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The COP21 Agreement and the Economics of its Implementation

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Abstract

After the triumph in Paris in December 2015, it seems that we are back to zero. People appear to miss the crux of the climate change problematic: How to implement the COP21 objectives of halting and starting a large reduction of CO2 emissions? The literature on policy implementation entails that it is not only complicated but also likely to meet with failures. In this paper, the standard information about CO2 will be employed to argue that only significant reduction is the use of coal for electricity and petroleum and diesel for transportation will contribute to the implementation success of COP21.

Keywords: policy – implementation, collective action costs, un-intended and un-recognized outcomes, sources of CO2, CO2 and energy, externalities, CO2 and greenhouse gases (GHG), coal and petroleum and diesel, country predicaments: the biggest CO2 polluters in the world

1. Introduction

The United Nations Climate Conference managed in December 2015 to arrive at an agreement or treaty about climate change after many years of meetings and consultations – transaction costs heavy. Some 195 governments have bound their respective states to stop or slow down the free riding upon the global environment. The primary focus is upon halting the growth of CO2 emissions quickly and then start reducing them during the rest of the century. But the COP21 framework also comprises promises about substantial money redistribution from rich to poor countries in order to lessen the environmental degradation in the latter, especially when attributed to global warming.

Now, nothing is done to implement these promises. Implementation is messy, costly and not always predictable. The objectives in the COP21 approach are vague, like:

a) Halt the increase in CO2 emissions 2018-20;
b) Decrease the CO2 emissions significantly until 2050;
c) Improve the environment in poor countries by means of a global fund paid by rich countries to finance ecology projects.

Implementing these goals will cost a lot of money, but the COP21 Agreement says nothing about the means to be employed. It envisages an almost completely decentralized implementation where countries decide for themselves under a vague supervision every fifth year by the UN Climate Program. How the super fund is to be managed is left for future meetings to plan.

2. The Biggest Externalities Ever

The climate change problematic enters the general global ecology degradation, driven by the generation of massive external costs that hit the entire globe. Correcting these externalities require both management and the payments for various costs involved. At present, there is no such global ecology management and no country seems willing to assume the costs for ecological improvement, especially when this would hurt economic growth.

There are basically 3 major types of externalities that have to be taken care of, meaning reduced considerably:

1) Cutting back CO2 emissions from electricity production sooner than later;
2) Reduce the CO2 emissions from transportation sooner than later;
3) Install waste and sewage stations in developing country cities.

It is true that there are other greenhouse gases (GHG) that also need to be looked at, like methane in agriculture, but the CO2:s constitute the bulk of externalities. They stem basically from two energy sources: coal (electricity) and petroleum or oil (transportation). As energy consumption has risen enormously the last twenty years, so have CO2 emissions, poisoning the air resulting in global warming. The poisoning of land and sea is the result of bad waste management and lack of sewage, besides the negative impact of global warming on both.

The costs involved in these external effects are potentially astronomical, literally speaking. The Planet Earth could become too warm for mankind and its oceans may be turned into junkyards. Counter-acting these mega-trends calls for global implementation of COP21, involving the highest risks for humanity ever, besides total nuclear war. Uncertainty is great, as the costs are conceivably infinitesimal.

But the COP21 Agreement says very little about implementation, strategies and costs. Each and every country must immediately start asking:

i) How to initiate a change in electricity production?
ii) How to start to decarbonize transportation?
iii) How to fund the building of waste and sewage stations as soon as possible?

These are the three key implementation tasks for the next years. Will governments take the first necessary steps? Will they also be sufficient steps? I doubt that.

3. Logic of Implementation

Implementation of a decision or policy is more than mere execution, because the concept entails the idea of accomplishment of the stated objectives, preferably with the stated means. Thus, outcomes are crucial to implementation, and they can be eu-functional or dys-functional to the decision/policy. The all-important outcome for COP21 is the reduction of CO@ emissions.

Some scholars argue that the CO2 emissions have peaked in 2015, but that is only true for a bunch of countries. Moreover, the CO2 in the atmosphere keeps augmenting, because halting the increase in CO2 emissions is not enough. They need to be reduced considerably up to 2020. How?

Three features of implementation theory may be emphasized:

1) Perfect implementation is a figment of imagination with the traditional public administration scholar (Dunsire, 1973), as unintended and unrecognized outcomes show up after some time;
2) Bottom-up implementation is more likely to succeed than top-down implementation (Pressman and Wildavsky, 1984);
3) Economic incentives are more powerful than administrative steering, at least in many cases. However, carbon taxes and trading permit schemes have not worked out as well as expected concerning CO2:s.

If we apply these major research findings to the problem of implementation COP21, what would be the implications for the choice of strategies by the various country governments in a decentralized approach.

3. Decarbonisation

To reduce CO2:s one must look at the country energy situation and enquire into the economic consequences of policies that decrease these emissions. To stop deforestation is a most relevant policy alternative, but it is most probably unfeasible at the moment.

Reducing CO2 emissions, one must know where they come from. Figure 1 shows that they stem from almost the important sectors of an economy, like the US economy.

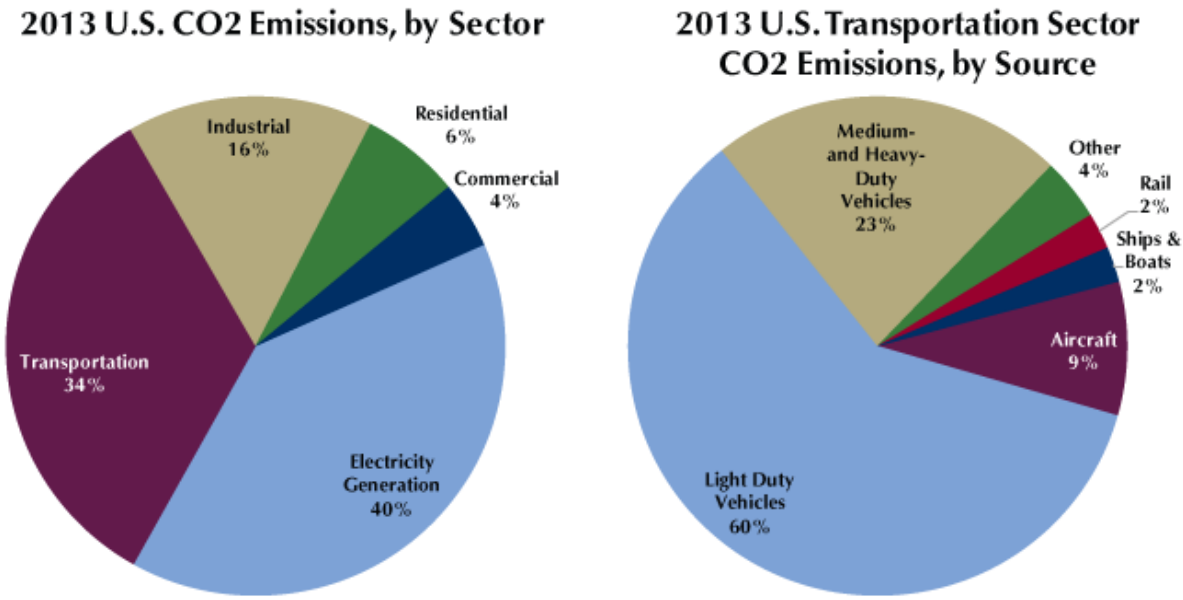

Figure 1. CO2 emissions from sectors of the US economy

Source: U.S. Environmental Protection Agency (EPA), Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013 (Washington, DC: U.S. Environmental Protection Agency, 2015).

Electricity generation is by far the biggest source of CO2, because it uses lots of coal. The transportation sector produces one-third of U.S. carbon dioxide emissions. Note that Aircraft is responsible for nearly 9 percent of U.S. transportation sector carbon dioxide emissions.

Also sea transportation is heavily polluting. Given this picture in Figure 1, can CO2 emissions be strongly reduced with impacting upon all the activities in these sectors?

Speaking globally, the CO2 emissions from all sectors of the economy stem basically from fossil fuels, where coal and oil dominate (Figure 2). CO2 emissions can only be reduced in two ways: (a) less economic activity; (b) new sources of energy.

