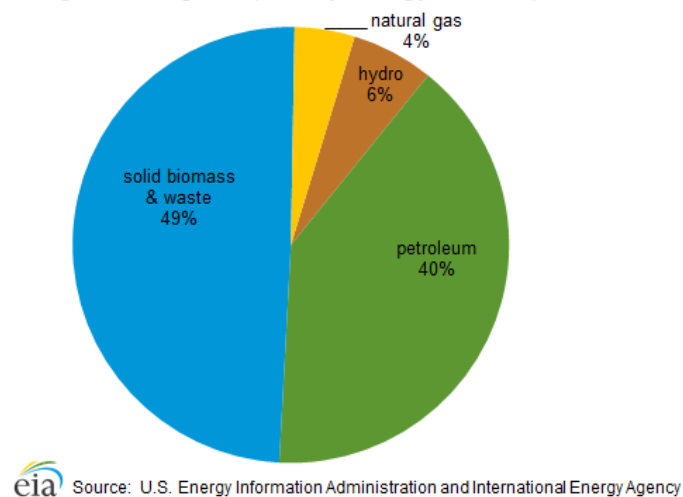


Figure 23. Angola

Angola like Kongo has suffered from long and terrible civil war. In the mass of poor villages, energy comes from wood, charcoal and dung—all with negative environmental consequences. Angola has immense fossil fuels—oil and gas, but the political elite family may prefer to export these resources instead of using them for electricity generation. Giant Nigeria has a resembling energy mix—see Figure 24.

Figure 1. Nigeria's total primary energy consumption, 2012

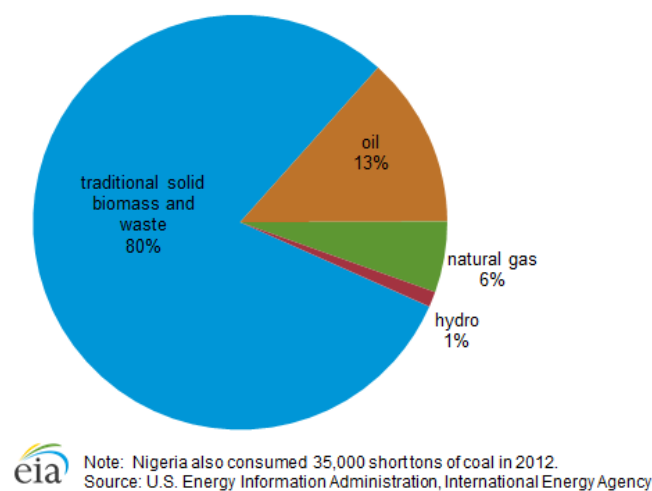
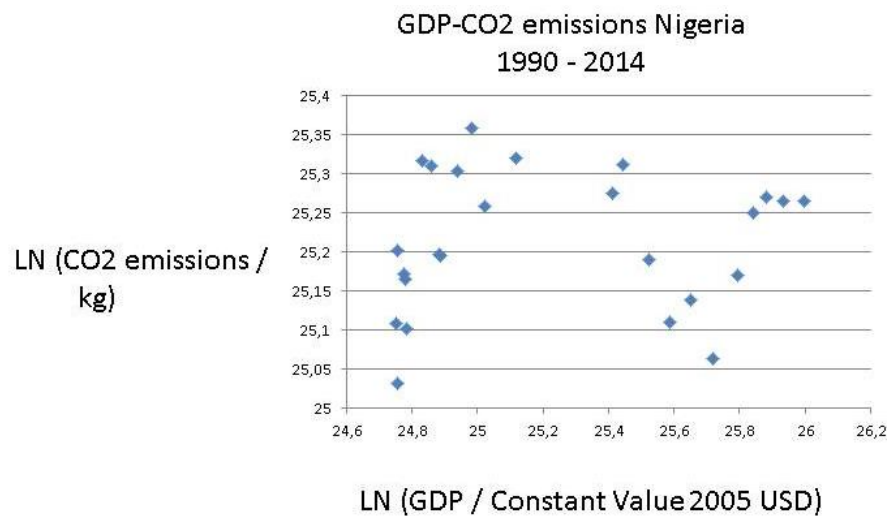


Figure 24. Nigeria's Energy Mix

Nigeria would have to diminish the use of traditional renewables in order to meet the COP21 goals. The very same policy recommendation applies to two countries in the Nile valley, namely Sudan and

Ethiopia—extremely poor countries relying mainly upon traditional renewables. Nigeria’s curve is somewhat erratic, but recent definitely upwards (Figure 25).



