

Global Management and the COP21 Process: Climate Change as *Juggernaut*

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Received: August 14, 2016

Accepted: August 30, 2016

Online Published: September 13, 2016

doi:10.5430/bmr.v5n3p51

URL: <http://dx.doi.org/10.5430/bmr.v5n3p51>

Abstract

Examining the status quo with regard to emissions, energy and GDP leads to a pessimistic view on the feasibility of the COP21. Achieving its 3 major goals will be very difficult for a majority of countries. Only a few nations have started the decarbonisation process. And many countries is in dire need for financial assistance from the Super Fund in the COP21. This sets up the management task of the 21st century on a global scale. The colossal sum of 100 billion dollars a year is mentioned in the COP21. Probably decarbonisation will prove so expensive, given the enormous reliance of most countries on fossil fuels and traditional renewables. But managing this gigantic money in a successful manner is a herculean task in global governance. To which countries should major financial assistance go? This paper discusses a few options.

Keywords: COP21 management, Super Fund, variety of country predicaments, GDP-CO2 links, Energy consumption patterns

1. Introduction

Some 195 governments in collaboration with IGO:s and NGO:s have committed their states to the active achievement of the basic goals of the COP21 Agreement, namely decarbonisation of the economy and society up to the second half of this century. It will require both massive public policies and private sector innovations writ large, because global warming is nothing less than a *Juggernaut*. It is very doubtful whether the participants involved in the Paris “historical” climate decision have fully understood what this decision entails comprehensively. Moreover, many states in the world struggle in a Hobbesian order, where the government only has one goal: survival of their state, and no capacity of pursue COP21.

The COP21 objectives include;

- a) GOAL 1: Reversal of CO2 emissions trend by 2020, from growth to decline;
- b) GOAL 2: The cut of 40 per cent in CO2 emissions compared to roughly 2005;
- c) GOAL 3: Complete decarbonisation of all economies or societies by 2075.

Environmentalists debate whether this will be enough to save the planet, meaning halting global warming rise. To put it simply: if temperatures go up much, then men and women cannot work besides all other negative consequences for the oceans, fresh water, the North and South poles, the glaciers and other animal species. Thus, climate change brought about poverty, famine and human misery. However, cornucopians claim that ecologists overexaggerate. I will not talk about this all important issue for the natural sciences in this century, but raise the problem of feasibility or practicality in relation to the objectives above, GOAL 1-3, from the point of view of the social sciences.

At the same time as scientific debate is intense about climate change in the natural sciences, looking for new evidence all the time and trying to explain global warming in the light of the laws of physics, little has been out done in the social sciences. The COP21 process is a class of coordination or collective action.

2. Concepts of Cooperation and Coordination

When choice participants come together and sign a contract about a common project, then we have collective action. It presents its peculiar problematic – cooperation against defection – that has its standard analysis in game theory. Most probably the Paris people did not know much about these difficulties that could easily derail the COP21 process. Thus, we have the following insights from advanced game theory about what could happen in interaction

where there is a distance between *Saying* and *Doing*;

- opportunistic behaviour with guile: governments are tempted to report falsely;
- asymmetric information: governments know more than global surveillance inviting cheating;
- free riding: small countries may renege as they do not matter much globally;
- renegeing: if economic growth is hurt by COP21 measures, then favour economic development;
- individual rationality resulting in group foolishness: if many countries renege rationally one way or the other, all countries lose out.

Given these strategies, coordination may fail. Cooperation may be only a promise, as defection enters the interaction ex post.

What makes these choice paradoxes – promising one thing, doing another – in the climate change developments so essential and costly is the fact that they affect the crucial links between energy and GDP in the most wide sense of the economy, also household economic administration.

The debate between ecologists and cornucopians targeted the environment in its most wide range and scope, but global warming only covers the harmful effects of antropogenic emissions from the burning of fossil fuels. It does not include ecological deficits or the finiteness of resources as in the classical Ehrlich - Simon bet. Thus, some have argued that we must be prepared to move towards a sustainable economy, involving cuts in energy consumption and correspondingly economic output (Sachs, 2015)). But this is hardly likely to happen, as future projection about energy speak of a doubling in energy consumption, especially in Asia.

3. The Basic Global Links: Energy, GDP and GHG:s

Energy is the capacity to do work. Lacking energy, no social system can operate, not eve the family. The daily use of energy is almost astronomical on a small Planet Earth, and it has had a trend of steady increase year by year. The governments of the states of the world have obliged the change the prevailing energy pattern profoundly in a short time period of a few decades.

Not only may all forms of energy be measured, but all these measures are translatable into each other – a major scientific achievement. One may employ some standard sources on energy consumption and what is immediately obvious is the huge numbers involved – see Figure 1.

Table 1. Energy consumption 2015 (Million Tonnes of oil equivalent)

	Total	%
Fossil fuels	11306,4	86,0
Oil	4331,3	32,9
Natural Gas	3135,2	23,8
Coal	3839,9	29,2
Renewables	1257,8	9,6
Hydroelectric	892,9	6,8
Others	364,9	2,8
Nuclear power	583,1	4,4
	13147,3	100,0

Source: BP Statistical Review of World Energy 2016)

Examining Figure 1, one understands the size of the task of the decarbonisation policy effort. Complete decarbonisation would mean the elimination of the energy consumption of fossil fuels and traditional renewables. This is a herculean task, impossible simply. But the mix of energy usage will change during this century towards more of carbon neutral energy sources, but all the stylised energy projections provide fossil fuels with prominent share of energy markets.

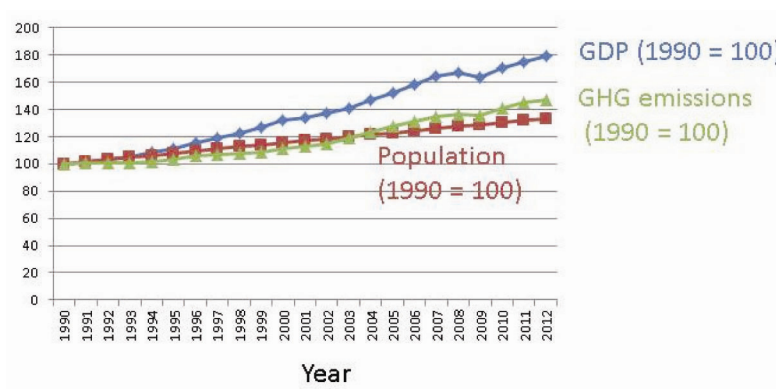


Figure 1. The global scene

COP21 management can do nothing about population growth increasing the CO₂s directly and indirectly, but it may attempt to change energy consumption so that the link between GDP and GHG(CO₂) is broken (Figure 2).

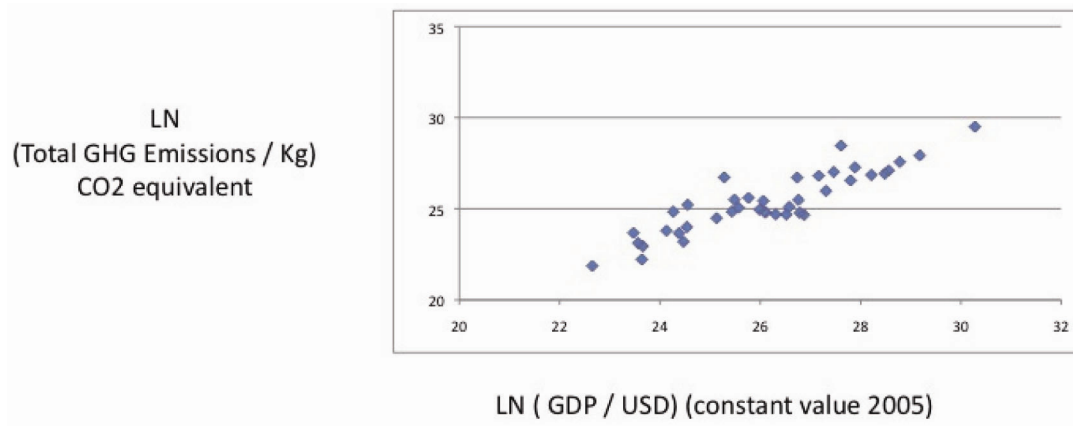


Figure 2. GDP-GHC link globally

However, given the link in Figure 2, COP21 management cannot simply recommend that economic output be cut back – Sach's sustainable economy. Decarbonisation is to be maximised, given the constraint that economic growth is NOT undermined. But the energy needs of human social systems just keep augmenting (Figure 3).

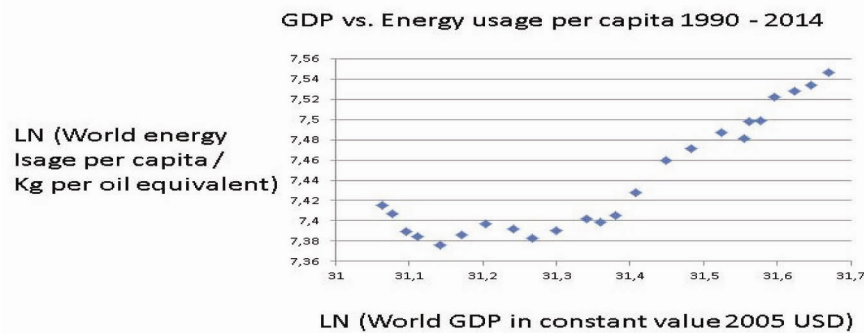


Figure 3. Economic development and energy per person

Thus, the «*noyveau*»: Change energy pattern! But it can only be done by each country in the world. Let us distinguish the promising cases from the not so promising ones, i.e. with regard to the possibility of rational management of COP21 goals. Where is goal achievement likely?

4. Theory and Hypotheses

One needs a uniform and parsimonious model to organise all the country facts. It would allow for the derivation of a few hypotheses to be tested in systematic data about emissions, energy and GDP.

4.1 The Basic Model

COP21 management has to take the following two factors into account :

<GDP-GHG/CO2 link, energy mix>,

when it starts. And these factors affect the likelihood of success or degree of goal attainment.

4.2. Some Hypotheses

Based upon the model above, one would be inclined to surmise the following:

- decarbonisation will be easier if the GDP-CO2(GHG) has peaked and started to decline rapidly:
- decarbonisation would be helped much by energy diversification;
- decarbonisation is supported by a most advanced economy with innovations in renewables.

Let us look at a few countries on the basis of the model above.

5. Findings

It is perhaps not astonishing that Nordic countries have broken the GDP-GHG(CO2) link and have conducted decarbonisation with admirable success. These are tiny countries and little affect the global scenarios above in Figures 1-3. But they often set the tone at international meetings on climate change. Let us examine Denmark (wind power) and Sweden (hydro power).

5.1 Environmentalists' Top Cases

Denmark

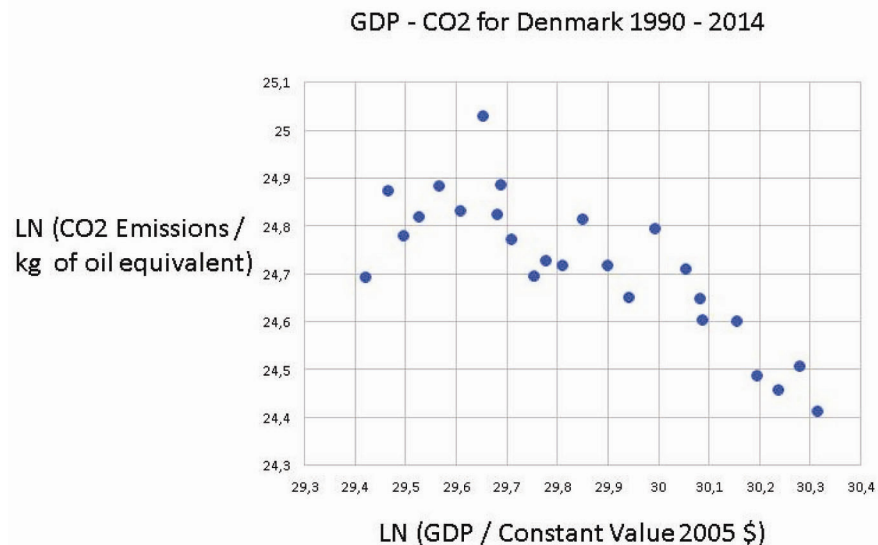
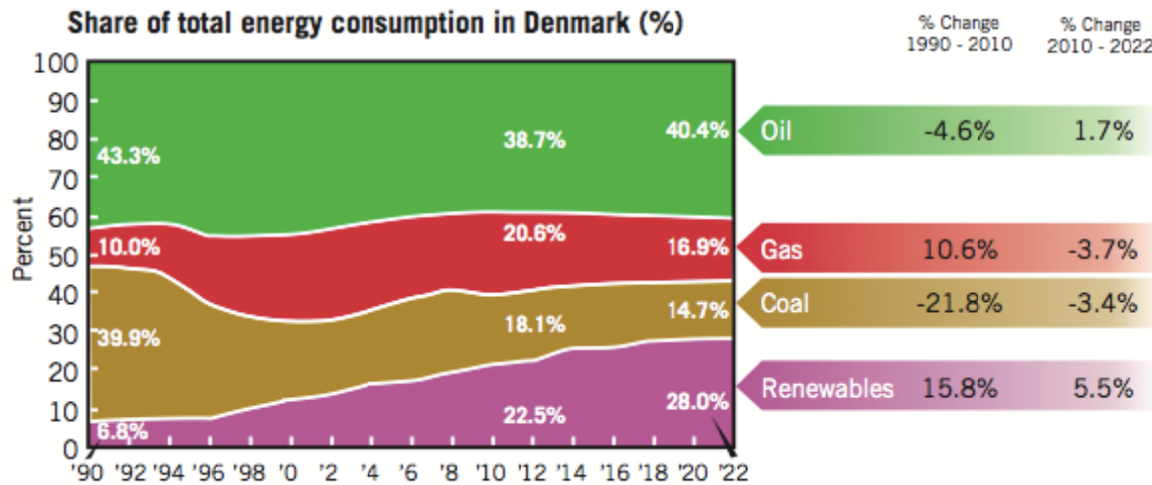


Figure 4. Denmark : $y = -0,4394x$; $R^2 = 0,6459$

Danish governments and society has achieved a remarkable turn around, combining economic growth with the decrease of CO2:s. Yet, this accomplishment much advertised abroad satisfies GOAL I in COP21 management, i.e. the first objective for 2020.

Denmark like any advanced capitalist county still relies upon fossil fuels, including coal (Figure 4).

Fig. 1: Energy consumption in Denmark (1990-2022)



Source: The Danish Energy Agency: "Danmarks olie-og gasproduktion 2010"

Figure 5. Danish state and society must reduce oil and natural gas more to comply with the GOAL II in COP21 management – solar power ?