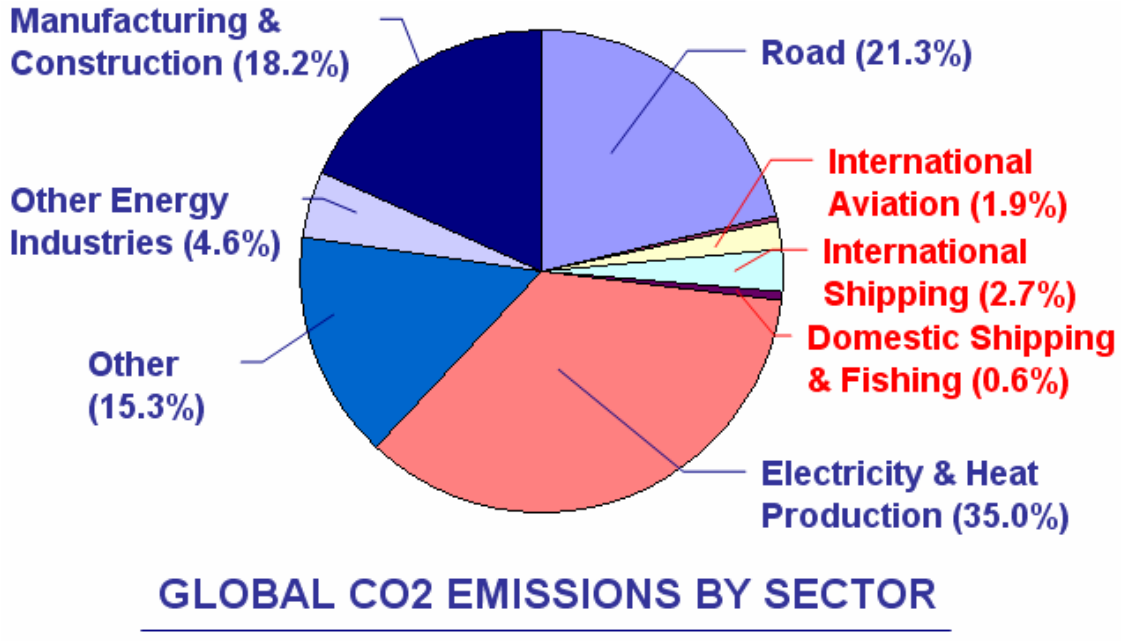

Figure 2. Global CO2 emissions by sector 2013

The two main sources of CO2 emissions is coal powered electricity generation and petroleum products consumption in transportation. Implementing COP21 objectives entails a focus upon fossil fuels, especially coal and petroleum (Figure 3). There are non-human sources of CO2, but the human ones are the heaviest.

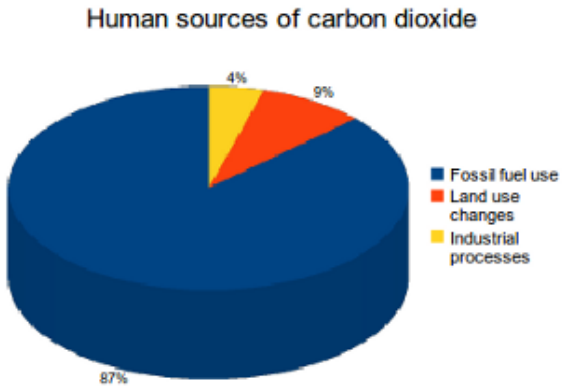

Figure 3. Human sources of CO2

Source: Le Quéré et al. (2013). The global carbon budget 1959-2011.

The human CO2 emissions are closely related to energy consumption. Energy is a necessity in economic life as well as for economic development (growth). Will cutting CO2 emissions also lead to less of energy consumption?

4. Energy

Behind the contested nature of the CO2 question lays the worry for energy provision and its link with economic development. As Figure 4 shows, the countries in the world have little choice but the fossil fuels. But they produce the human CO2 emissions, as shown above.

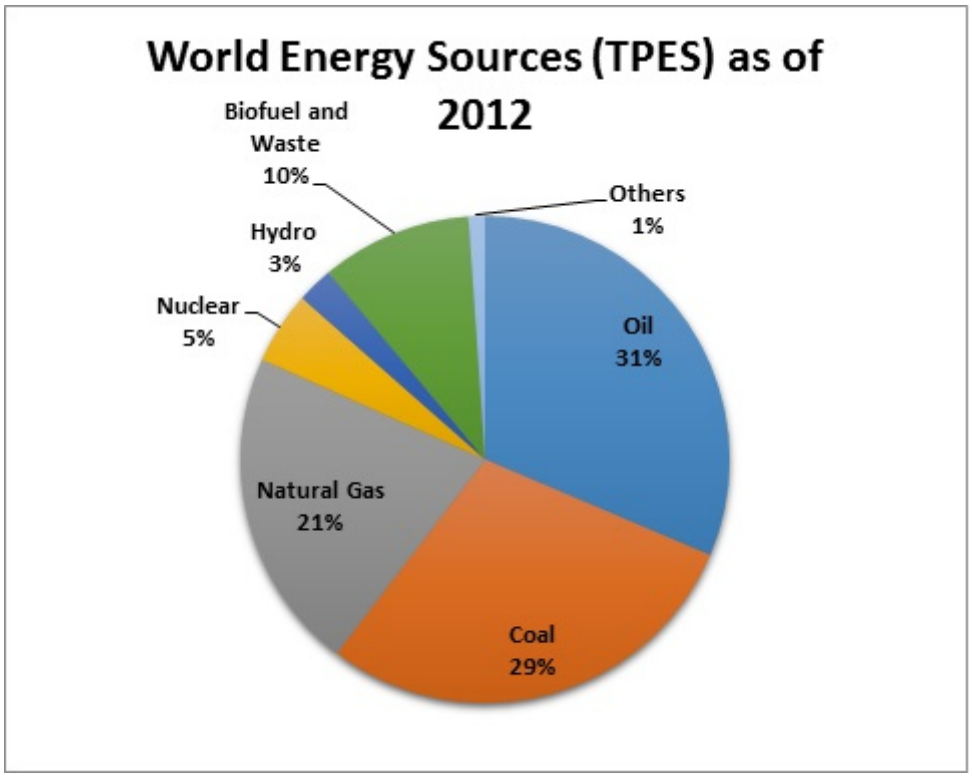

Figure 4. Sources of energy

Other = Solar + Geothermal + Wind etc. Data: (International Energy Agency, 2014).

To reduce CO2 emissions thus entails to cut back the burning of fossil fuels. One may focus either upon electricity generation (Figure 5) or transform the transportation sector. Since the latter will meet with incredible resistance from pressure groups, it is more promising to look at electricity production and see what changes can be made in the short and long run.

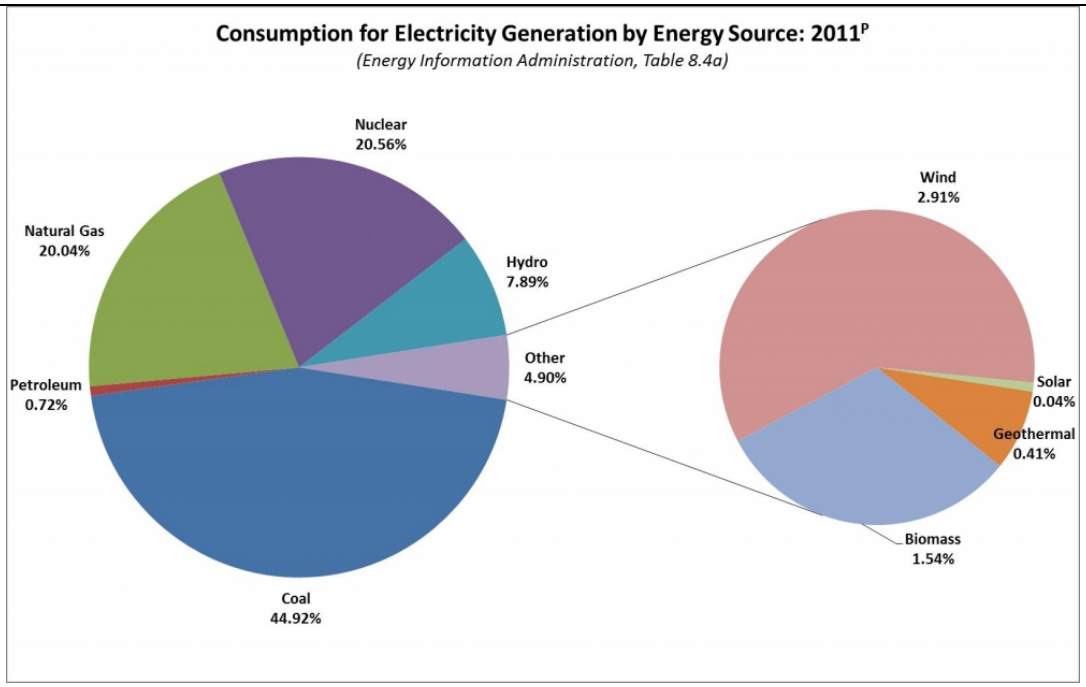

Figure 5. Electricity sources

Here, there is room for change. One can replace the huge portion of coal with other sources, rather quickly. And one install 100 per cent filter on coal fired power stations. What should be guiding the implementation of COP21 is the "dirtiness "of the power source – see Table 1.