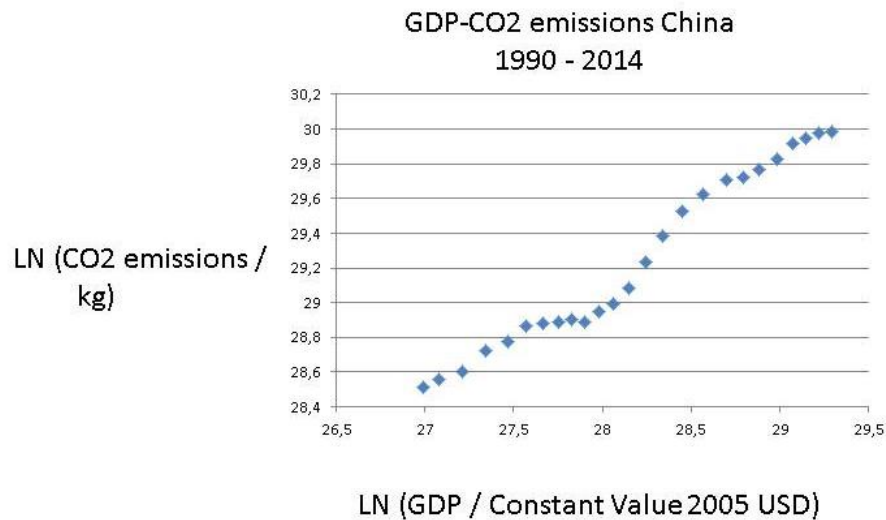
**Figure 25. Nigeria’s Link GDP-CO2:  $y = 0,016x + 24,8$ ;  $R^2 = 0,006$**

The countries that rely upon traditional renewables to an extent up to 50 per cent or more have to reflect upon how to bring these figures down considerably with modern renewables. The massive employment of wood coal leads to deforestation and desertification.

### *3.6 Pitfall 5: The Basic Option: Reneging*

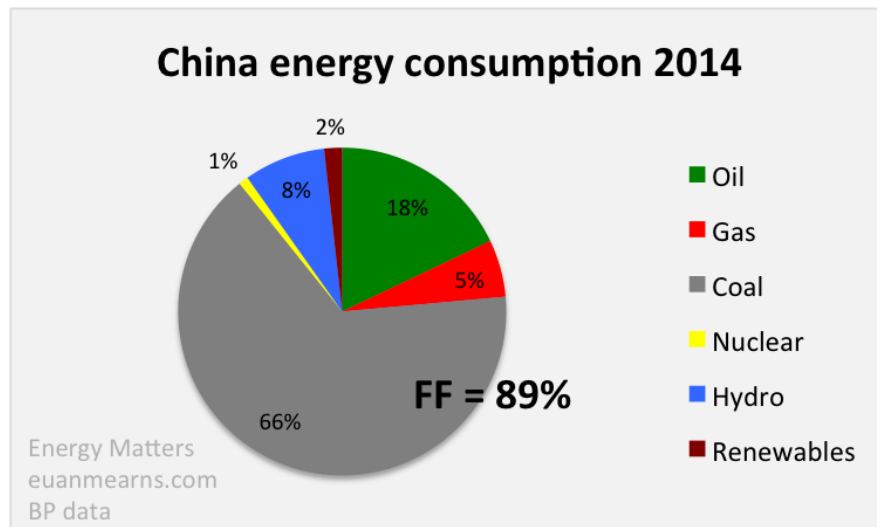
One may find that the emissions of CO<sub>2</sub>s follows economic development closely in most countries. The basic explanation is population growth and GDP growth—more people and higher life style demands. Take the case of China, whose emissions are the largest in the world, totally speaking (Figure 26). China was a Third World country up until yesterday.

## China



**Figure 26. China's Link GDP-CO<sub>2</sub>:  $y = 0,703x$ ;  $R^2 = 0,97$**

The sharp increase in CO<sub>2</sub>s in China reflects not only the immensely rapid industrialization and urbanization of the last 30 years, but also its problematic energy mix (Figure 27).



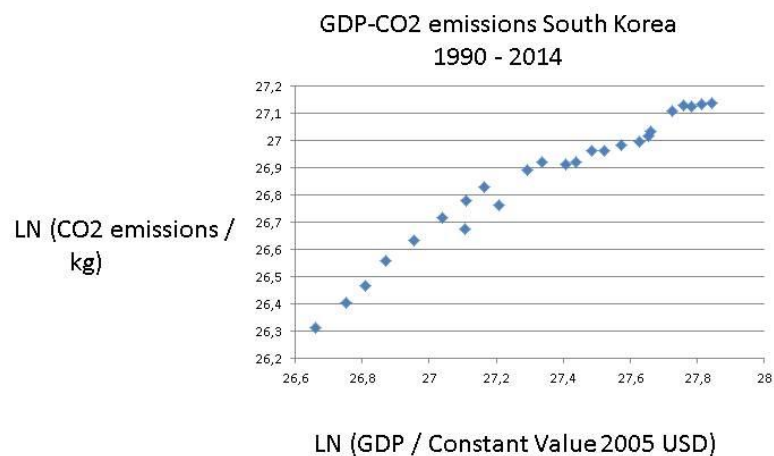
**Figure 27. Energy in China**

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 countries, 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 and 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 CO<sub>2</sub>s with 40 per cent while supply almost 50 per cent more energy power, according to plan?