59)

Sweden

The Swedish curve for GDP-CO2:s looks much the same as Danish neighbour, downward and outwardsloping, but the Swedish energy mix is very different from Denmark's (Figure 6), as for instance Sweden is not a producer of oil and natural gas. However, Sweden presents a most diversified energy production and consumption pattern, which constitutes a POSITIVE for accomplishing the GOAL I and II in time.

Swedish Energy Generation 2015

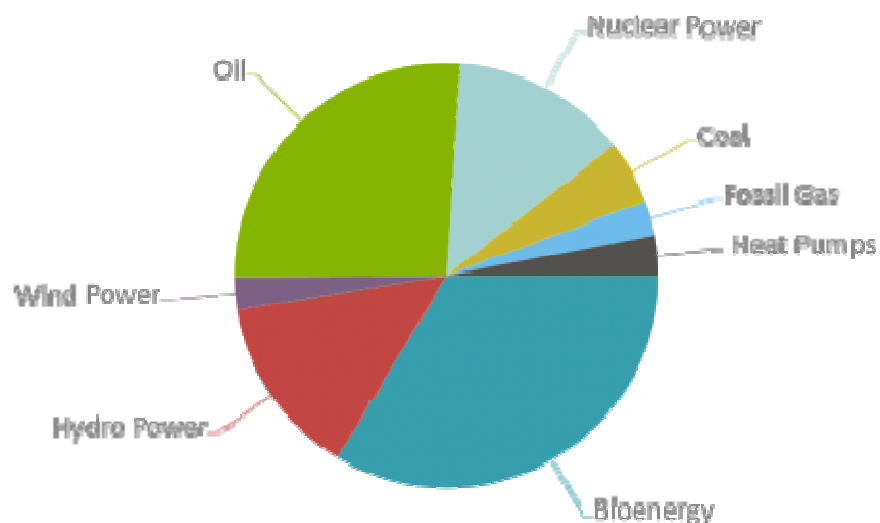


Figure 6.

The problem in Swedish energy management is policy ambiguity, reflecting the availability of many means too few goals. Sweden pursues an aggressive line of anti-nuclear power, either closing plants or restrain it by taxation. Thus, modern renewables like solar, wind and thermal power sources are given favourable treatment by the state. But this policy ambiguity characteristic of European environmentalism mixes up two entirely different kinds of green concern, viz the short-run fear of global warming with the long-run storage problem of atomic waste. Sweden has started use rely much upon burning waste and peats, despite their emissions.

The Nordic countries display good numbers on decarbonisation today and constitute a promise for the achievement of GOAL I and II though hardly for GOAL III. They have actually high GHG;s or CO2:s per capita, although not like the Gulf States (Qatar!). One man require in COP21 management that they reduce CO2:s even more than GOAL II, but this is to enter justice into the management model. Justice comes up naturally through contribution via the Super Fund to poor nations with huge emissions totally see but low on a per capita level.

Germany

Another interesting country is the largest EU economy, namely Germany. Figure 9 shows a marked decrease in CO2 emissions.

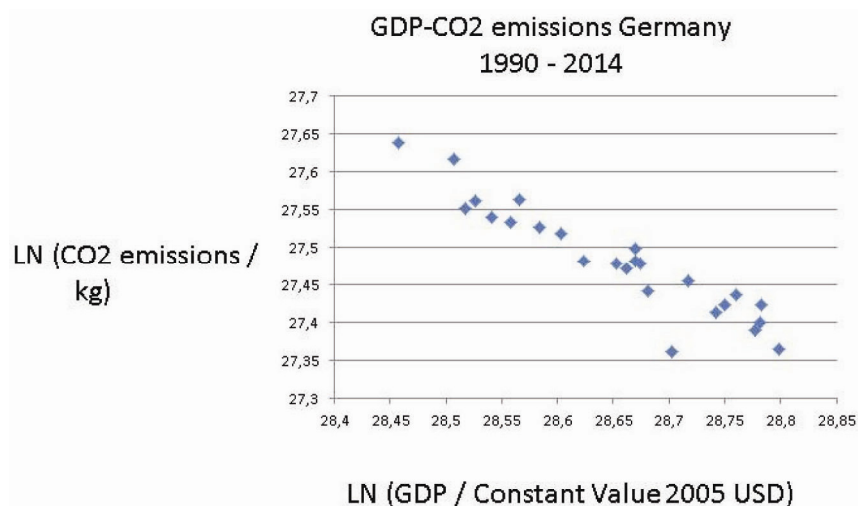


Figure 7. GERMANY: LN (CO2 / Kg and LN (GDP / Constant Value 2005 USD) ($y = -0,69x + 47,3$; $R^2 = 0,88$)

The German data show an impressively consistent decreasing trend, which is not to be found with many countries, if at all. How come that Germany has succeeded in a short time span to reduce CO2:s? Germany needs massive amounts of energy for industry and transportation, but it has decided to phase out nuclear power. Can really the domestic employment of renewables satisfy this giant's demand for electricity? German energy policy – *ENERGIWENDE* – is spectacular comparatively speaking, but it also appears risky indeed.

It is true that nuclear power and renewables has made it possible for Germany to decrease its CO2:s much, but the country is still dependent upon fossil fuels, especially coal and oil – almost 60%. 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 on a truly massive scale will be difficult to say the least. Already, Germany uses more coal from Columbia and gas from Russia.

The German energy policy is causing much stir, because the losers – nuclear industry and coal power interests – want compensation that will run into billions of dollars, if not more.

France

Interestingly, also France has like Germany managed decarbonisation to some extent (Figure 8). It reflects its unique energy mix, relying much upon nuclear power in a comparatively unique way.

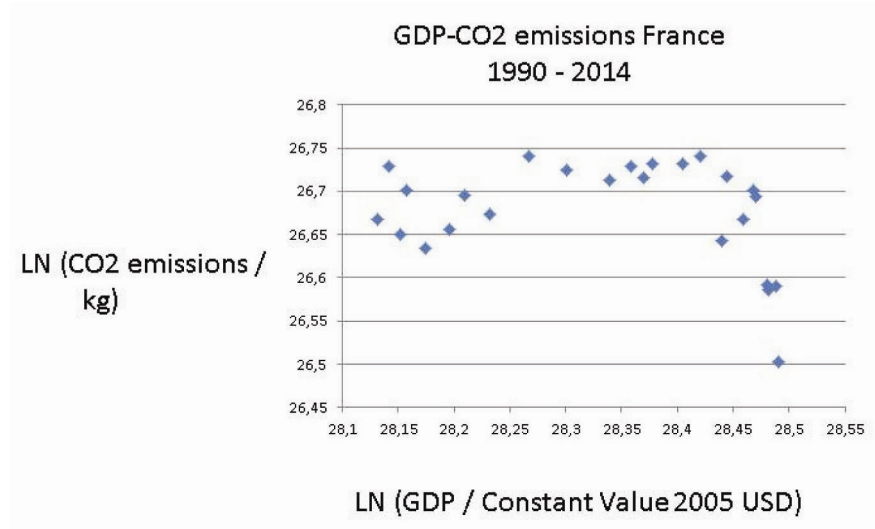
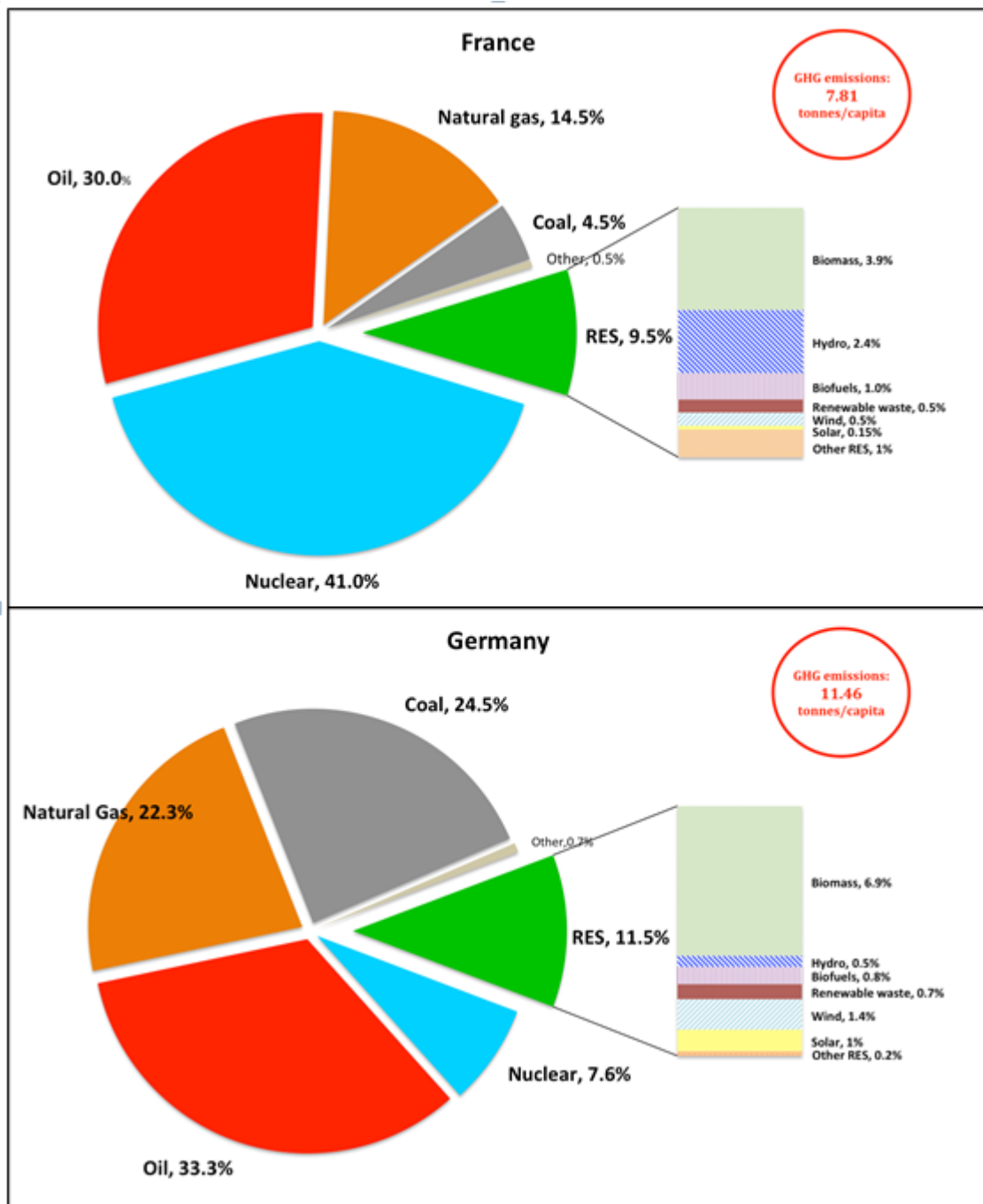


Figure 8. France ($y = -0,13x + 30,4$; $R^2 = 0,08$)

Yet, France has decided to diminish its reliance upon nuclear power. But how will it be replaced by other sources of energy? Figure 9 informs about the reliance upon fossil fuels in Germany and France too.

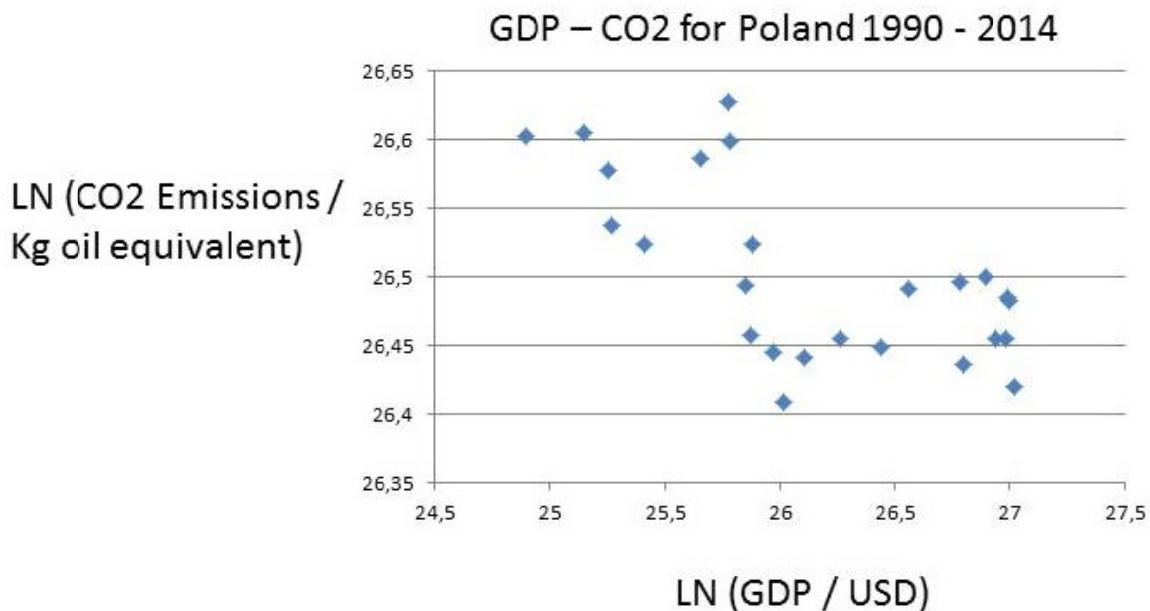


Source: <http://blog.iass-potsdam.de/2015/05/energy-transition-france-following-in-germanys-footsteps/>

Figure 9. Mixes of energy in France and Germany

As underlined, no other country in the world employs nuclear power to such an extent (Figure 9), allowing France to avoid lost of CO₂s. But the Green movement’s criticism of nuclear power is based upon entirely different argument than the wish to decarbonise economy and society. Actually, doing both – decarbonisation and de-nuclearisation – may prove difficult for France. The French energy sector – EDF and AREVA – has suffered immensely from lower energy prices and scepticism about nuclear power, requiring massive state support.

Poland ($y = -0,1671x$; $R^2 = 0,3821$)



The decline in CO2:s in Poland although economic development has not stagnated is much due to the dismantling of the Command Economy, which was highly energy inefficient. Even 10 years after the fall of the Planned Economy, Poland relied almost exclusively upon fossil fuels. This reliance has not been altered.

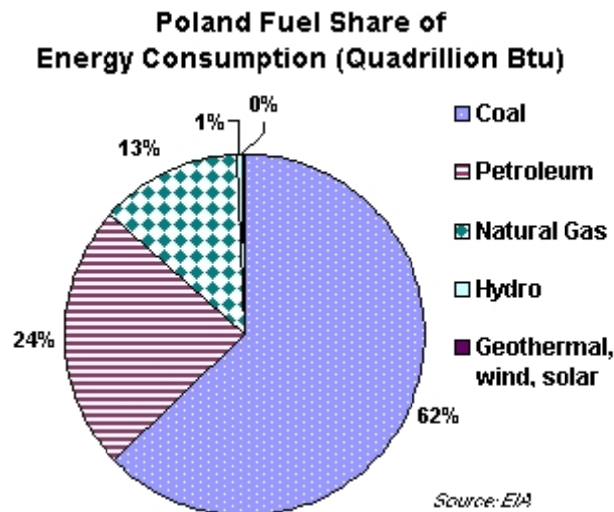


Figure 10. Poland 2001

When one goes beyond the EU, one finds only two cases of declining GDP-COP curve: Australia and Japan. Japan has for a long time substituted coal for atomic power, although recently with a crucial set. But Australia has always been the country of fossil fuels, exporting coal and iron in huge amounts. However, it has reached its CO2 peak recently (Figure 11).