Table 1. CO2 emissions from energy sources

Specific Energy, Energy Density & CO2

Fuel	Specific Energy kj/g	Density KWH/gal	Chemical Formula	lbs CO2/gal
Propane	50.4	26.8	C3H8	13
Ethanol	29.7	24.7	C2H5OH	13
Gasoline	46.5	36.6	C7H16	20
Diesel	45.8	40.6	C12H26	22
Biodiesel	39.6	35.0	C18H32O2	19
Methane	55.8	27.0	CH4	3
Oil	47.9	40.5	C14H30	20
Wood	14.9	11.3	approx weight	9
Coal	30.2	22.9	approx weight	19
Hydrogen	141.9	10.1	H2	0

Source: DOE, Stanford University, College of the Desert, & Green Econometrics research

Coal, gasoline, oil and diesel are the worst from the point of view of the concerns of COP21. Yet, mankind has built the world economy upon these energy sources, which is no longer sustainable. Change is urgent, eliminating coal and reducing petroleum, oil and diesel!!

TO SUM UP:

The above exercise with some global figures ends with the conclusion in Figure 6.

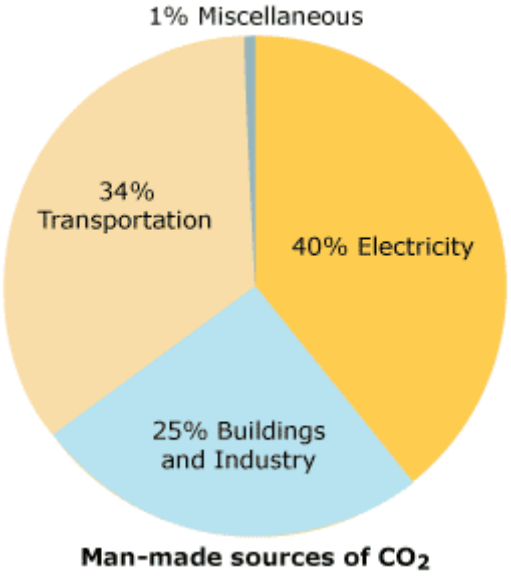

Figure 6. Man-made sources of C02

Source: http://www.e-inst.com/combustion/sulfur-compound-emissions.

It is the electricity generation that needs urgent transformation, but also the transportation of the world economy is too polluting. The remedy must be the reduction of the use of coal, gasoline and diesel. Let us see what such a change would mean for the really big CO2 polluters in the world today.

5. Costs of Collective Action Failures

The climate change problematic of implementing COP21 is severely aggravated by profound coordination difficulties, as governments simply cannot cooperate easily to cut back emissions. Governments have one major priority, namely economic development or economic growth, and when this goal collides with costs for the environment and climate change, and then governments renege or postpone action. Or they begin arguing about who is to reduce the most. Carbon neutral technology is sometimes available for investments in new projects, but it is only employed in a piecemeal fashion. Some countries boast that they are the leaders of carbon neutral economic development, but at the same time they have the highest emissions per capita in the world: Qatar, Kuwait, UAE and Singapore to some extent!

Two difficulties make for coordination failure:

(1) Free riding: Warming's insight 1911

The pollution of the atmosphere with greenhouse gases is like much environmental degradation a prisoners' dilemma game due to open access, creating the externality problematic in Stern's vocabulary (Stern, 2007). When a resources lies in open access, then it will not be allocated in a Pareto-optimal fashion, not even in the long-run. Instead, the players involved in harvesting the resources will capture as much as they can individually and myopically (Nash equilibrium). There are two situations, already discovered by Danish economist Jens Warming, anticipating the tragedy of the commons (Scott, Gordon, and Hardin):

1) If the use of the open access resources involves costs, then the resources will be exploited until average cost = average value, depleting the economic rent completely;
2) If the use of the open access resource is free without any charge, then its use will be driven to extinction.

At first, the emission of greenhouse gases could be done freely, meaning that nobody cared. Secondly, small groups of people concerned by the local effects of climate change began to complain – environmental refugees. Now, several governments have started to realize the dangers as the pollution costs mount, but how can they handle the transaction costs involved in managing a gigantic PD game with 200 players?

The costs of global warming differ locally, but they are an obvious concern for all governments. Now, how are the costs of reducing the emission of greenhouse gases to be divided onto the various governments = N? If this requires accepting lower economic growth rates in a few countries, should the costs be shared by all somehow? Suppose the total cost of reducing emissions by 50 per cent is C. A single small country would argue that it could not take its share C/N, because there would be no real difference if it was left out of the global agreement, i.e. C/N-1. Or a huge country could argue that it would not wish to take on a major part of the cost, because it is only one of many polluting countries and whatever sacrifice it makes will be shared with the others, i.e. 1/N.

(2) Transaction costs: Wicksell's major mistake 1896 (Polish Diet)

Since the global coordination meetings on climate change employ *unanimity* as decision method (Knut Wicksell's ideal for social choice), the transaction costs skyrocket. The outcome is predictable: delays, promises not fulfilled, postponements, etc. Then we must add the confusion of total and per capita emissions. There will many meetings of the UN environmental program, but what will really be achieved, i.e. implemented?

6. The Big Polluters

When the global situation is examined concerning CO2, then one is struck by the basic fact that most emissions come from a small set of countries. That is where the implementation of COP21 should start and be concentrated upon, and not upon endless discussions about emissions per capita- transaction costs!

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 7).

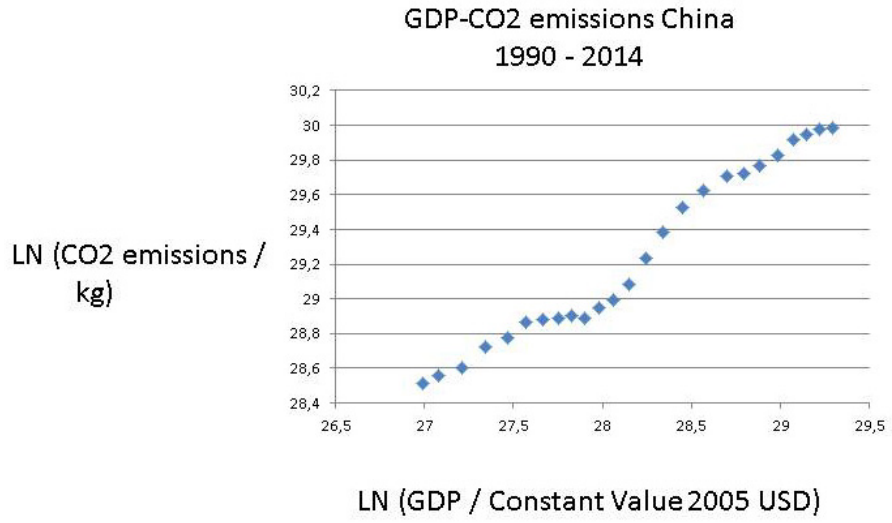

FIGURE 7. CHINA

The sharp increase in CO2:s in China reflects not only the immensely rapid industrialization and urbanization of the last 30 years, but also its problematic energy mix (Figure 6).

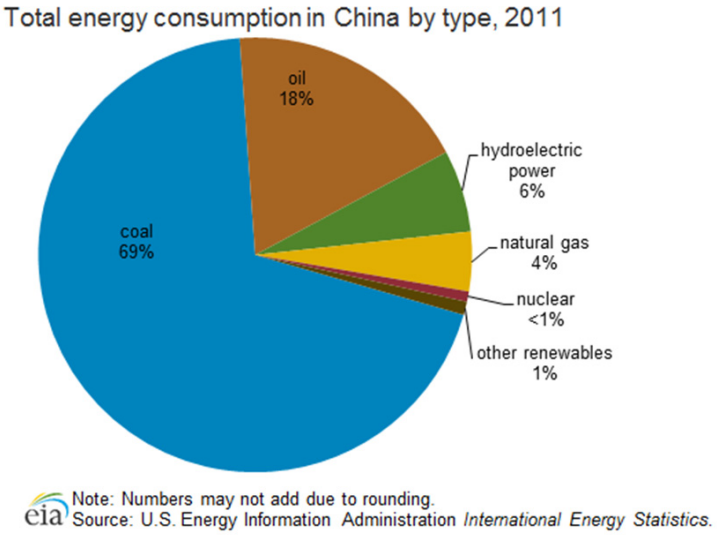

FIGURE 8

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 very small indeed. This makes China very vulnerable to demands for cutting CO2 emissions, employing other energy sources as well as the 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). China must close

down its old coal stations and put filter on the rest. It should not build new ones, but rely upon natural gas and renewables.