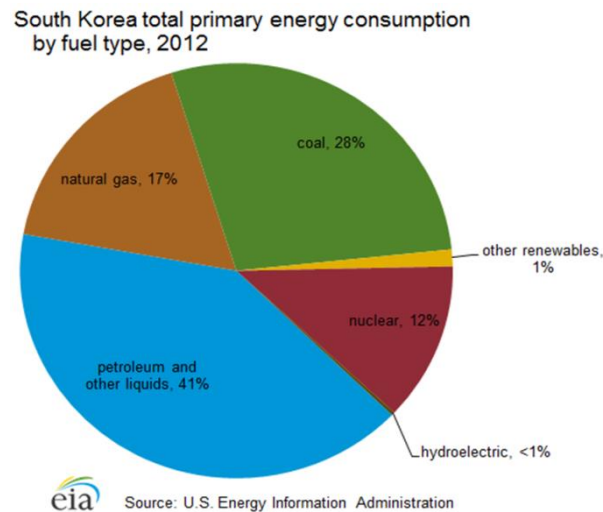
### South Korea

Industrial giant South Korea is very interesting from the perspective of the COP21 Agreement, because the basic trend violates both Goal I and Goal II. An entirely different trend than that of other mature economies is to be found in South Korea (Figure 28), which has “caught up” in a stunning speed but with enormous GHG emissions.



**Figure 28. South Korea's Link GDP-CO<sub>2</sub>:  $y = 0,65x + 9,19$ ;  $R^2 = 0,96$**

Lacking much hydro power, South Korea has turned to fossil fuels for energy purposes, almost up to 90 per cent (Figure 29). Now, it builds nuclear plants, but South Korea needs to move aggressively into solar power to reverse trends.



**Figure 29. Energy in South Korea**

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 renewable energy sources, as well as reducing coal and oil for imported gas or LNGs. China or South Korea are on line for fulfilling the COP21 Goal I, as they are not reducing their emissions, like other advanced or mature economies as Japan, the EU and some EU nations. Goal II seems far away in terms of achievement for these two industrial giant, still very dependent upon fossil fuels. They innovate with renewables, but hope to consume even more energy in the coming decade.

#### 4. Conclusion

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 deal, 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, decarbonisation 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

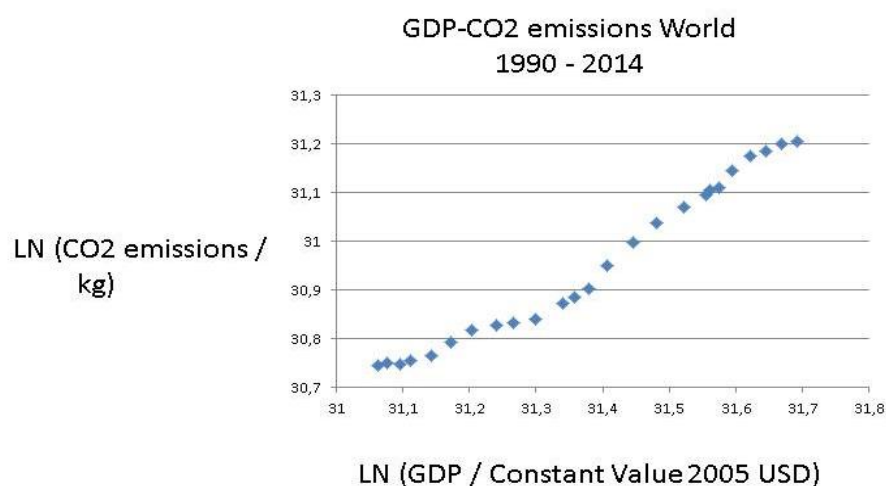
optimal outcomes, as the choice participants chose Pareto inferior strategies due to self-interest seeking with guile. Coordination failures arise when individual rationality prevails over collective rationality:

- Reneging (PD game).
- Threat (Chicken game).
- Sub-optimality (Negotiation game).
- Second best solutions (Assurance game).

The basic argument here is that the achievement of decarbonisation according to the COP21 goals (I-III) is going to stumble upon the implications of the Kaya model, namely that CO<sub>2</sub> emissions are fundamentally driven by economic forces, like the GD per capita and the size of the population besides energy and carbon intensity. To make it feasible for large poor countries to reduce CO<sub>2</sub> emissions but yet maintain a decent level of economic development, the Super Fund must be made operative. Yet, it does not even “exist” in a more articulate form on paper.

Global markets are characterized by myopia, meaning that they will not react to the giant market failure than climate change tis conducive to, until it is too late. For now, it is business as usual: more air transportation, bigger cars, rapid urbanisation and a swelling demand for electricity. The use of coal is going down, which is very positive, but the number of cars is increasing in the huge countries. And giant cement constructions still come up in for instance Dubai and other Gulf States or emirates.

Figure 30 shows that the force of energy globally. Even if a few countries manage to cut back CO<sub>2</sub>s, most countries rely upon fossil fuels and wood coal for their energy consumption, which fuels economic development. When a few countries shift away from coal, car and air transportation skyrockets It is said that putting the immense global car park on electricity will solve the problem, but where is the electricity to come from on such a scale?



**Figure 30. The Global Link GDP-CO<sub>2</sub>**

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