Australia

This country is of key importance in many debates about climate change, because it is the major exporter of coal and iron as of some oil and gas.

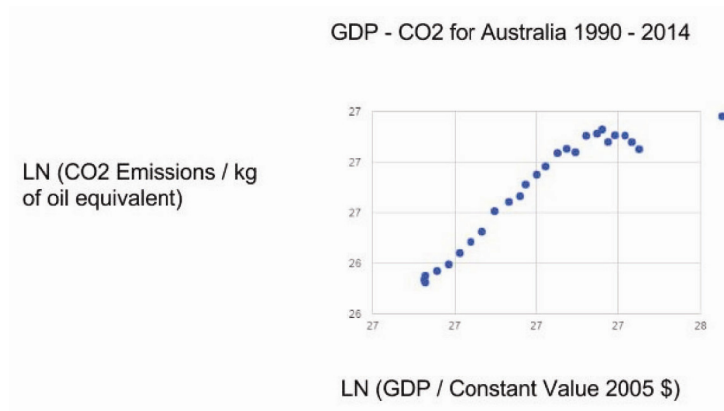
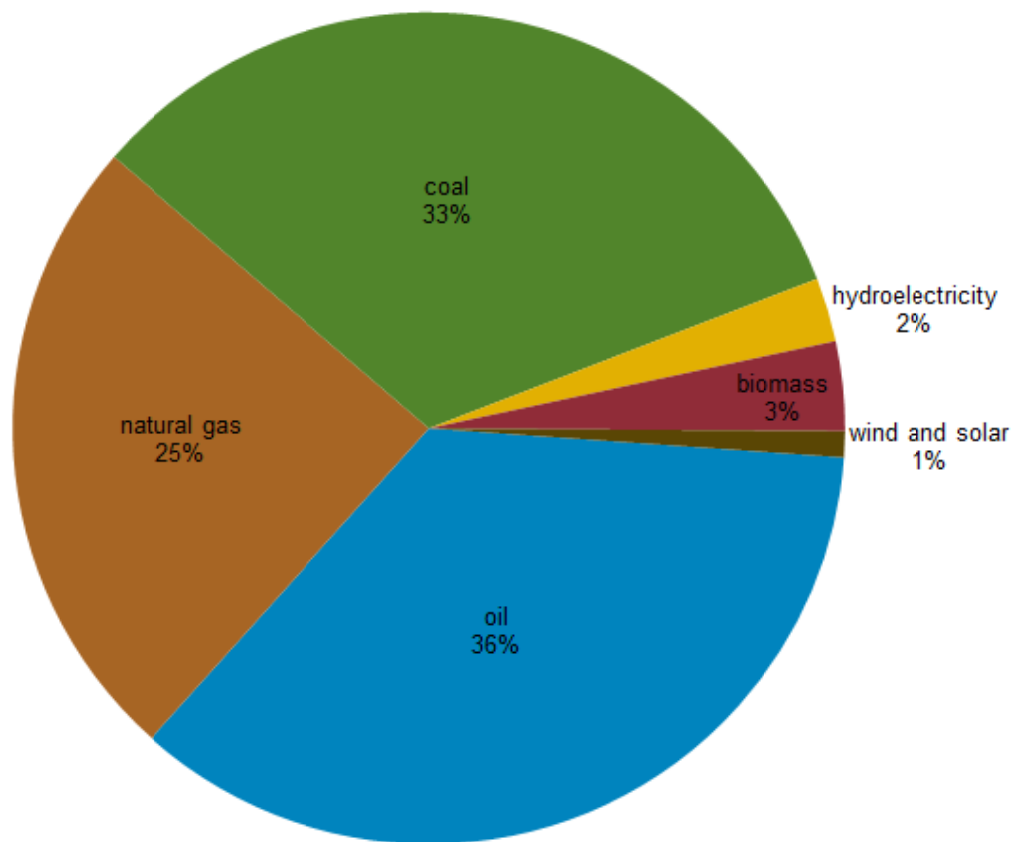


Figure 11. Australia

Australia has been extremely dependent upon fossil fuels, domestically and in exports. Cutting back its coal dependency will allow the country to halt its CO2 emissions, while moving to renewables. The fossil fuel dependency of Australia is simply stunning (Figure 12).

Australia's primary energy consumption, 2011



Source: EIA International Energy Statistics

Figure 12.

Australia has often been accused of fuelling climate change. These accusations appears to be vindicated in the Figure above that shows an extreme reliance upon fossil fuels. Add then all the export of raw materials!

ENVIRONMENTALISTS' NIGHTMARE

The bulk of CO2 emissions come out of Asia and the US. Change has been noted for USA (see below), but not for East Asia or South Asia. If these countries renege upon the COP21 objectives, then the whole policy or process will fail.

China

One finds that the emissions of CO2:s follows economic development closely in many countries, like China, South Korea and most Latin American countries. The basic explanation is population growth and GDP growth – more people breathing and searching for higher life style. Take the case of China, whose emissions are the largest in the world, totally speaking (Figure 13). Interestingly, China has begun a fundamental change of its energy policy in 2015, reacting to mostly domestic demands for cleaner air and environment.

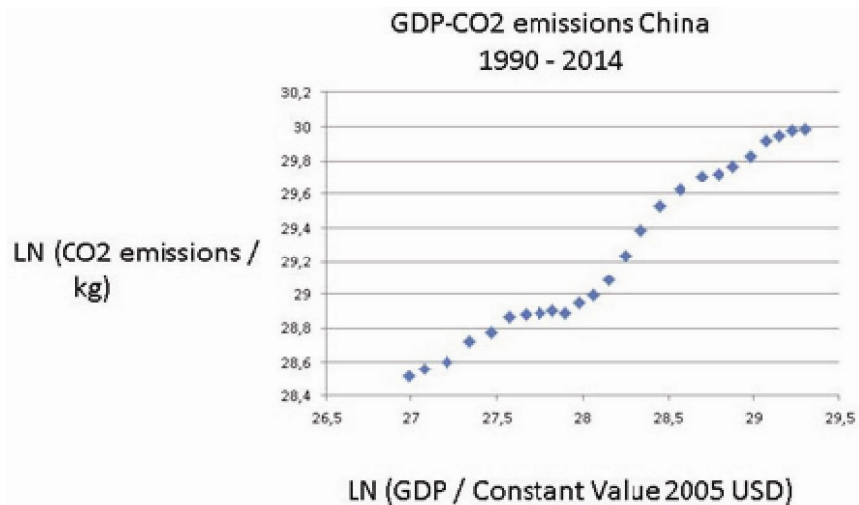
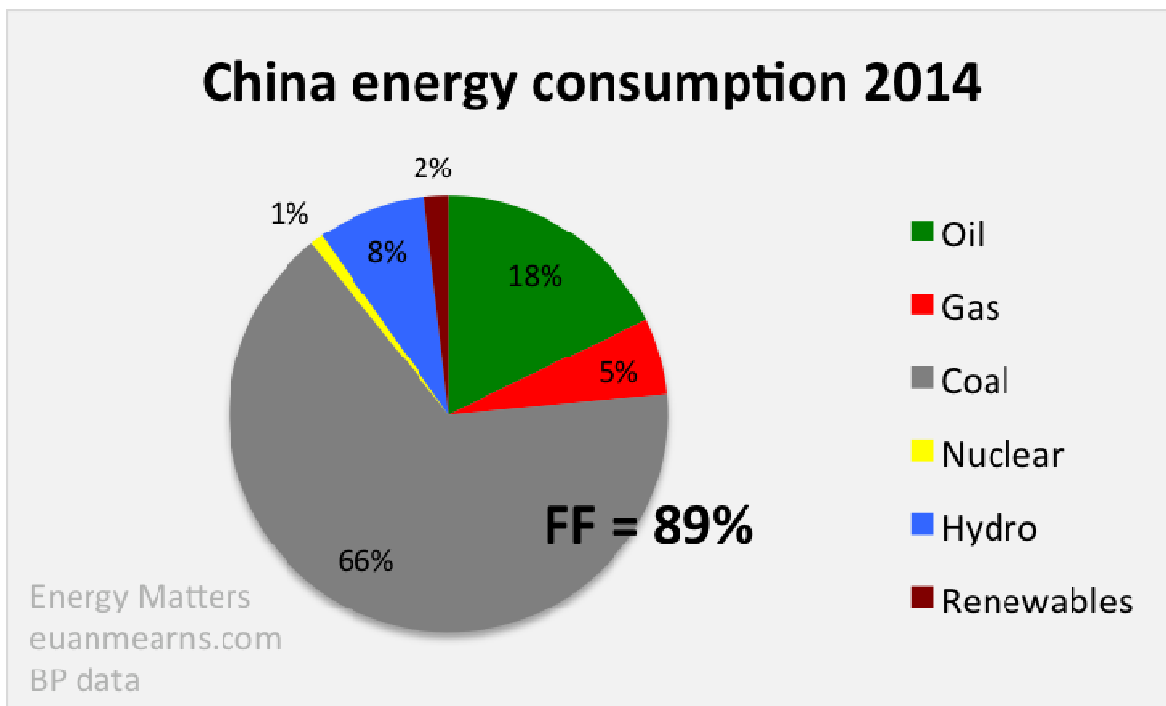


Figure 13. China: LN (CO2/ Kg and LN (GDP / Constant Value 2005 USD) ($y = 0,7x; R^2 = 0,97$)

The sharp increase in CO2:s in China reflects not only the immensely rapid industrialization and urbanization of the last 30 years, but also its problematic energy mix (Figure 14), which is now up for overhaul.



Source: <http://euanmearns.com/china-post-industrial-revolution/>

Figure 14.

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 is very small indeed but about to change. Numerous solar power plants as well as wind plants are constructed, as old coal fired stations are phased out.

Yet, this energy mix makes China very vulnerable and responsive to demands for radically cutting CO₂ emissions: use other energy sources or install massively highly improved filters for carbon capture. It is true that China has turned to wind power, solar power and nuclear power on a huge scale recently, but the task of achieving a 40% reduction is enormous – GOAL II. China evidently hopes to respect its COP21 commitments while still enjoying an economic growth rate around 5%, but it is realistic? New coal plants have actually been opened recently, replacing out-dated old ones in order to propel growth.

Decarbonisation in China will probably not achieve GOAL II, because CO₂ emissions are increasing in the transportation sector with the car market becoming the biggest in the world and air transportation exploding. What is saved in one sector is dissipated in another.

Several small countries have much higher emissions per capita than China, and also giant USA. This raises the enormously difficult problematic in COP21 management of *fair cuts of emissions*. Should the largest polluters per capita like the rich Gulf States cut most or the biggest aggregate polluters, like emerging economies China, India and Indonesia for instance? At COP21 negotiations in Paris, this issue about redistribution was resolved by the creation of a super fund to assist energy transition and environment protection in developing countries, as proposed early by economist Stern (2007)

India

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

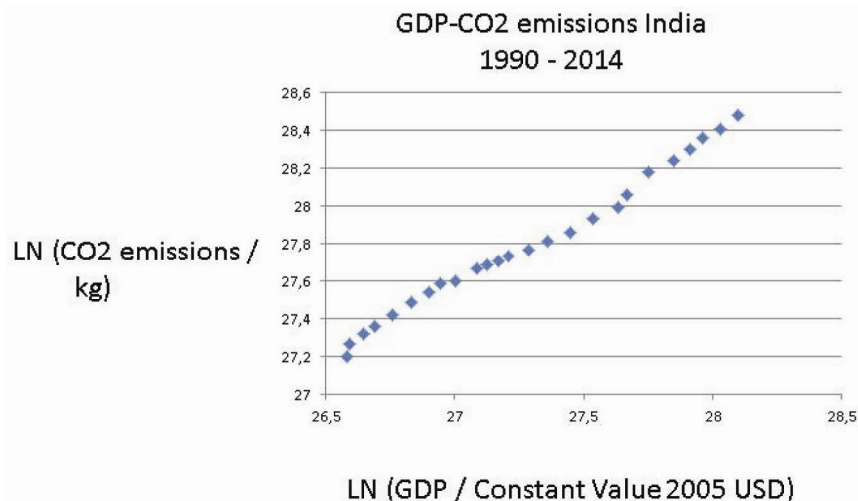
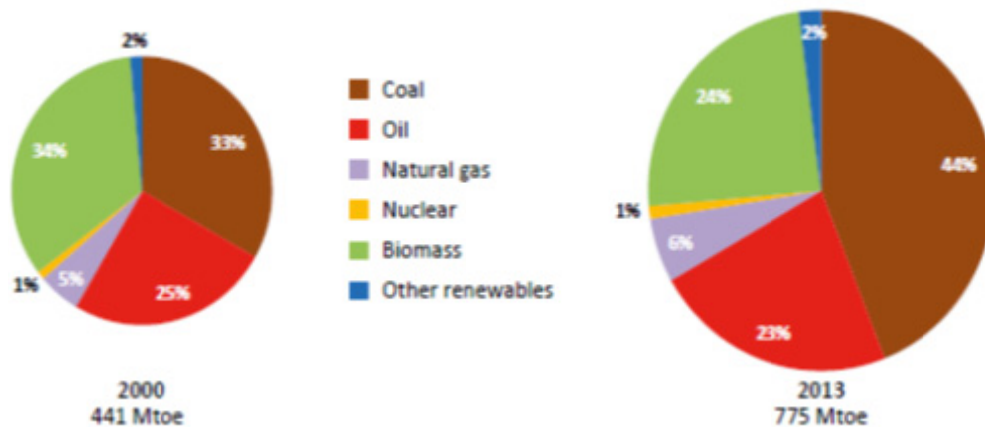


Figure 15. INDIA: LN (CO₂/ Kg and LN (GDP / Constant Value 2005 USD) ($y = 0,77x + 6,79$; $R^2 = 0,99$)

India needs cheap energy for its industries, transportation and heating as well as air-conditioning, meaning it aims strongly at electrification. From where will this power 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 small numbers for energy per capita, although it produces much energy totally. Figure 16 shows its energy mix where renewables play a bigger role than in China. However, the renewables in India may lead to deforestation and considerable pollution.

Figure 1.4 ▶ Primary energy demand in India by fuel



Source: <http://www.eia.gov/beta/international/analysis.cfm?iso=IND>

Figure 16.