For most countries hold that their emission of GHG:s increases, as well as augments with the GDP. However, there are a few notable exceptions of decreases that are worth mentioning. We start with the US (Figure 9).

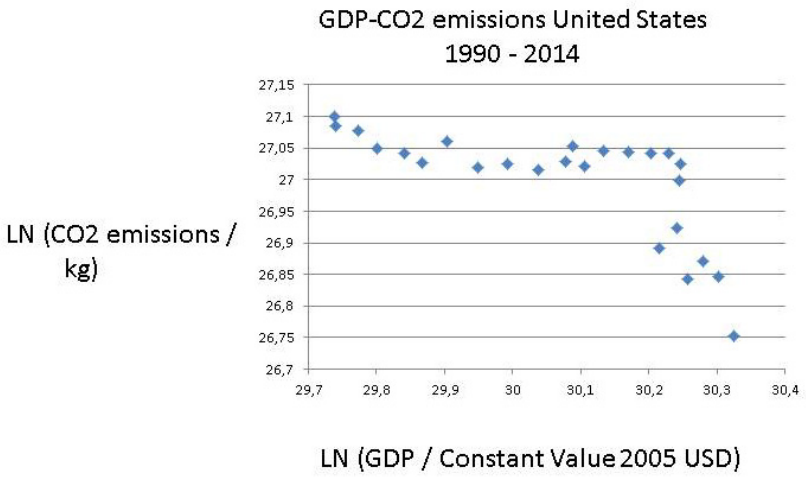

FIGURE 9. USA

Recently, the level of GHG emission has been reduced significantly in the US. It reflects no doubt the economic crisis that began 2007, but the US remains the second largest polluter in the world, reflecting that it cannot draw upon a mixed bag of energies (Figure 19). Per capita GHG:s is of course very high for the USA. As the economy now starts to accelerate, emissions are bound to go up again, unless the shift away from coal is accelerated. The US has all the means necessary for abandoning coal and employ carbon taxes on petroleum and oil to limit the CO2 emissions from transportation.

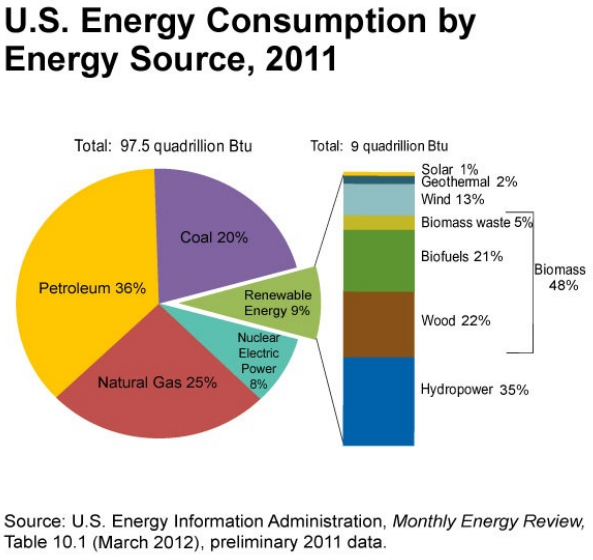

Figure 10

The US is still heavily dependent upon fossil fuels, or some 89 per cent comes there from. What is changing is the more and more of energy is produced within the US and no longer imported from outside – the *shake oil and gas* revolution. Further reduction of CO2:s will meet with firm resistance from the Republican House of Congress, which may oppose the COP21 Agreement. The advent of shale oil and gas has changed the entire energy markets, lowering the price of oil most substantially. This implies not only that there will be no *Hubbert peak* oil for the world, but also that switching to renewable energy source will be extremely expensive, relatively speaking. Yet, the US must replace its coal fired power stations.

India will certainly appeal to the same problematic, namely per capita or aggregate emissions. The country is even more negative than China to cut CO2 emissions, as it is in an earlier stage of industrialization and urbanization. Figure 11 shows the close connection between emissions and GDP for this giant nation.

India needs cheap energy for its industries, transportation and heating (Figure 11) 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 smallest numbers for energy per capita, although it produces much energy totally. Figure 12 shows its energy mix where renewables play a bigger role than in China.

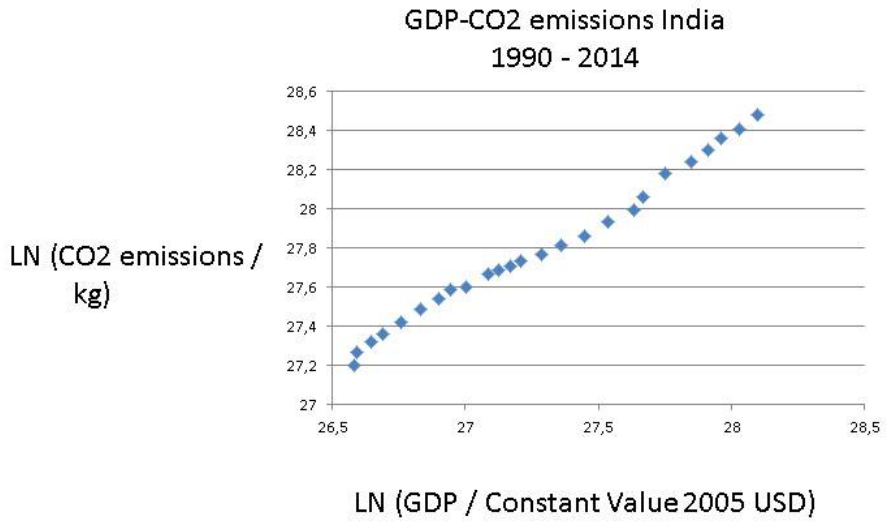

FIGURE 11. INDIA

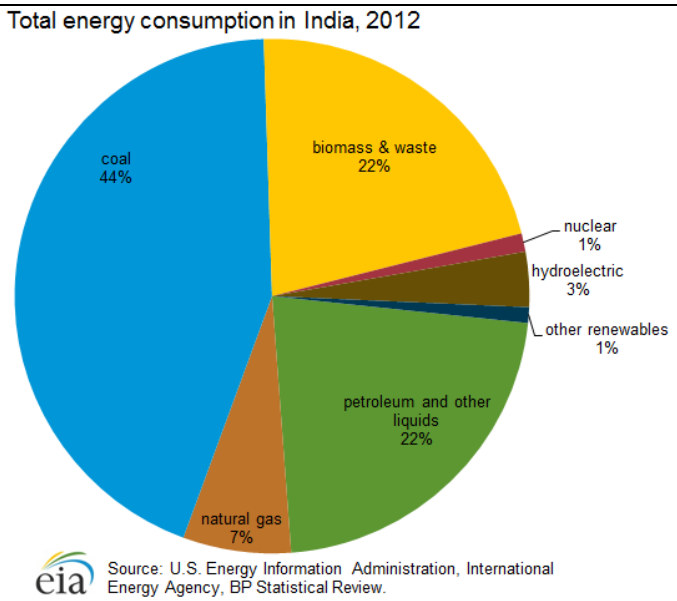

FIGURE 12.

India needs especially electricity, as 300 million inhabitants lack access to it. The country is much 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. India is now building new coal fired power stations – this is very bad for the implementation of COP21.

The Russian picture is split, with two series of estimates, both placing the country as a major polluter of CO2:s (Figure 13**).**

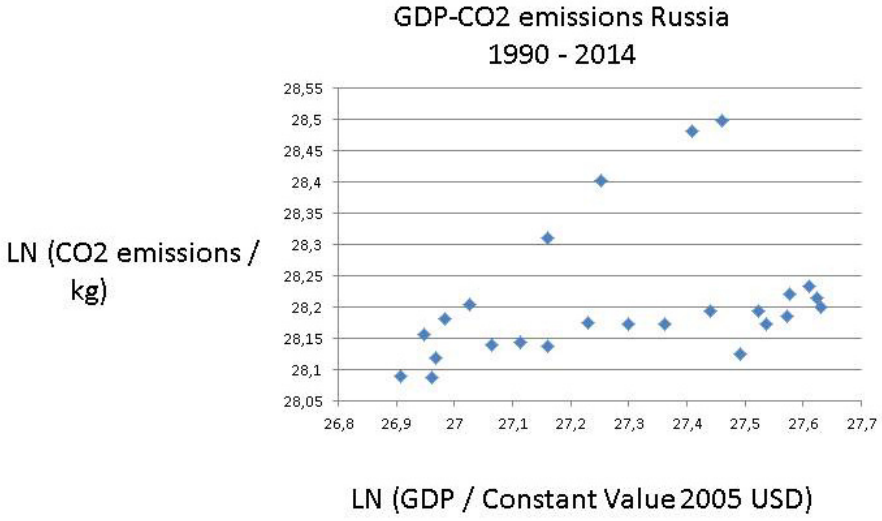

FIGURE 13. RUSSIA

The shifts in the data in Figure 16 may be due to the on-going deindustrialization process connected with the fall of the Soviet Union. In any case, Russia is extremely dependent upon fossil fuels – up to 90 per cent, especially natural gas (Figure 14).

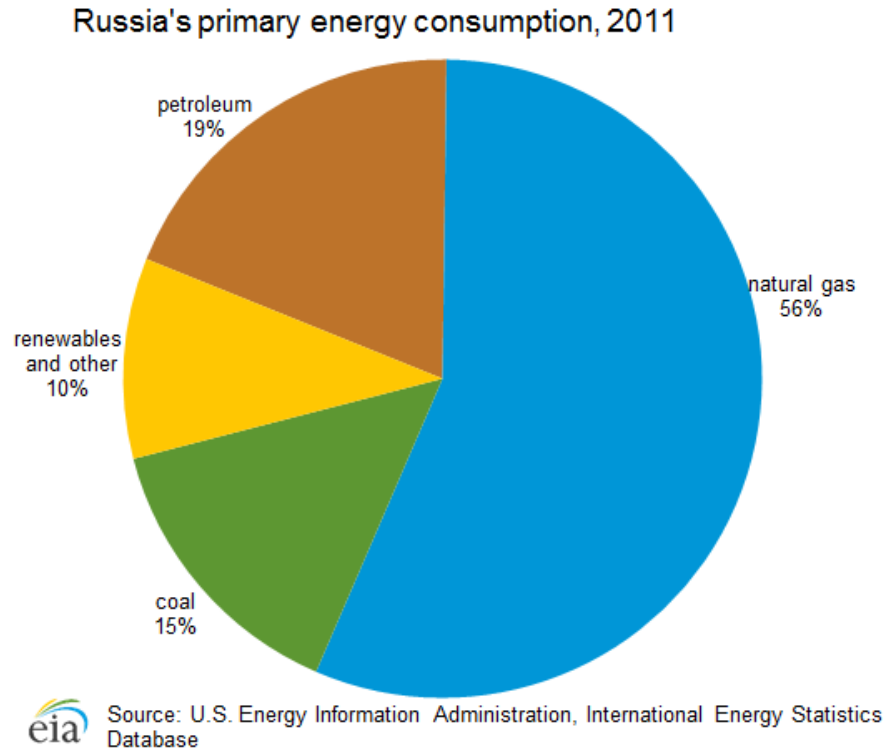

Figure 14

Russia will hardly be very active in promoting major reductions in CO2:s, as it has only so much hydro and nuclear power, relying upon fossil fuels, especially gas. But natural gas is much better than coal and oil from the point of view of COP21.

Japan has a rather similar situation in that it will no longer rely so much upon nuclear power. Its emissions have gone done recently, but seem to be on the rise again (Figure 15).

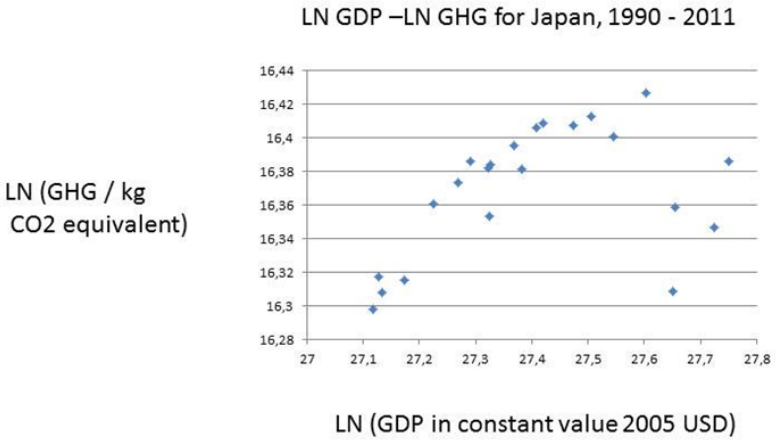

FIGURE 15. JAPAN

The decrease in emissions for Japan reflects the country's post-industrial developments. Production sites have been moved out of Japan with heavy investments in other Asian countries as well as in the EU and the US. Yet, Japan will still need massive amounts of energy (Figure 16). After the Fukushima disaster, it operates only 1 nuclear power station.

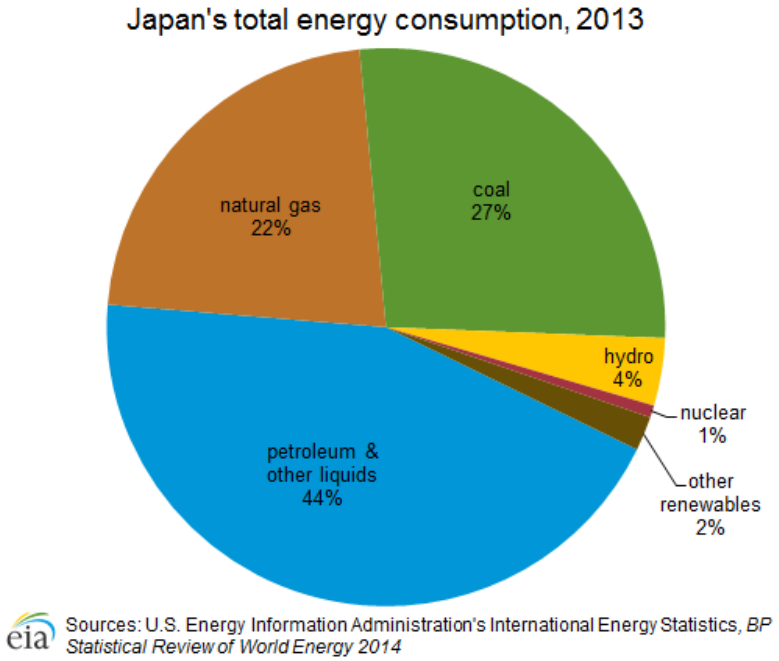

FIGURE 16

As Figure 16 shows, Japan is very dependent upon fossil fuels for generating electricity and transportation, especially when nuclear power is no longer a major option with only one nuclear power plant fully operating now in Japan. A positive is the low percentage for coal in Figure 16.

One may find a close link between GDP and CO2 emissions also in countries with an advanced economy. See Figure 16 for South Korea

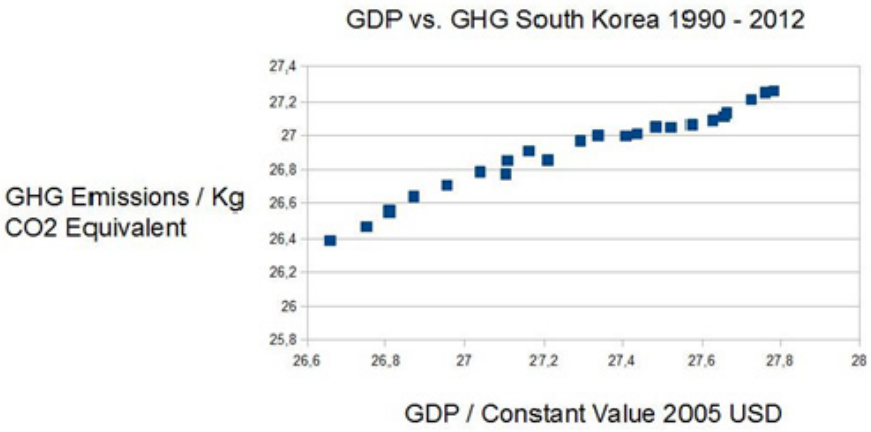

FIGURE 17. SOUTH KOREA: LN (GHG / Kg CO2 eq and LN (GDP / Constant Value 2005 USD)