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 much 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 – water shortages - and nuclear power meets with political resistance. Interestingly, India uses much biomass and waste for electricity production, which does not always reduce CO₂ emissions. India’s energy policy will be closely watched by other governments and NGO:s after 2018. The constant tension between the demand for economic growth on the one hand and environmental protection on the other hand is sharply portrayed in Ramesh (2015).

Indonesia

One may guess correctly that countries that try hard to “catch-up” will have increasing emissions. This was true of China and India. Let us look at three more examples, like e.g. giant Indonesia – now the fourth largest emitter of CO₂:s in the world.

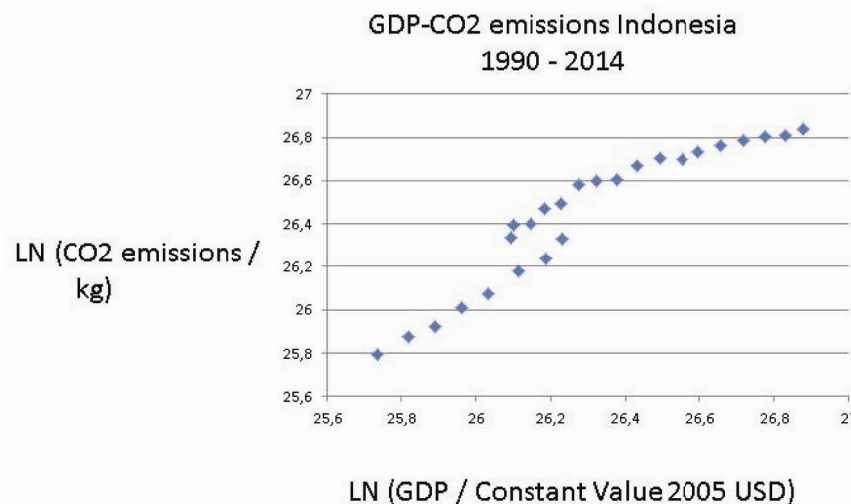
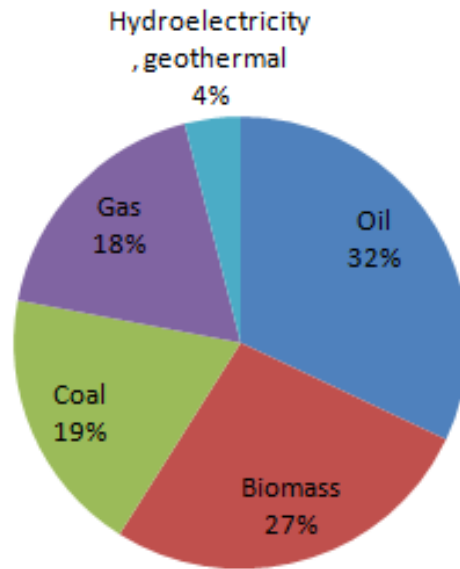


Figure 17. INDONESIA: LN (CO₂ / Kg and LN (GDP / Constant Value 2005 USD) (y = 1,69x; R² = 0,90)

Indonesia is a coming economic giant. Figure 18 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 CO₂ emissions very much. Figure 18 presents the energy mix for this huge country in terms of population and territory.



Distribution of Energy Consumption in Indonesia in 2009

Source: (<http://missrifka.com/energy-issue/recent-energy-status-in-indonesia.html>)

Figure 18. Indonesia

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, especially traditional renewables like charcoal and dung.

Neither India nor Indonesia will reach GOAL I and GOAL II. They need huge financial support from the Super Fund, as they not only utilize carbon full energy but also burn down forests, adding to deforestation and desertification.

But also rich South Korea is a huge polluter.

South Korea

One may find a close link between GDP and emissions also in countries with an advanced economy. See Figure 19 for South Korea.

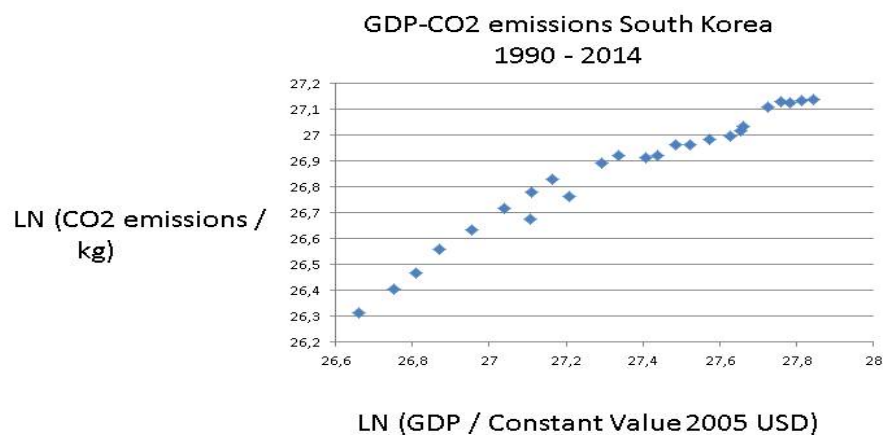


Figure 19. South Korea: LN (CO2/Kg and LN (GDP/Constant Value 2005 USD) ($y = 0.65x + 9.19$; $R^2 = 0.96$)

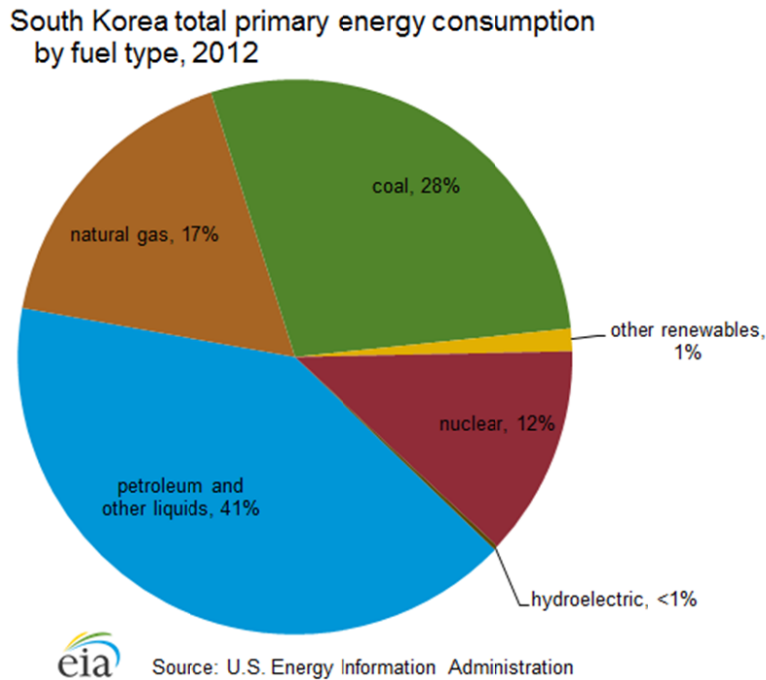


Figure 20. South Korea Total Primary Energy Consumption

Lacking much hydro power, South Korea has turned to fossil fuels for energy purposes, almost up to 90 per cent (Figure 20). 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 for imported gas or LNGs.

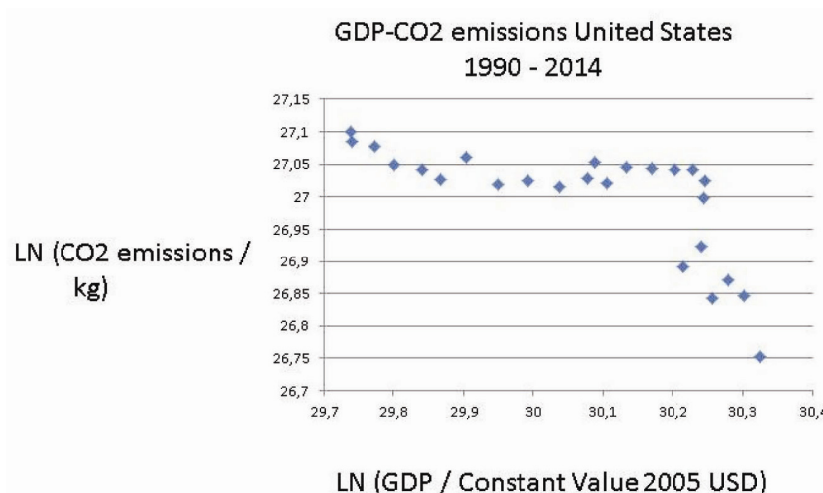
Among the above countries that are giant polluters in terms of CO2, China and South Korea uses mainly fossil fuels for energy consumption, whereas India also employs renewables and hydro power, lacking in the other two countries.

5.3 Environmentalists' Hopefuls

For most countries hold that their emission of CO2:s increases, as well as augments with the GDP. However, there are a few notable exceptions of decreases that are worth mentioning among the mature economies. We start with the US where changes occur now.

The US

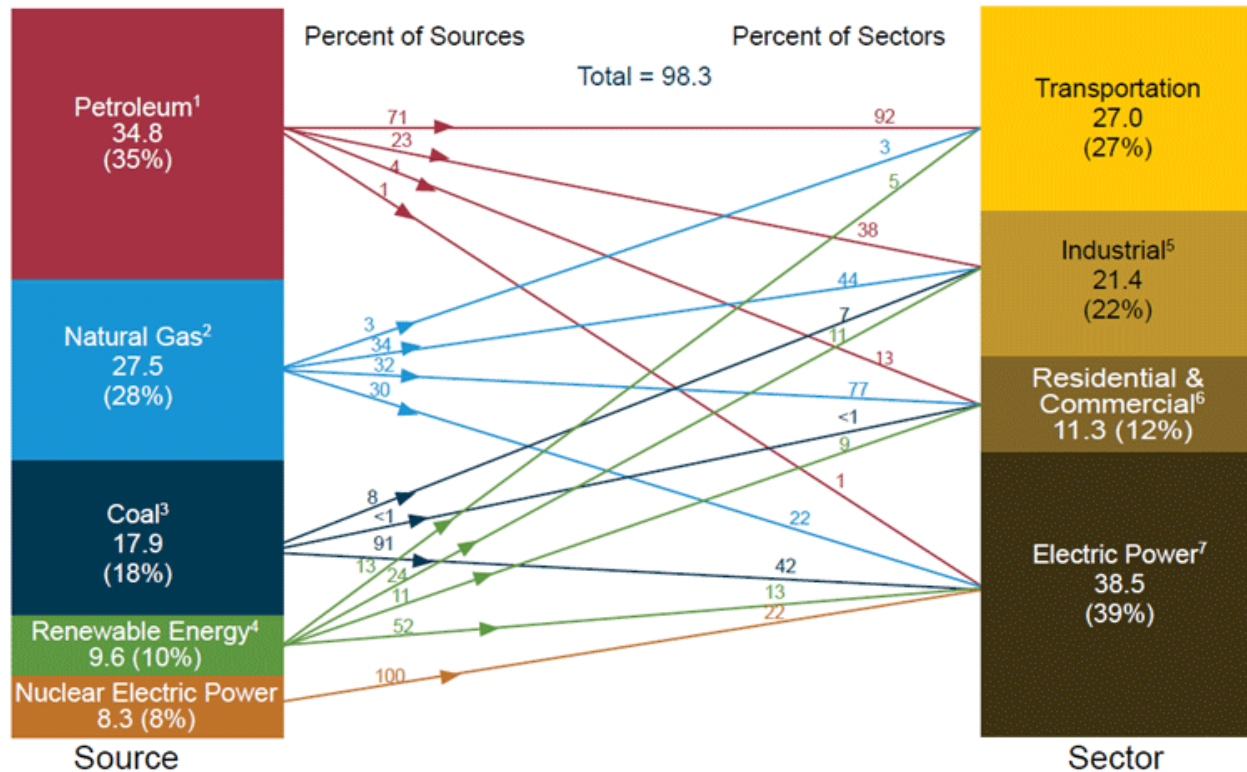
Although the US has had the targets CO2 emissions both totally and per capita, change has taken place recently (Figure 21).



Recently, the level of CO2 emission has been reduced significantly in the US. It reflects partly the economic crisis that began 2007, but the entire energy pattern is undergoing change, from coal towards modern renewables. Yet, the US remains the second largest polluter in the world. This CO2 reduction reflects that the US can draw upon a mixed bag of energies, including nuclear and hydro power, with solar power expanding rapidly (Figure 22).

Primary energy consumption by source and sector, 2014

quadrillion Btu



Endnotes:

¹ Does not include biofuels that have been blended with petroleum—biofuels are included in “Renewable Energy.”

² Excludes supplemental gaseous fuels.

³ Includes less than -0.1 quadrillion Btu of coal coke net imports.

⁴ Conventional hydroelectric power, geothermal, solar/photovoltaic, wind, and biomass.

⁵ Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.

⁶ Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.

⁷ Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.2 quadrillion Btu of electricity net imports not shown under “Source.”

Notes: Primary energy in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). • Sum of components may not equal total due to independent rounding.

Sources: U.S. Energy Information Administration, Monthly Energy Review (March 2015), Tables 1.3, 2.1-2.6.



Figure 22.

The US is still heavily dependent upon fossil fuels, as some 80 per cent comes there from, facing a challenger of reaching GOAL II. What is changing is the shale rock innovation, as more and more of energy is produced within the US, allowing even for considerable export of petroleum. The *shake oil and gas* revolution may though not promote decarbonisation. Further reduction of CO₂s may meet with firm resistance from the Republican House of Congress, which may oppose the COP21 Agreement, like presidential candidate D. Trump. However, solar power should be attractive in many US states, both in micro use in households and large plant use.

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

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

Figure 22 shows how important energy is to the entire US society, including for its superpower position. When further reductions in CO₂s threaten vital national interests, the US like other nations will no doubt employ fossil fuel.

Canada

Although Canada is a major emitter of GHG:s as well as one of the world's largest fossil fuel producer – oil sands, it has managed to stem the increase in emissions for the most recent years, i.e. halting the augmentation, at least for a time (Figure 21). Figure 23 may be invoked to explain this, showing a very mixed energy consumption pattern with lots of different energy sources.

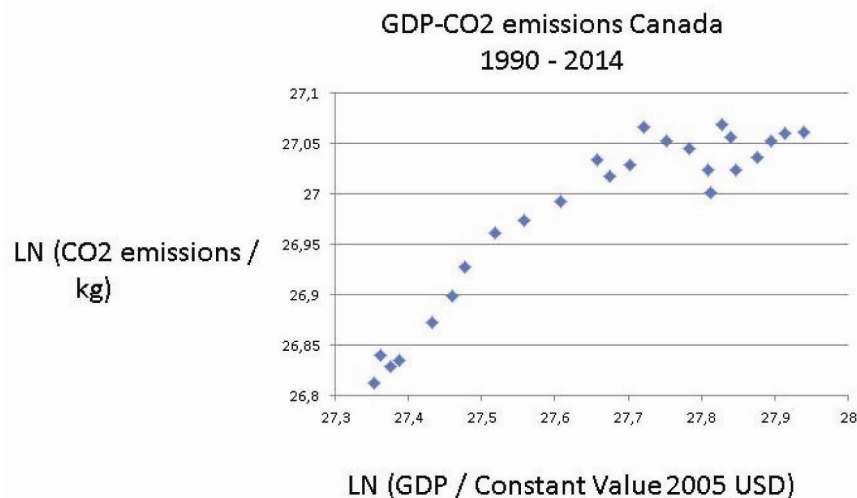


Figure 23. CANADA: LN (CO₂ / Kg and LN (GDP / Constant Value 2005 USD) ($y = 0,41x + 15,7$; $R^2 = 0,85$)

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. But its emissions still go up with GDP. How to break this dire link – that is the crux of the matter?!