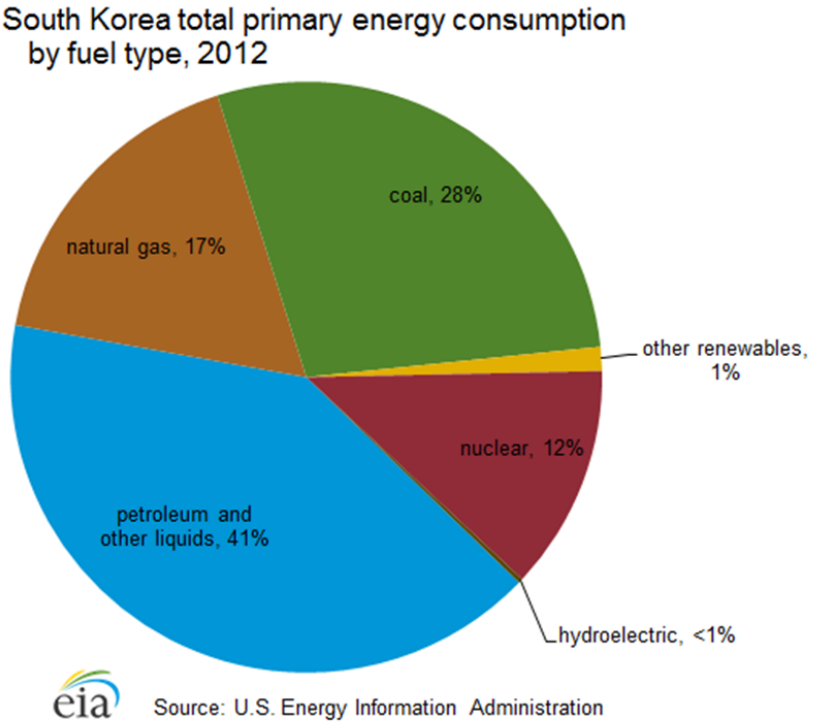

Figure 18

Lacking much hydro power, South Korea has turned to fossil fuels for energy purposes, almost up to 90 per cent (Figure 17). It differs from China only in the reliance upon nuclear power, where the country is a world leader in plant constructions. Reducing its hefty CO2 emissions, South Korea will have to rely more upon renewable energy sources, as well as reducing coal and oil.

The above three countries are giant polluters in terms of CO2:s. China and South Korea uses mainly fossil fuels for energy consumption, whereas India also employs renewables and hydro power. Yet, the burning of renewables like biomass and waste for electricity generation also leads to CO2 emissions. Only nuclear and hydro constitute emissions neutral energy.

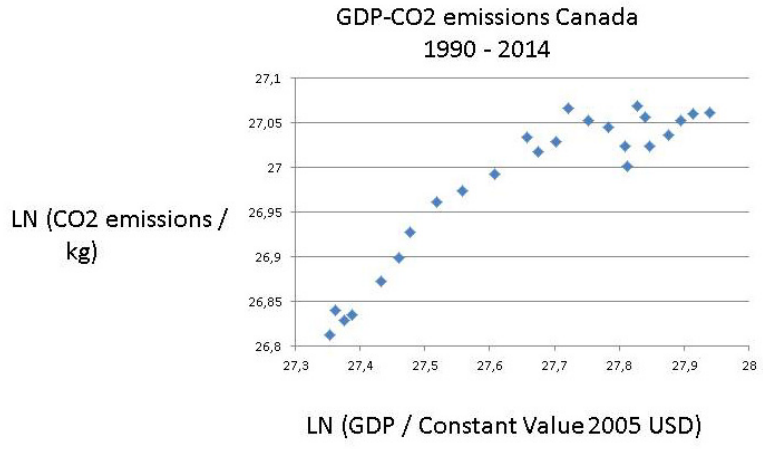

FIGURE 19. CANADA

Although Canda is a major emitter of CO2:s as well as one of the world's largets fossil fuel producer – oil sands, it had managed to stem the increase in emissions for the most recent years, i.e. halting the augmentation. Figure 20 may be invoked to explain this, showing a very mixed energy consumption pattern.

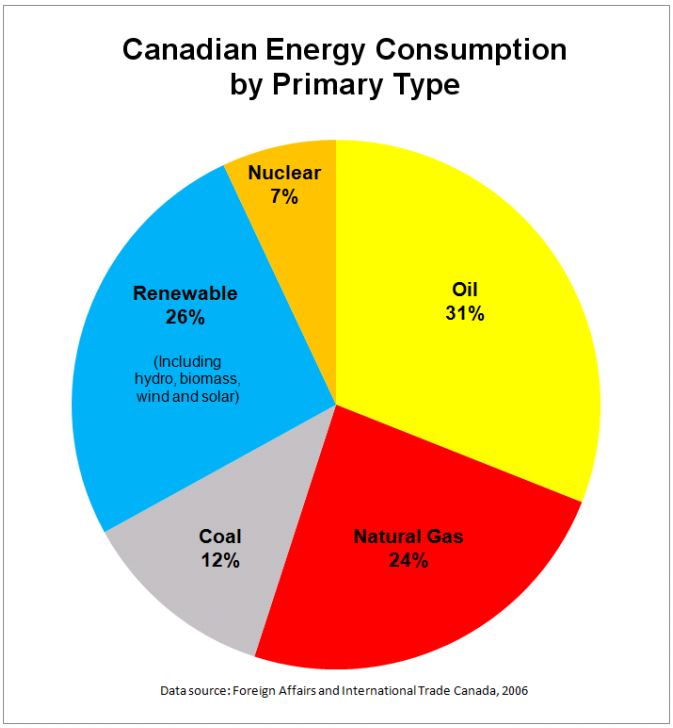

FIGURE 20

Canada has a strong advantage compared with for instance China and India in that it has access to lots of hydro power and natural gas. The burning of coal is as low as 12 per cent, but oil still makes up almost a third of energy consumption. Reducing CO2:s more should not be too costly for Canada.

Let us look at the ethanol country *par preference*: Brazil. Figure 21 shows a considerable drop in total emissions, but it is followed by huge increases that tend to flatten out.

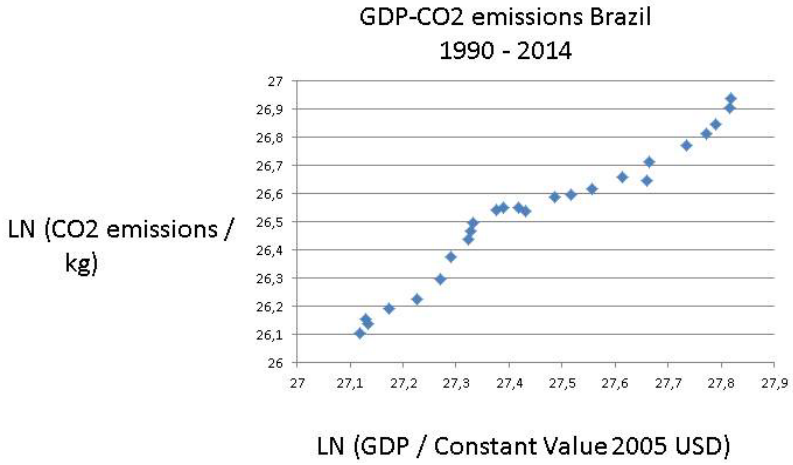

Figure 21. BRAZIL

Brazil employs the most biomass in the world, but the emissions stay at a high level, which is a reminder that renewables may also have CO2:s. One advantage for Brazil is the large component of hydro power, but the overall picture for the largest Latin American country is not wholly promising when it comes to reduction of emissions. Global warming reduces the potential of hydro power, and Brazil has very little nuclear power (Figure 22).

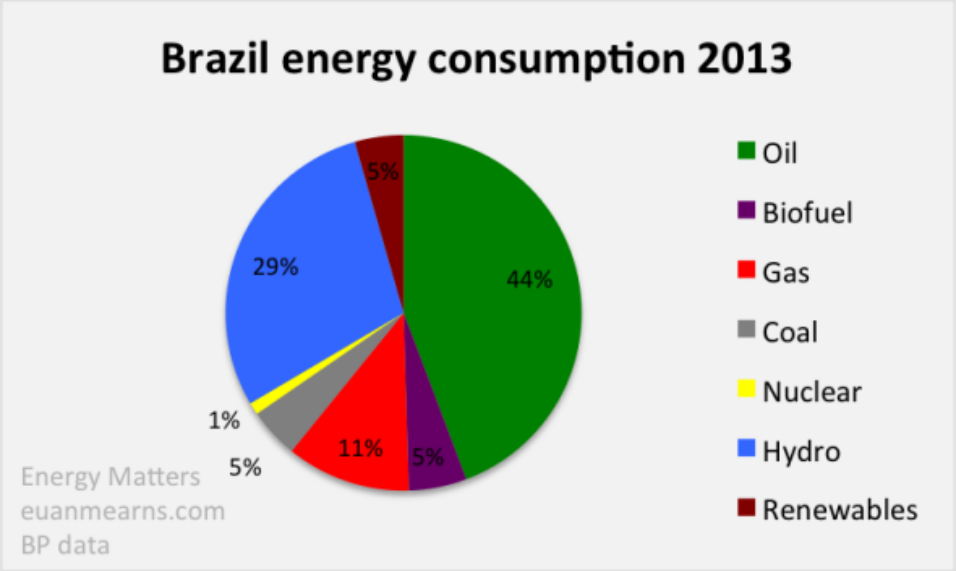

FIGURE 22

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 three more examples, like e.g. giant Indonesia – the fourth largest emitter of CO2:s in the world now (Figure 22).