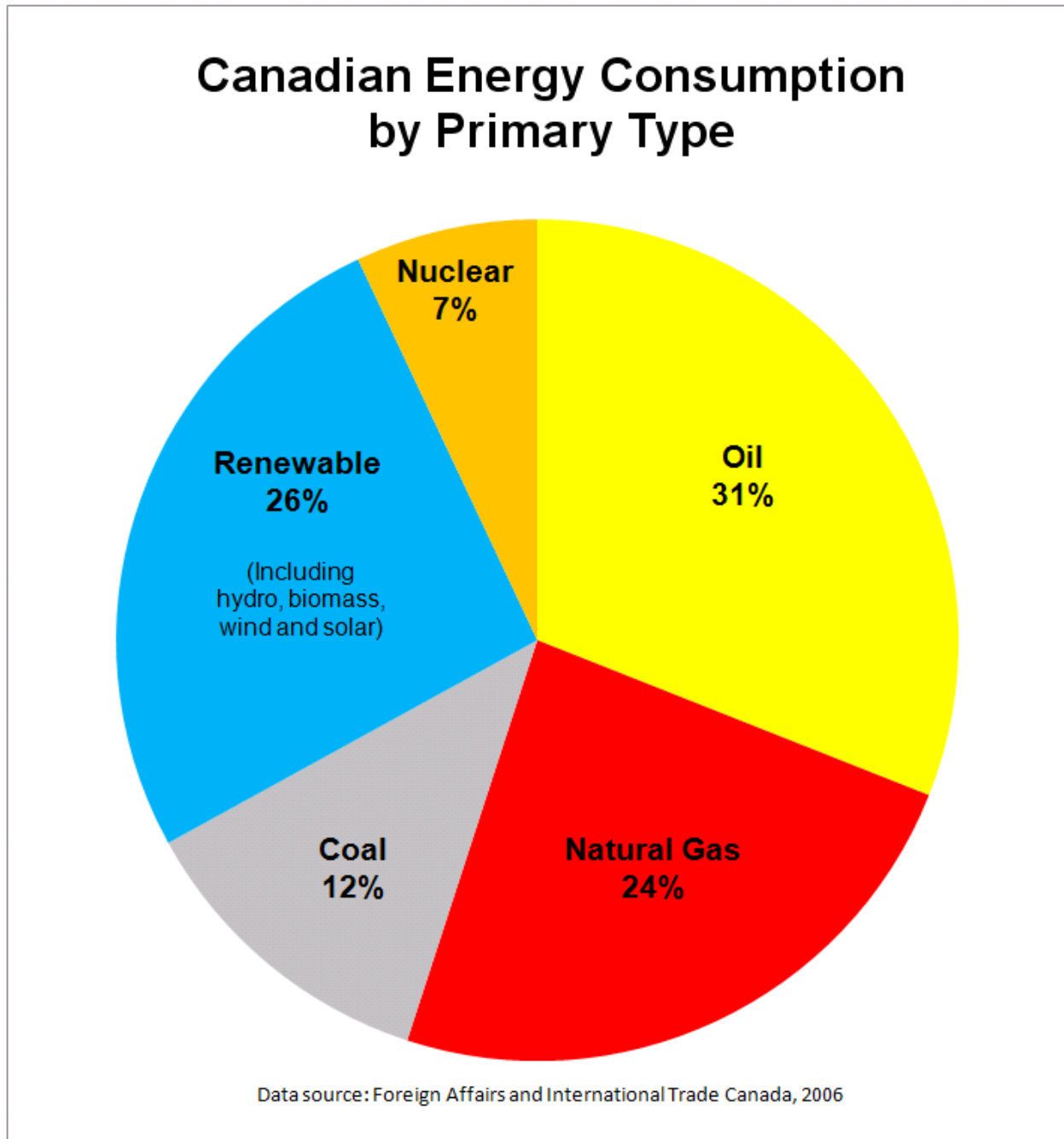


Figure 24.

Canada has not yet like the US managed to clearly and definitely turn the links – GDP-energy, GDP emissions - downwards. The collapse of the oil price should make Canada invest more in water and modern renewables or atomic power.

5.4 Environmentalists' Costly Cases

Most countries in the world would fail on GOAL I, if nothing is done up to 2020, as they have rising curves between GDP and CO₂s or GHG:s. And any achievement of GOAL II is completely unfeasible, unless strong action is not taken up to 2030. We are talking about mainly Third World countries that have little own resources for replacing fossil fuel dependency. Here the Super Fund enters the policy-making process of COP21,

The Super Fund

The Third World is heavily into the use of fossil fuels. They can only change that when provided financial assistance. Here is where the super fund comes, It has been mentioned the phenomenal sum of 100 billion dollars/year. But no binding decisions have been takes about its structure and operations. What it entails is that rich countries pay for the decarbonisation of the poor countries. This fund would help COP21 management, but it may also create its own difficult problematic to handle. At this point of tine, there are many unknowns in the conditions for COP21 management: the fund, the use of plan or market means, carbon trading schemes, carbon taxation schemes, oversight techniques and correction mechanisms.

Lots of questions can be raised about this Super Fund:

- funding
- project evaluation
- financial control.

But it seems certain that many countries will ask for support for their decarbonisation plans.

Brazil

Let us here look at the ethanol country *par preference*: Brazil. Figure 14 shows a considerable levelling out of total emissions, but it is followed by huge increases, mirroring the GDP development.

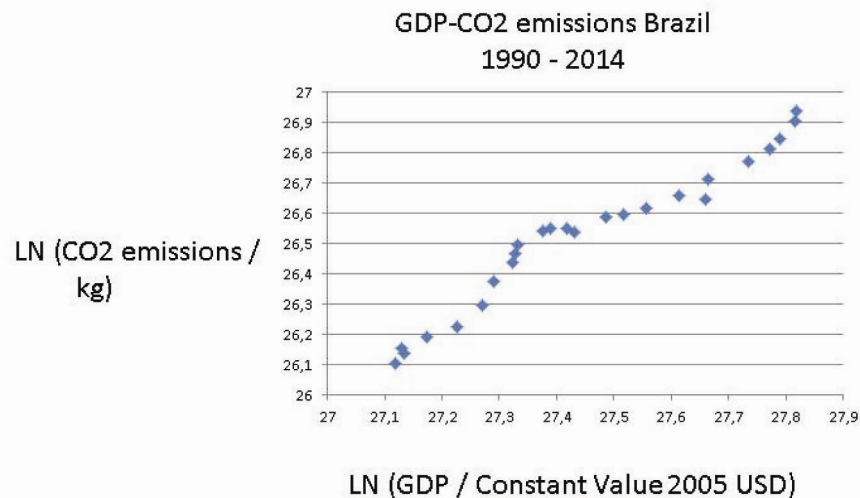


Figure 25. BRAZIL: LN (CO₂ / Kg and LN (GDP / Constant Value 2005 USD) ($y = 1,029x - 1,72$; $R^2 = 0,95$)

Brazil employs the most biomass in the world - ethanol, but the emissions stay at a very high level, which is a reminder that even modern renewables may lead to CO₂s. One advantage for Brazil is its large component of hydro power, but the overall picture for the largest Latin American country is not wholly promising, when it comes to reduction of emissions. Will it accomplish GOAL I – maybe! But hardly GOAL II. Two caveats:

- Global warming reduces the potential for hydro power – water scarcity, and Brazil has very little nuclear power (Figure 26). There are plans for mega hydro projects in the Amazon basin, but Brazil has first and foremost to come to terms with the extensive deforestation of this huge rain forest, contributing a lot to global warming. And other nations are involved here.
- Biomass and waste only contribute to decarbonisation when there is a sequence of harvesting and build-up of new carbon consuming entities. When the rain forest is cut down once and for all, or poisonous waste burnt, then there is carbonization. Ethanol fulfils decarbonisation.

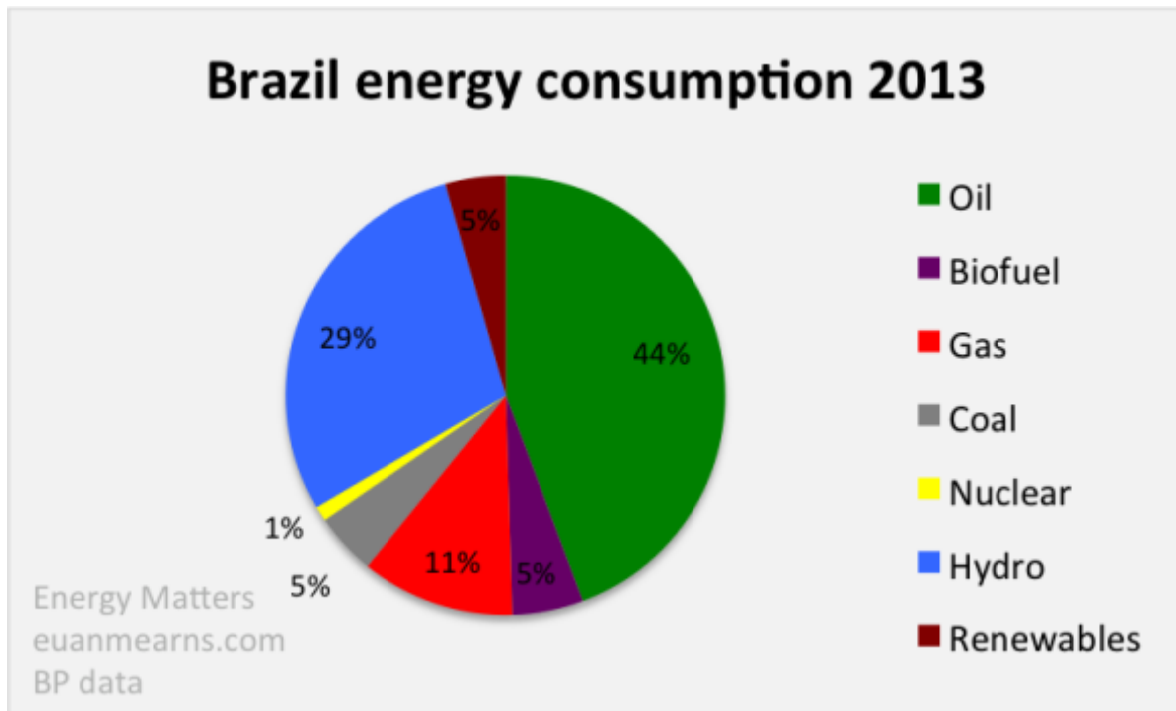


Figure 26.

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

Peru

Another medium large country that will need financial assistance from the Super Fund is Peru. Its emissions have followed its economic development. Reducing these emissions with some 40 per cent is conducive to what ?

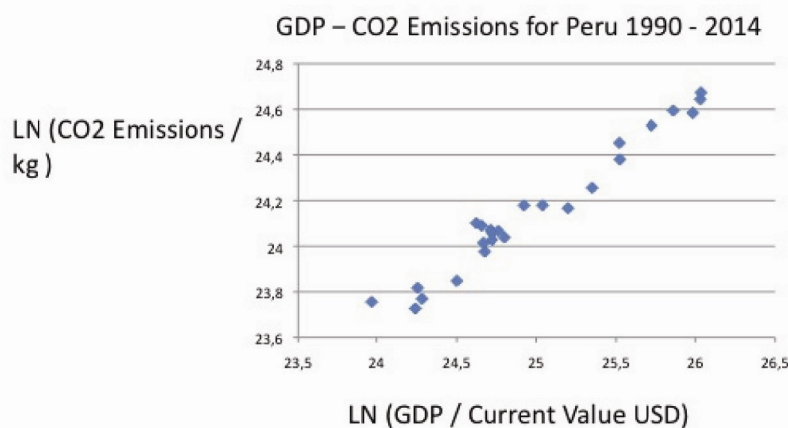
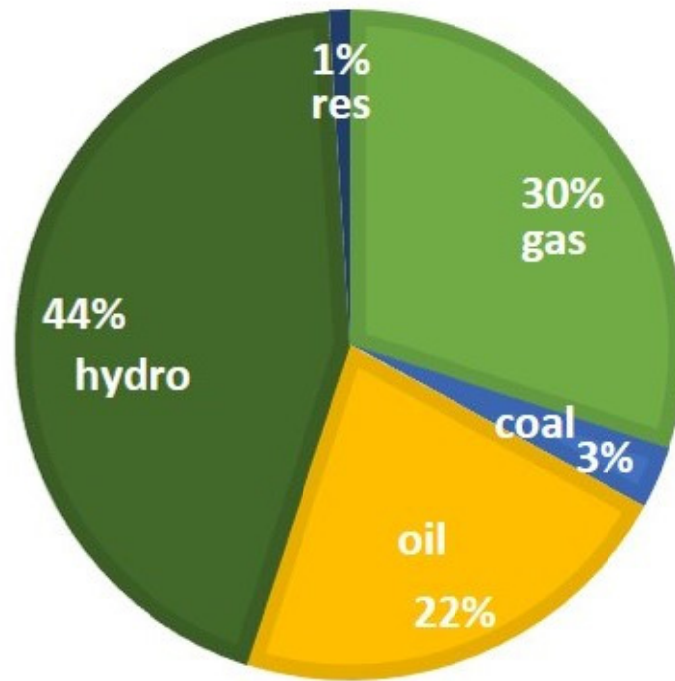


Figure 27. Peru ($y = 0,4656x$, $R^2 = 0,96456$)

Although Peru utilises water power, as expected, it still has a rising GDP-CO2 curve. Total energy in Peru is difficult to document, but the electricity sector (Figure 28) relies considerably upon fossil fuels. The transportation sector is of course based upon petrol. Peru needs help to decarbonise.

ELECTRICITY GENERATION PER SOURCE



CHILE

Generation mix per source

Figure 28. Electricity Sector In Peru

Chile

On the contrary, rich Chile has managed to halt its yearly increases of CO₂:s (Figure 29).