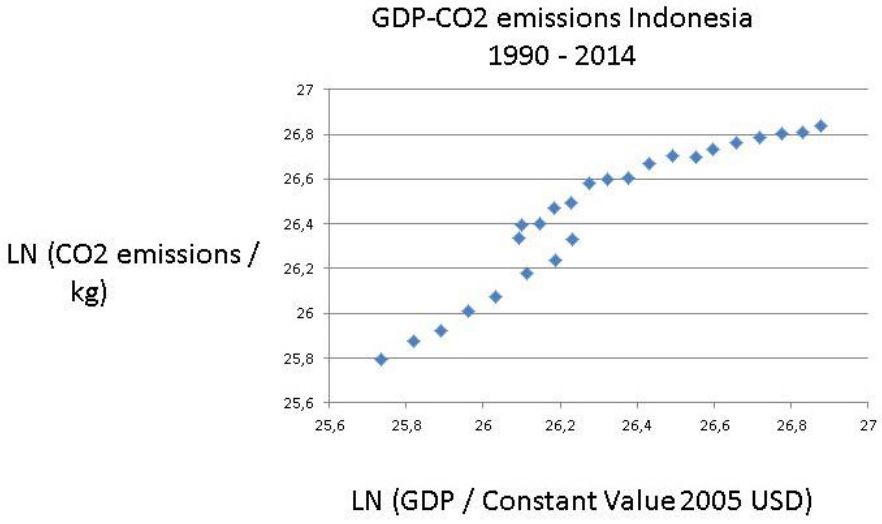

Figure 22. INDONESIA

Indonesia is a coming giant, both economically and sadly in terms of pollution. Figure 22 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 23 presents the energy mix for this huge country in terms of population and territory.

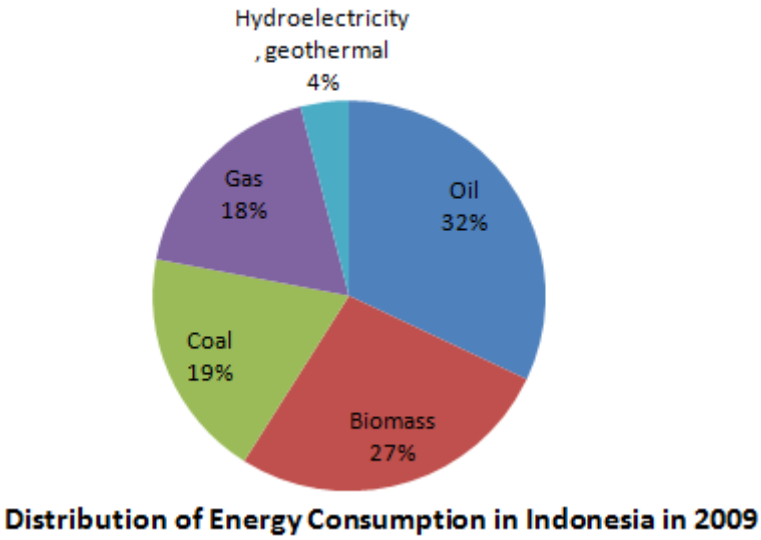

FIGURE 23. (http://missrifka.com/energy-issue/recent-energy-status-in-Indonesia.html)

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 needs fianance from the super fund to replace coal and stop deforestation. South Afica faces also a grim prospect of implementing COP21 (Figures 24 and 25), as its CO2:s constiture the major bulk if its GHG:s.

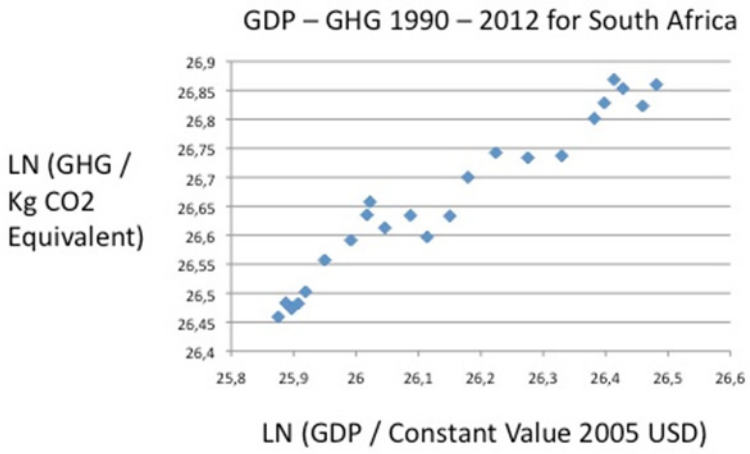

Figure 24. SOUTH AFRICA

CO2 emissions like GHG:s are high for RSA, following GDP.

And the coal dependency is frighteningly high.

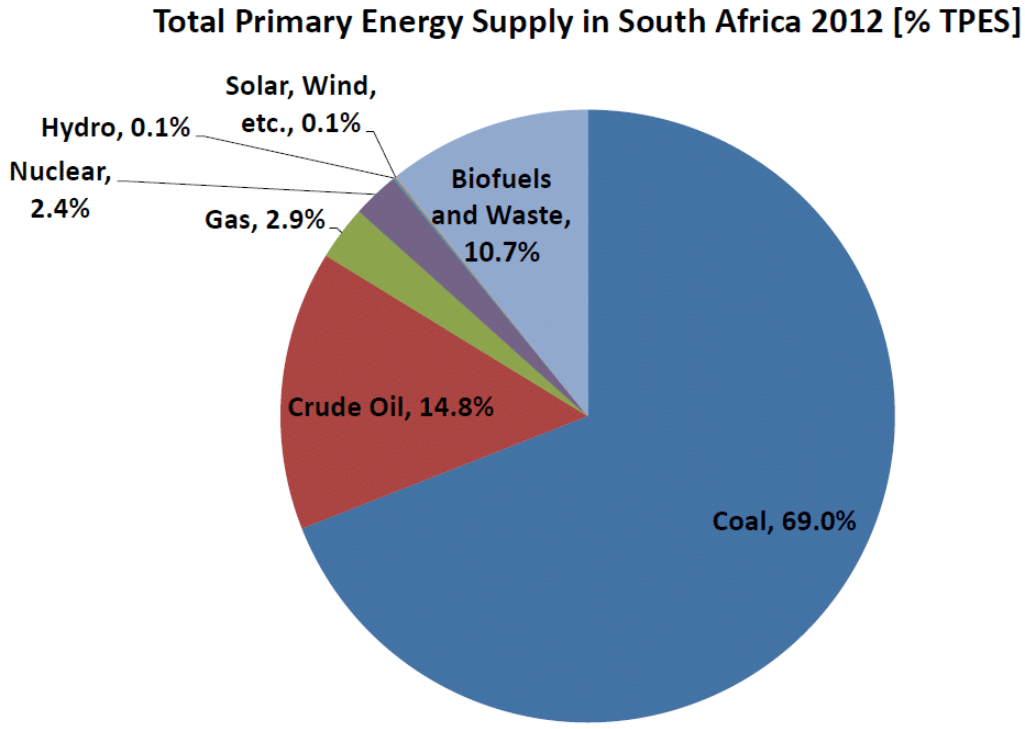

Figure 25. Energy sources in the RSA

7. CONCLUSION: THE EU

It remains to point out that the EU in total is the 3rd largest emitter of CO2:s, with Germany, France and Italy in the top. However, CO2:s have decreased in several EU countries, perhaps reflecting the recent economic decline. Look at the Figures 26 and 27 for Germany for instance,

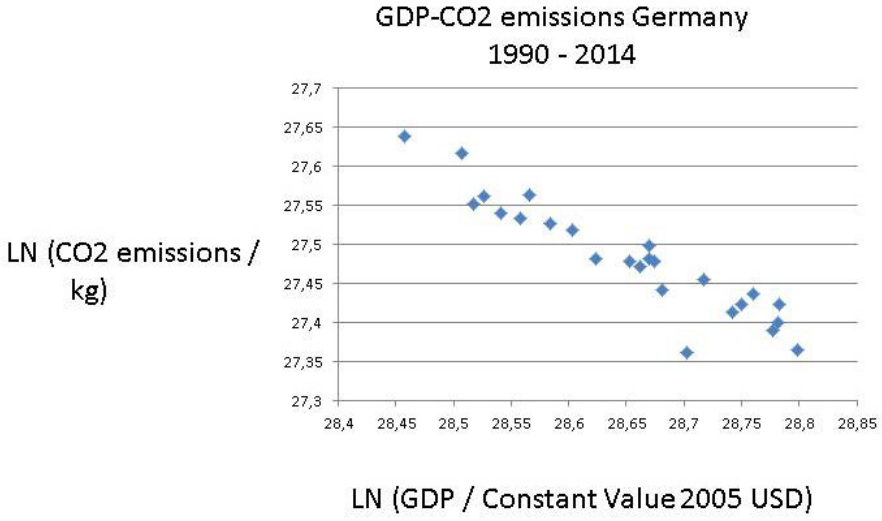

FIGURE 26. GERMANY

The German data shows a consistent decreasing trend, which is not to be found with many countries, if at all. How come this German exceptionalism? Germany needs massive amounts of energy, but it decided to phase out nuclear power. Can really the domestic employment of renewables satisfy this gigantic demand (Figure 27)?