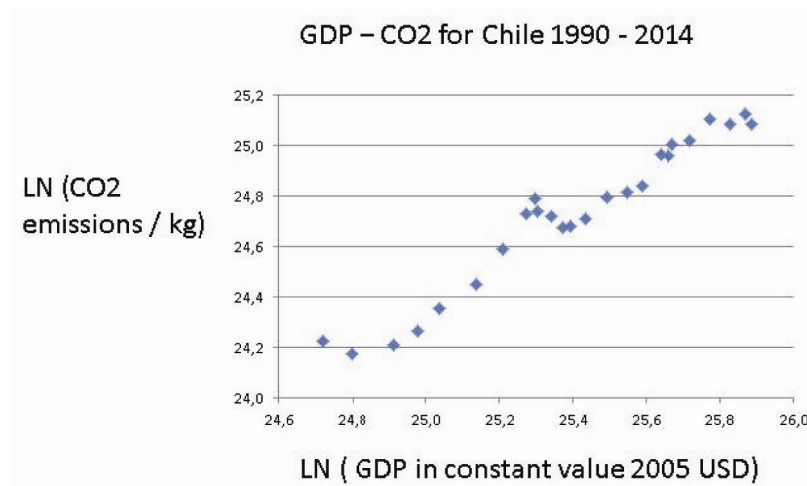


Figure 29. GDP-CO₂ in Chile: $y = 0,88x R^2 = 0,95$

One should emphasize that CO₂ emissions are big in this country with an advanced economy and lots of mining. And they have followed the rate of economic growth for a number of years, just to stall recently. One reason for the halting of these emissions is the successful turn to massive solar power in the large mining fields in the North, at high altitudes in the Andes with plenty of sun. Yet, also Chile needs fossil fuels – see Figure 10.

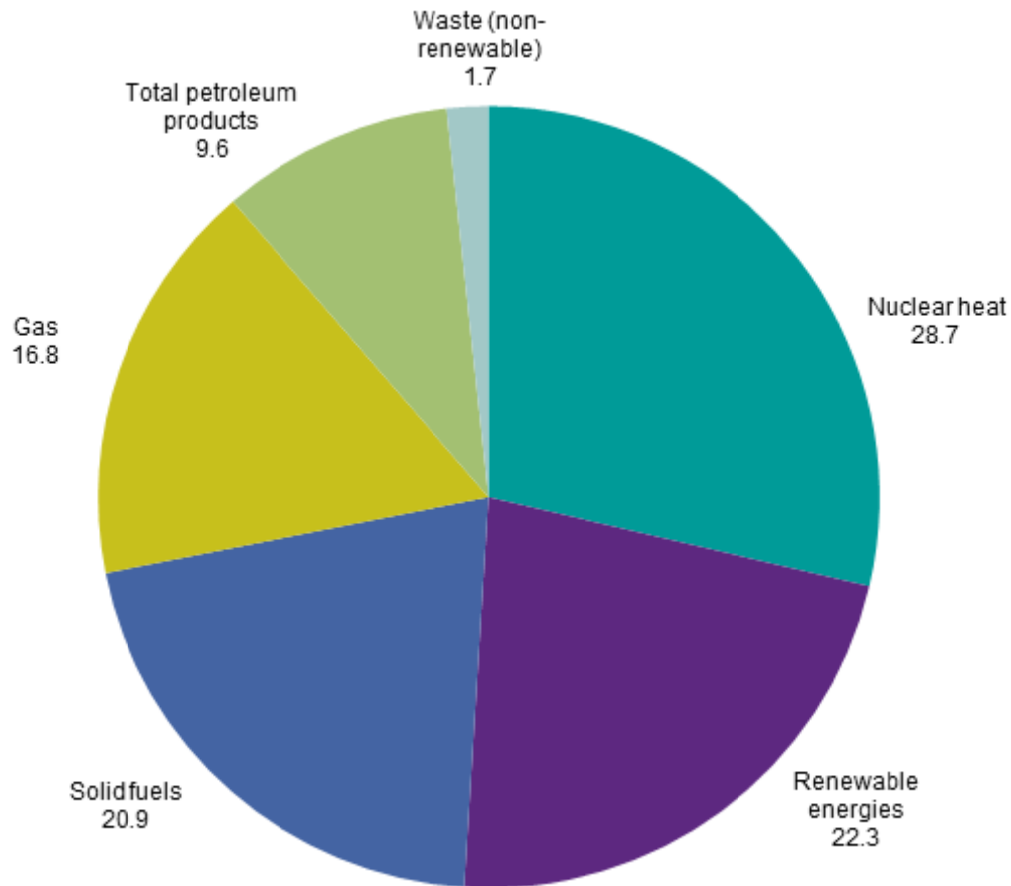


Figure 30. Energy consumption in Chile

Source:Energy statistixs, ec:Europe.

Although Chile has diversified considerably towards renewables and nuclear power, it still relies to more than 50% upon fossil fuels, coal, natural gas and petroleum. However, it possess the technology for augmenting the share of renewables and atomic power. And hydro power is essential for Chile, which is also true of Colombia, Equador and Honduras.

Egypt

Egypt has a huge population with high unemployment and mass poverty besides a certain level of political instability, resulting from religious conflicts. But surely it has electricity from inta giant Assuam dam and the Nile? No, it does not coult for much where most people live in the Nile delta (Figure 31).

The share of hydro power is stunning low for a country with one of largets rivers in the world. Actuallu, the water of the Nile is the source of interstate confrontation between Egypt, Sudan and Ethiopia.

As Egypt relies upon fossil fuels, it has massive CO2 emissions, the trend of which follows its GDP (Figure 20).

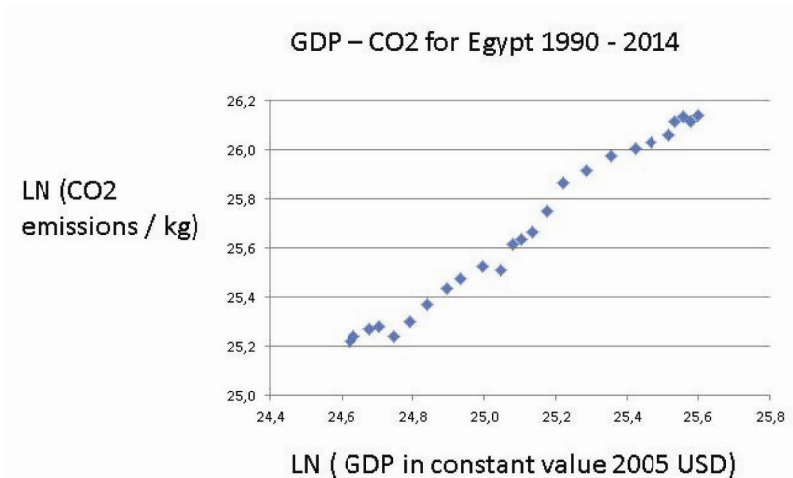


Figure 31. GDP-CO2 for Egypt: $y = 1,02x$; $R^2 = 0,99$

It will be very difficult for Egypt to make the COP21 transformation, at least without massive external support. But where to build huge solar power plants in a country with terrorism, threat or actual?

Primary energy consumption in Egypt, by fuel, 2013

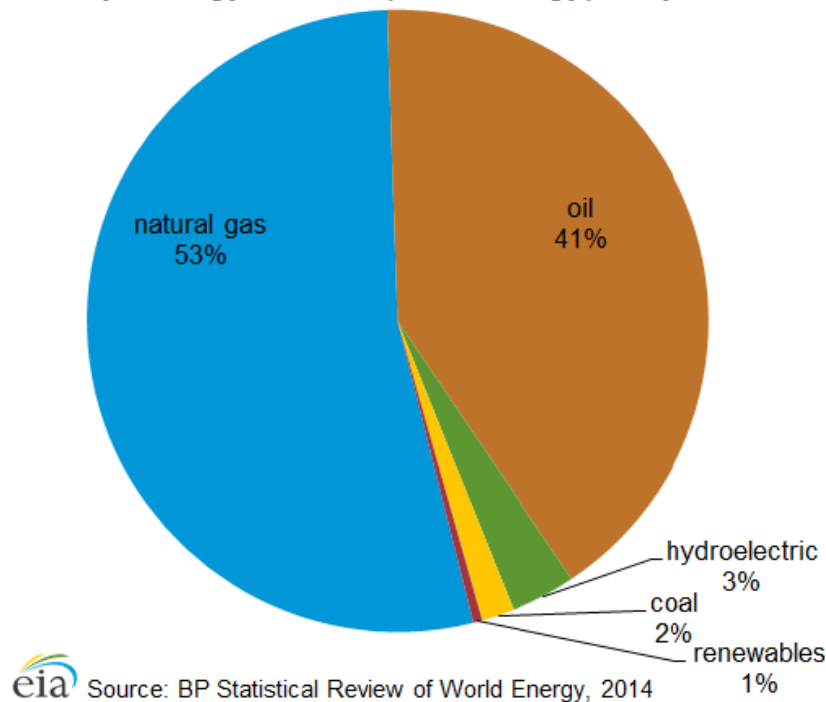


Figure 32.

RSA

The COP21 framework outlines the three main goals for the 21st century in order to keep Planet Earth habitable. Thus, these 3 objectives are now accepted as desirable, but scholars now question whether they are feasible, at least without massive costs or economic decline and global depression (Sachs, 2015). A few countries are almost completely dependent upon coal. How will they implement the COP21 goals? Look at South Africa. Emissions are high, because South Africa uses a lot of coal to generate electricity. Decarbonisation will be difficult and costly. The reliance upon coal in this largest economy in Africa is stunning.

The RSA has a modern economy running on mainly coal (Figure 33). In transportation, it uses petroleum. This makes the RSA a major polluting nation. It wants to spread electricity to all shanti-towns, but with what energy source?

Total Primary Energy Supply in South Africa 2012 [% TPES]

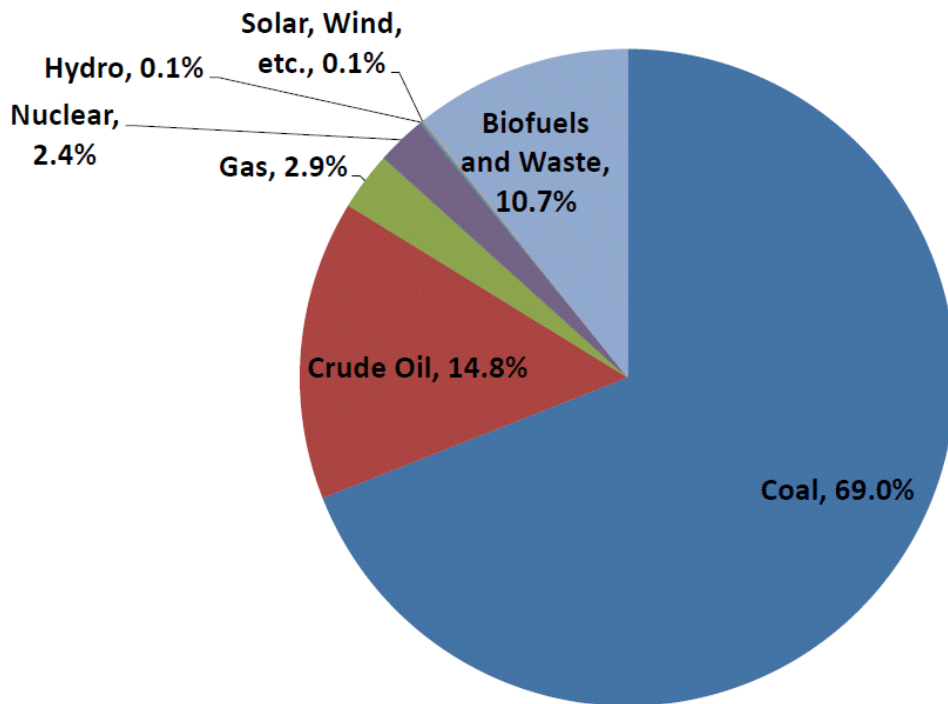


Figure 33. Energy consumption in RSA

Does the RSA have the resources and motivation to cut the coal consumption radically and move to solar energy for instance? Or could the RSA renege – the always available option in collective action endeavours.

It would be understandable or rational if the Super Fund gives money support to Latin American or African countries in general, but what about the oil producing countries. Surely, the Gulf States are rich enough to handle decarbonisation, but not all oil countries are rich.

5.5 Environmentalists' Hard Cases The Oil Producers

One would expect to find huge CO₂ emissions in this large emerging economy with lots of oil production. Countries like the Gulf States have massive CO₂:s because they drill and refine oil and natural gas. For Mexico holds the following situation (Figure 34).

Mexico

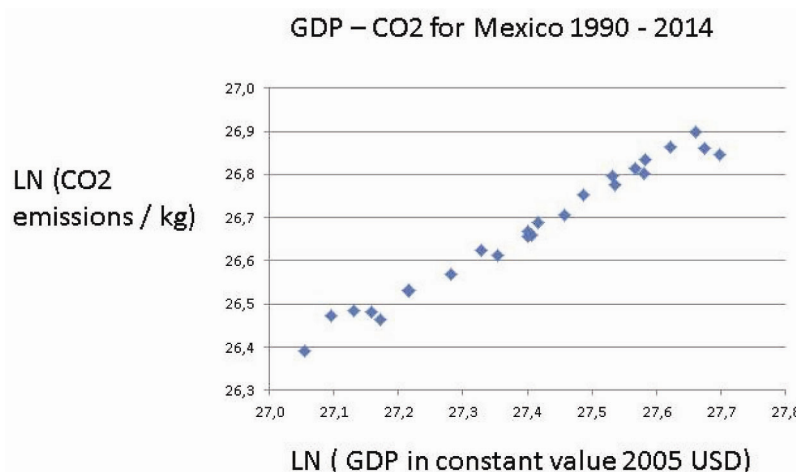


Figure 34. GDP-CO₂ in Mexico: $y = 0,77x$; $R^2 = 0,98$

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 CO₂s 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

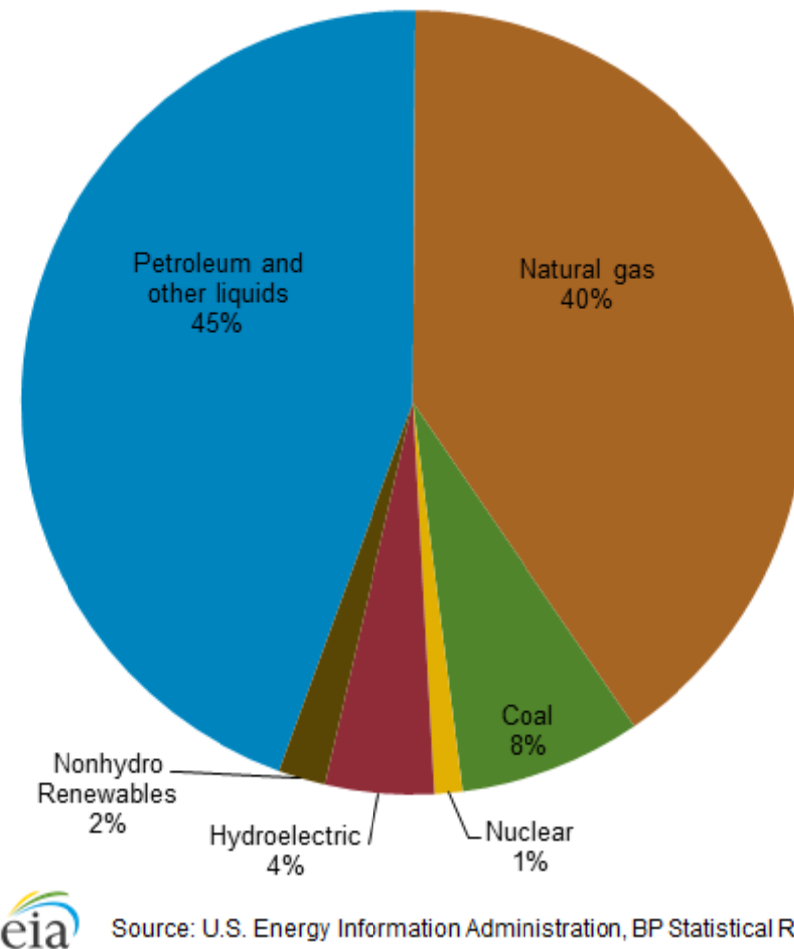


Figure 35. Energy mix for Mexico

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

Venezuela

Energy is an interesting aspect of this nation, which is now in turmois because of the lack of it, despite the immense oil and gas resources of this country. Just as with otheroil producing countries, one expects the CO₂s to be quite substantial. Figure 36 confirms thiss expectation, but one may note many yearly ups and downs in reWhy this link is not a smooth one may be explained both by the energy mix and the volatile politics of Venezuela.

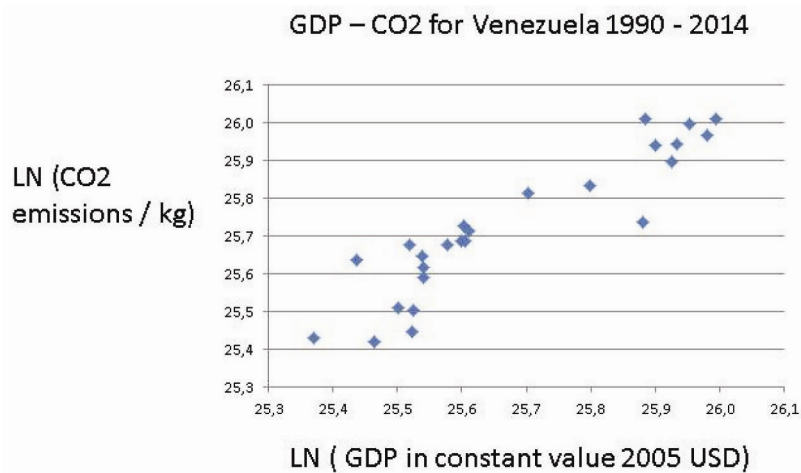
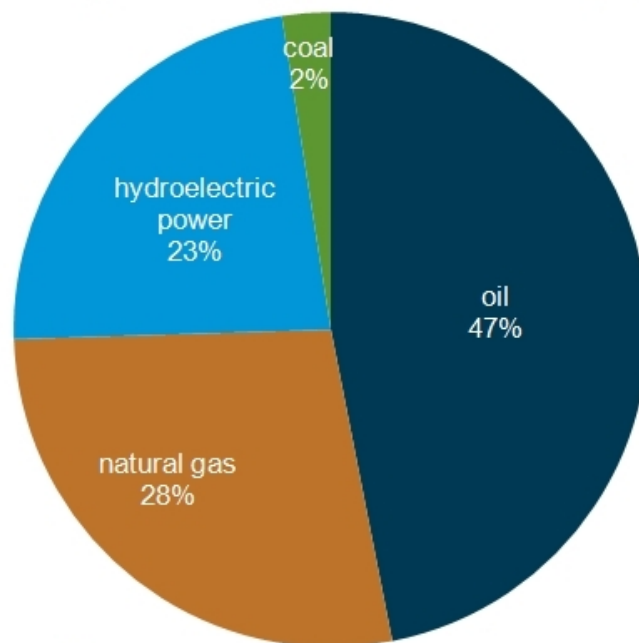


Figure 36. GDP-CO2: $y = 0,87x$; $R^2 = 0,85$

The dependency upon fossil fuels is high in Venezuela, but the country differs from Mexico in that it disposes of considerable hydro power.

Total energy consumption Venezuela, by type (2010)



Source: U.S. Energy Information Administration

Figure 37. Venezuela

Typical of Latin America is that several countries make use of hydro power to mitigate their dependency upon fossil fuels, mainly oil and natural gas. In the case of Venezuela, it is the water resources that have failed, causing such electricity chaos, resulting in loss of output and work. Strangely, the Venezuelan government has not taken any steps towards precaution, building back up generators based upon its massive oil and gas reserves. Perhaps the hope of a totally carbon free society is an illusion: What happens when water dries up for instance?

Iran

Countries may rely upon petroleum and gas mainly – see Iran (Figures 38 and 39). CO2 emissions have generally followed economic development in this giant country, although there seems to be a planning out phase recently, perhaps due to the international sanctions against its economy.

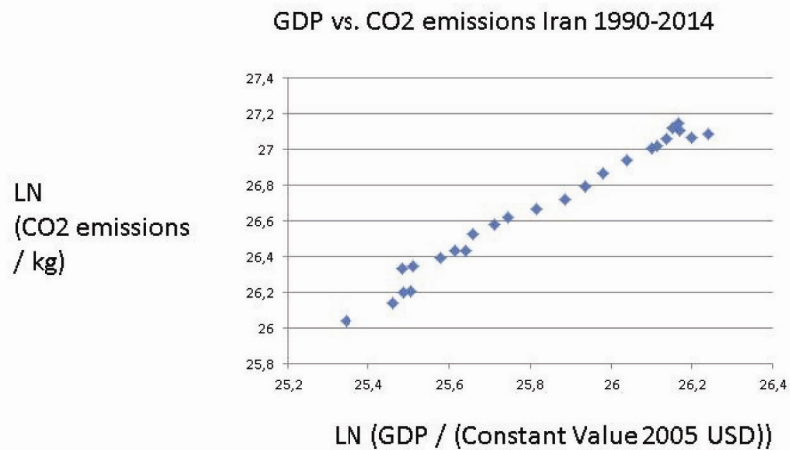


Figure 38. Iran ($y = 1,2229x - 4,91$; $R^2 = 0,98$)

Iran is together with Russia and Qatar the largest owner of natural gas deposits in the world. 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.

Methane is better than oil, which is better than coal, from the point of view of decarbonisation. But when a nation burns a lot of it, like Qatar, then CO2 emissions skyrocket just the same.

When countries are exclusively dependent upon either natural gas or petroleum, they are not likely to accomplish GOAL I or GOAL II. Iran could try other energy sources (Figure 39) – solar, atomic – but the first resource is costly and the second resource has proved very controversial from the point of view of international relations

Iran's total primary energy consumption, share by fuel 2013

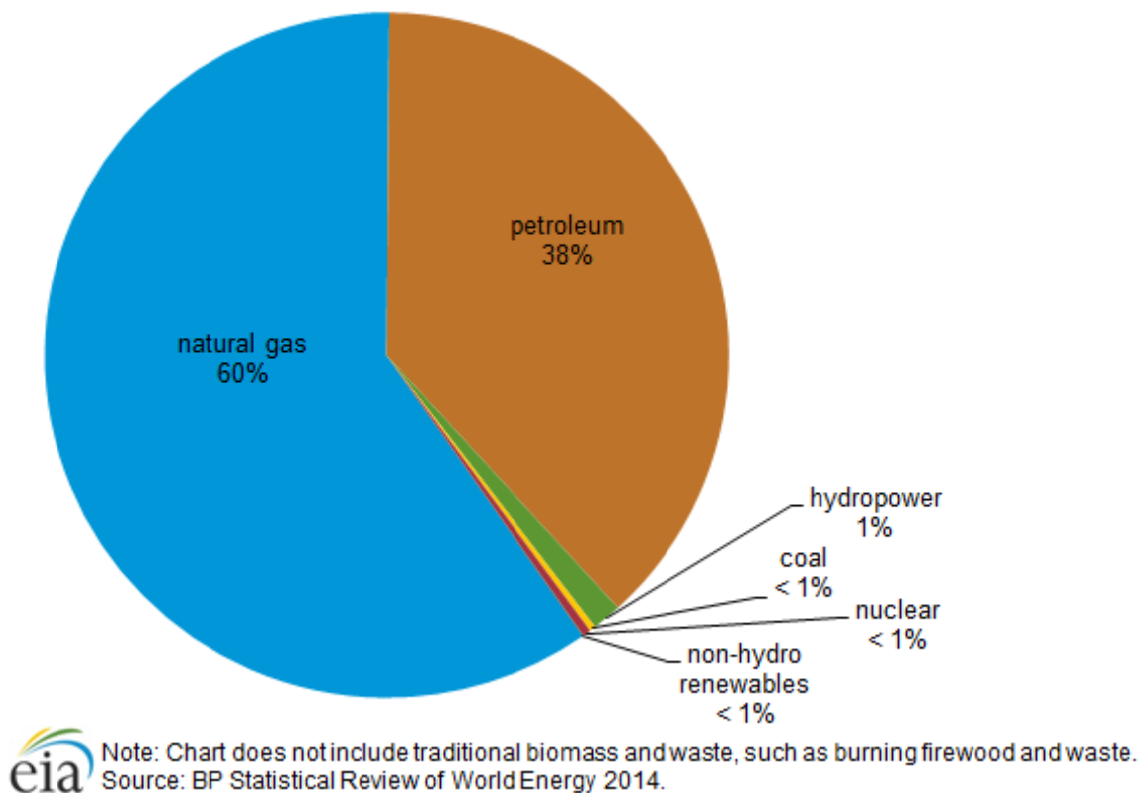


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Algeria

Algeria ia a major exporter of natural gas and oil, Thus, we expect that it relies mainly on fossil fuels, like Mexico and the Gulf States. Figure 21 verifies this expectation.

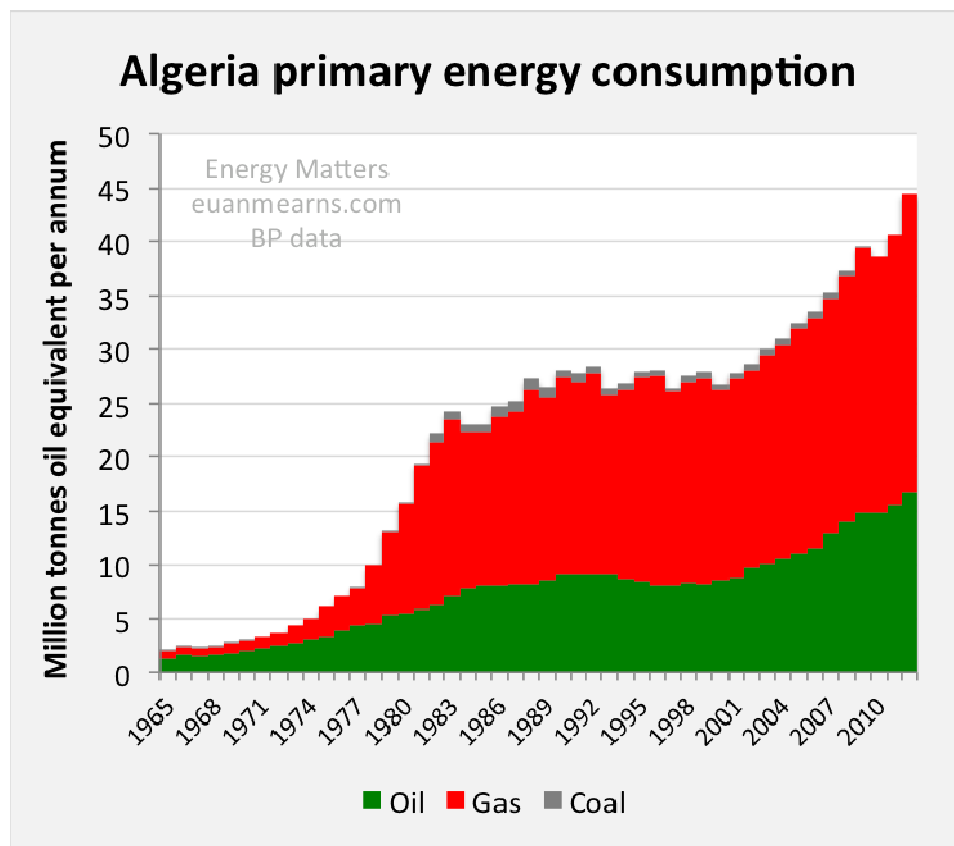


Figure 40.

Source: <http://euanmearns.com/post-peak-algeria/>

Although Algeria may trust in the availability of future fossil fuels resources, it still faces the demand for a 40% reduction of its CO₂ emissions. They have thus far followed the economic progress.

One would naturally suggest solar energy as a viable alternative to the heavy dependence upon fossil fuels in Algeria, given its immense Saharan territory. Yet, also Algeria has been plagued by the attacks of terrorists or looters.

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 41 describes the energy mix for Angola.

Angola and Nigeria

Figure 1. Angola's primary energy consumption, 2012

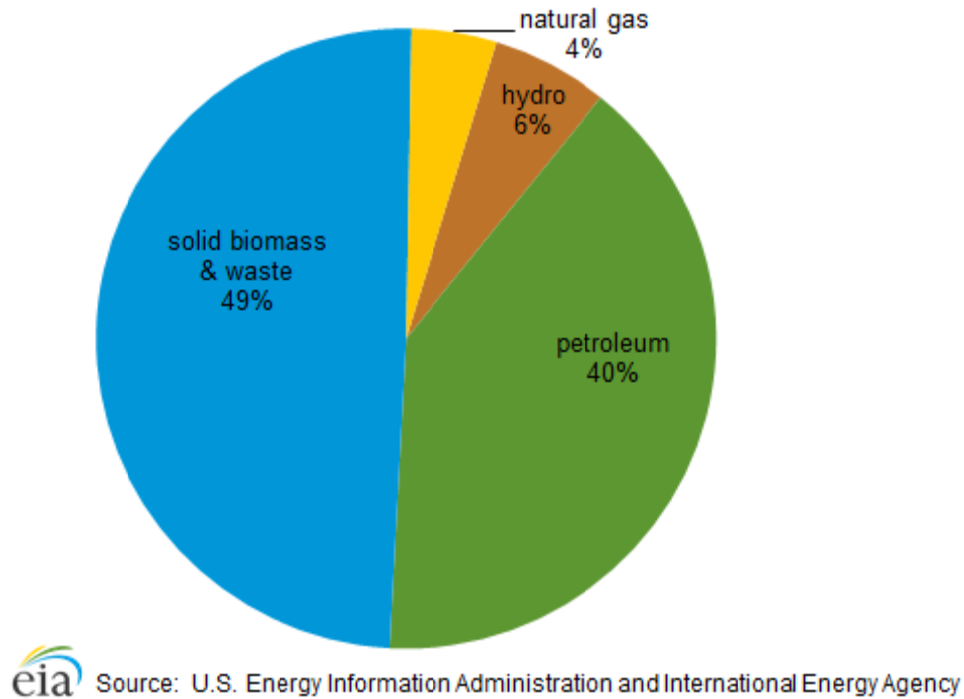


Figure 41.