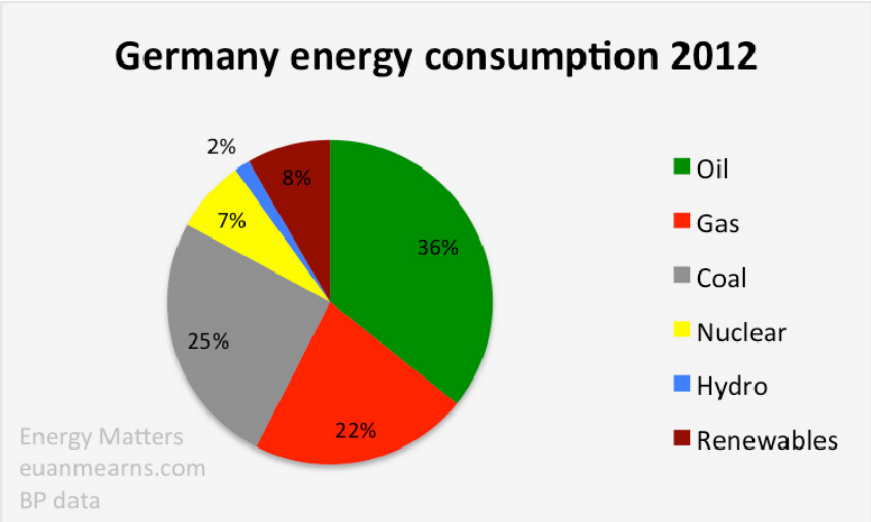

Figure 27

It is true that nuclear power and renewables has made it possible for Germany to decrease its CO2:s, but the country is still dependent upon fossil fuels, especially coal and oil. What will happen with the nuclear power stations are phased out in 2022 is that most likely the CO2 emissions will start going up again. To replace nuclear power with solar and wind power will be difficult to say the least. Already, Germany uses more coal from Columbia and gas from Russia.

It is a major surprise that France with its enormous nuclear power still has substantial CO2 emissions (Figure 28). But they are declining!

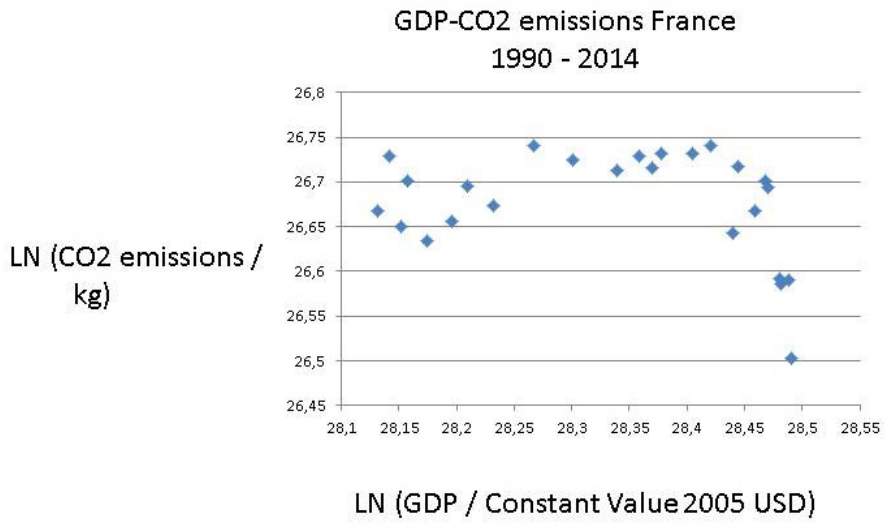

Figure 28. France

France relies upon nuclear power more than any other nation. But it may reduce this reliance in the future (Figure 29).

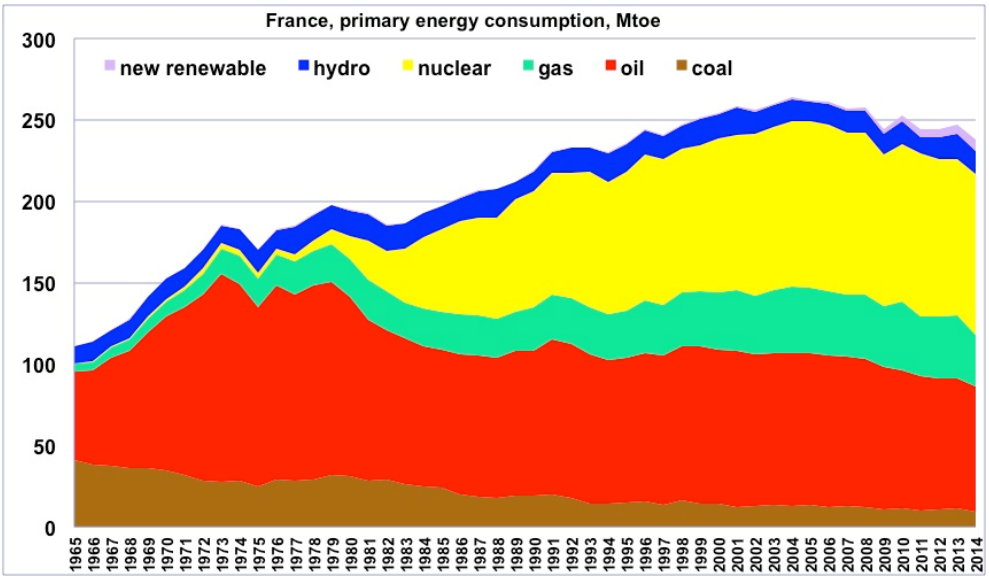

Figure 29. Energy consumption in France

Source: http://www.manicore.com/documentation/chiffres_energie.html

It is hardly promoting the objectives of COP21 when a country cuts back nuclear power and replaces it with coal or oil. Nuclear power is less and less politically acceptable, but it eliminates the CO2 problematic. Whereas rich countries diminish nuclear power, several developing countries increase this power source for electricity.

Yet, the implementation of COP21 can succeed if and only if CO2:s start being reduced significantly with the huge polluters, where one could also include Iran and Saudi Arabia. This necessarily requires the sharp reduction of coal and using filters against coal emissions. Finally, carbon taxes should be employed to reduce CO2:s from cars, busses and trucks, if not plainly prohibitions against diesel and big polluting vehicles. The basic crux of the matter is the close link between CO2:s and GDP in many countries, as this link must be broken.

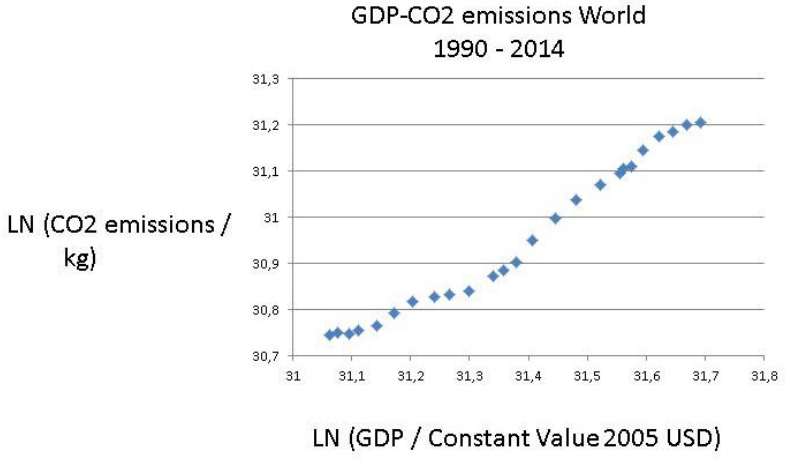

Figure 30

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