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 42.

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

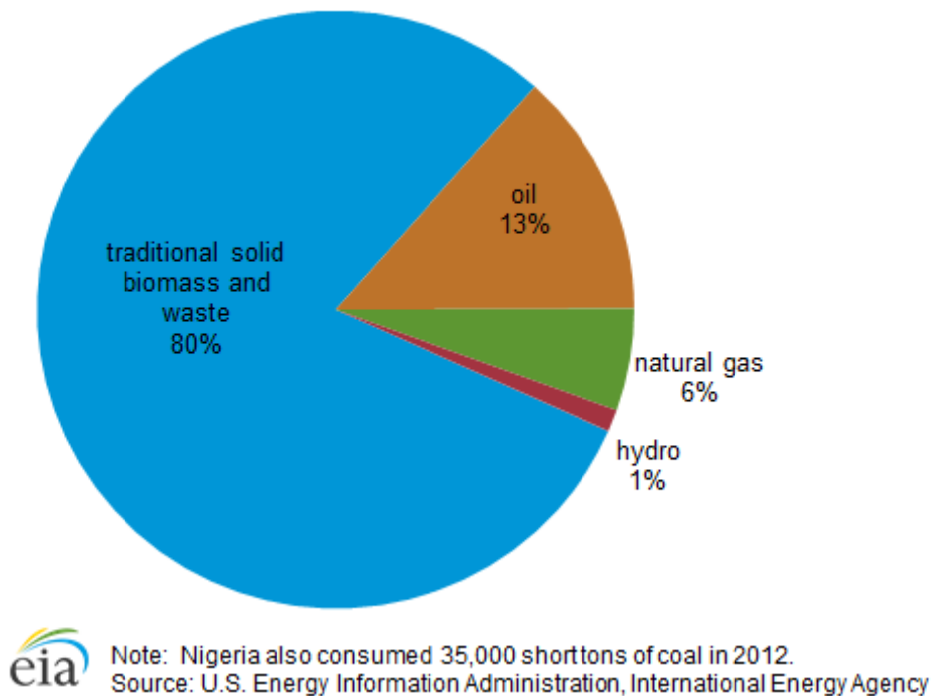


Figure 42.

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.

Kazakstan

CO2 emissions may go down just to up again. Consider an oil and gas giant in the former Soviet Union.

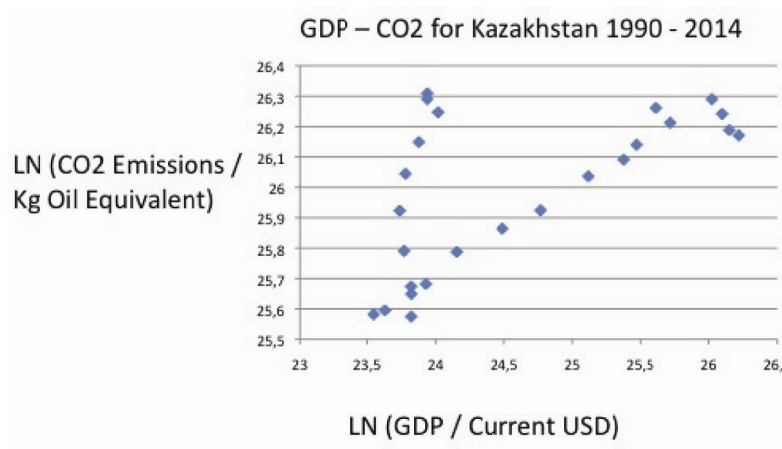


Figure 43.

The fall of the planned economy resulted in the closure of many dirty factories, but now this country is a major polluter again.

5.6 Environmentalists' Poor Cases

Cop21 management will of course also include the poorest countries in the world. They are not major polluters, but they still have to face the CO2 problematic, either using traditional renewables or burning fossil fuels.

Ethiopia

Surely, both Ethiopia and Sudan would want to utilise the great Nile river for their electricity consumption. However, Egypt wants to have a SAY over the energy planning of these two countries up the river. Thus, far many rounds of negotiations have resulted in the construction of only a few power plants, a few in Sudan (Merowe Dam, etc) and one another huge in Ethiopia – Grand Ethiopian Renaissance Dam. The problem is the common pool of the Nile, where one country, Egypt, may find that the water level has shrunk too much for its own needs, electricity or irrigation. Actually, the risk of draughts is a real one for all countries trying to exploit the Nile. Sudan is dismally poor with deep-seated internal conflicts ethnically. How to move to large solar panel plats in a country with so much political instability resulting huge numbers of death from domestic violence? The reliance upon traditional renewables is so high in neighbouring Ethiopia that electrification must be very difficult to accomplish over the large land area. Figure 26 displays a unique predicament.

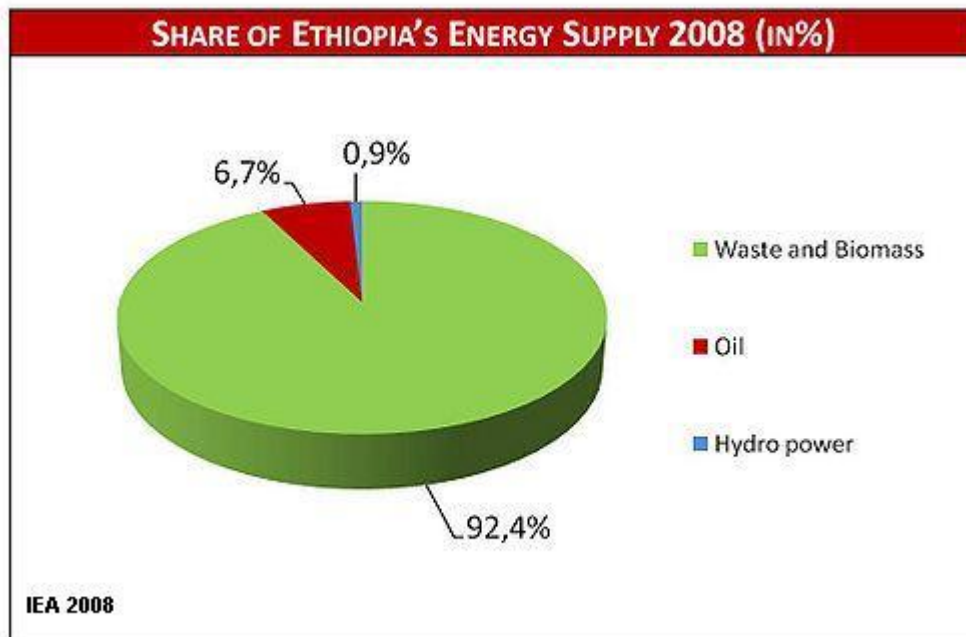


Figure 44. ETHIOPIA: Energy mix

Is there any advantages with such a skewed energy mix? No, because even mainly rural Ethiopia works with lots of CO₂: - see Figure 45.

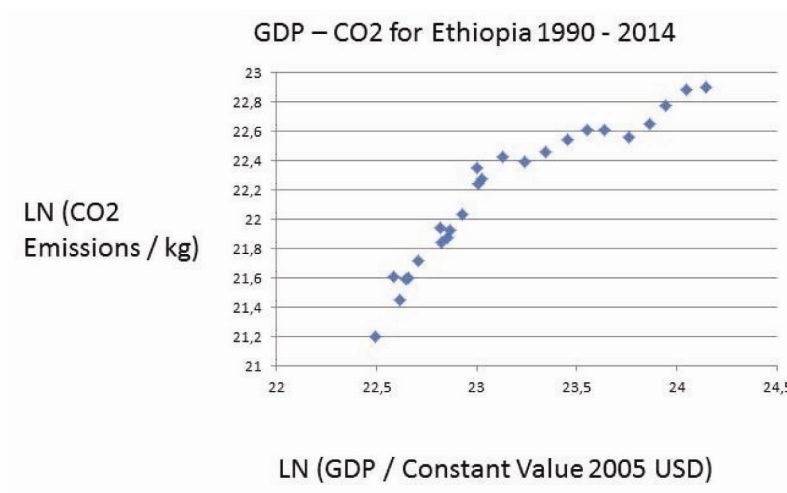
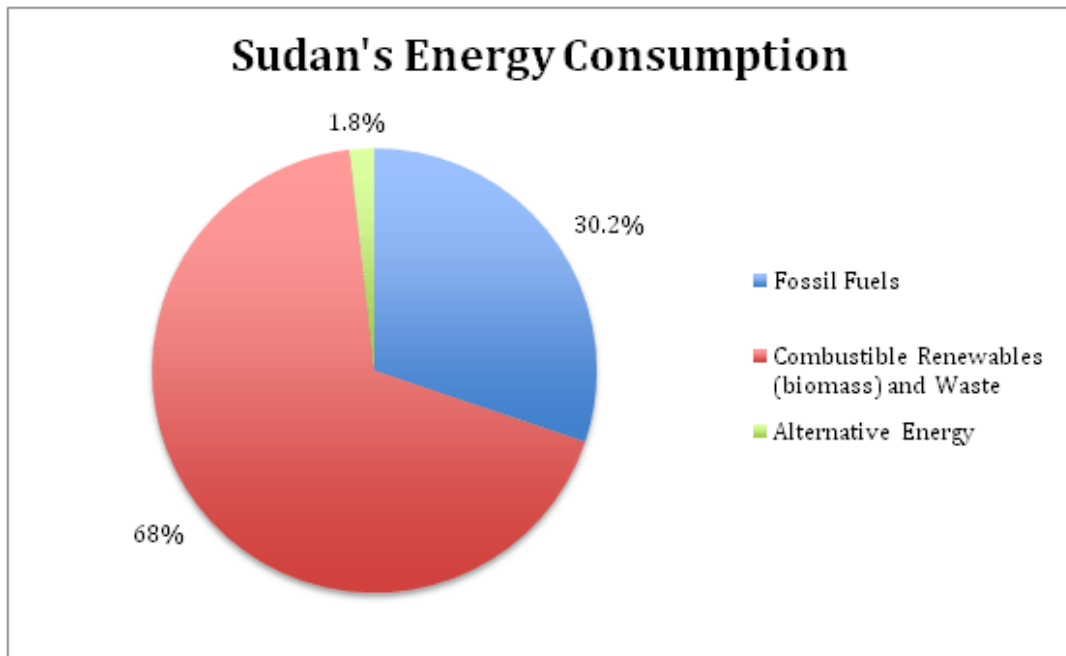


Figure 45. Ethiopia: GDP and CO₂: $y = 0,90x$, $R^2 = 0,88$

The zest with which Ethiopia is pursuing its control over water resources becomes fully understandable, when Figure 45 is consulted. What we see is the same smooth linear function plotting CO₂s upon GDP, as is obvious in countries based upon fossil fuels – see below. For Ethiopia, to complete with COP21 goals is going to pose major challenges, especially if economic development is not going to be reduced. The country needs massive help, both financially and technologically.

Sudan

Sudan is dismally poor with deep-seated internal conflicts ethnically. How to move to large solar panel plants in a country with so much political instability resulting in huge numbers of deaths from domestic violence?



<http://500wordsmag.com/science-and-technology/the-case-of-photovoltaics-in-sudan/>

Figure 46.

Pakistan

The energy mix of another poor giant, Pakistan, is rendered in Figure below. It actually has a rather mixed energy bag, but it needs massive support to decarbonise.

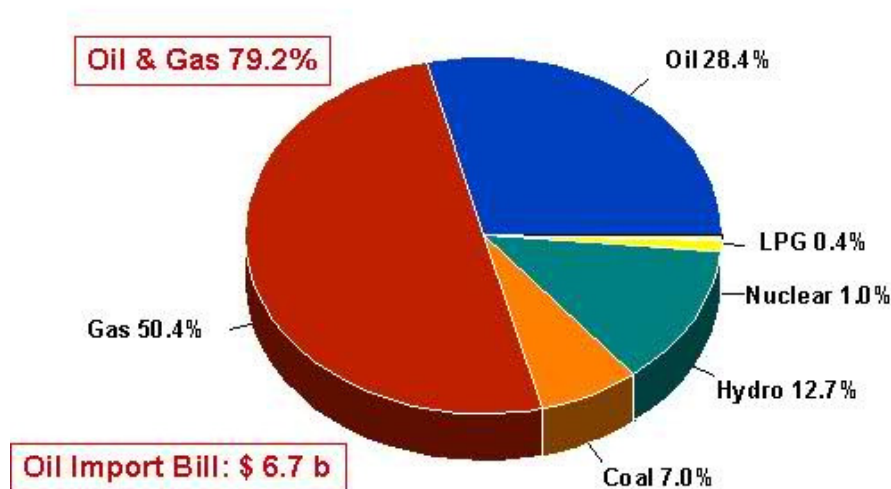


Figure 47. Pakistan

Moving on to another giant nation in South Asia, Bangladesh, we find an entirely different set of conditions for implementing COP21. Figure 48 shows that the major GHG of CO₂s follows economic development closely.

Bangladesh

This country is already hard hit by global warming, losing land to the sea. This means more of poverty.

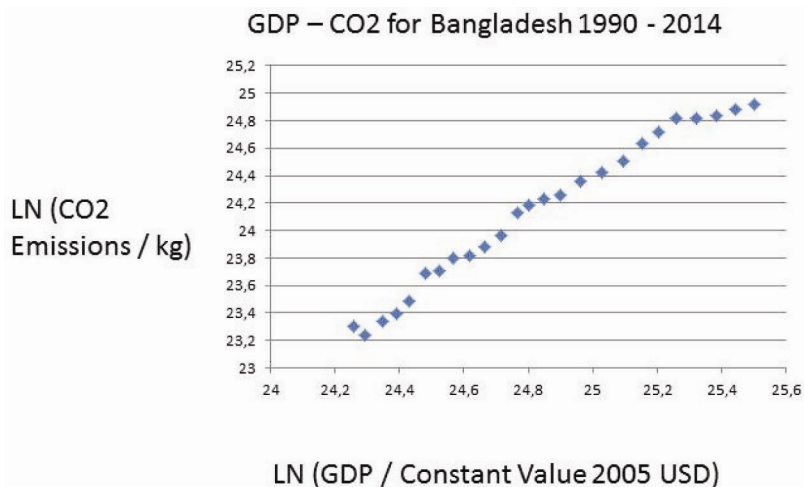
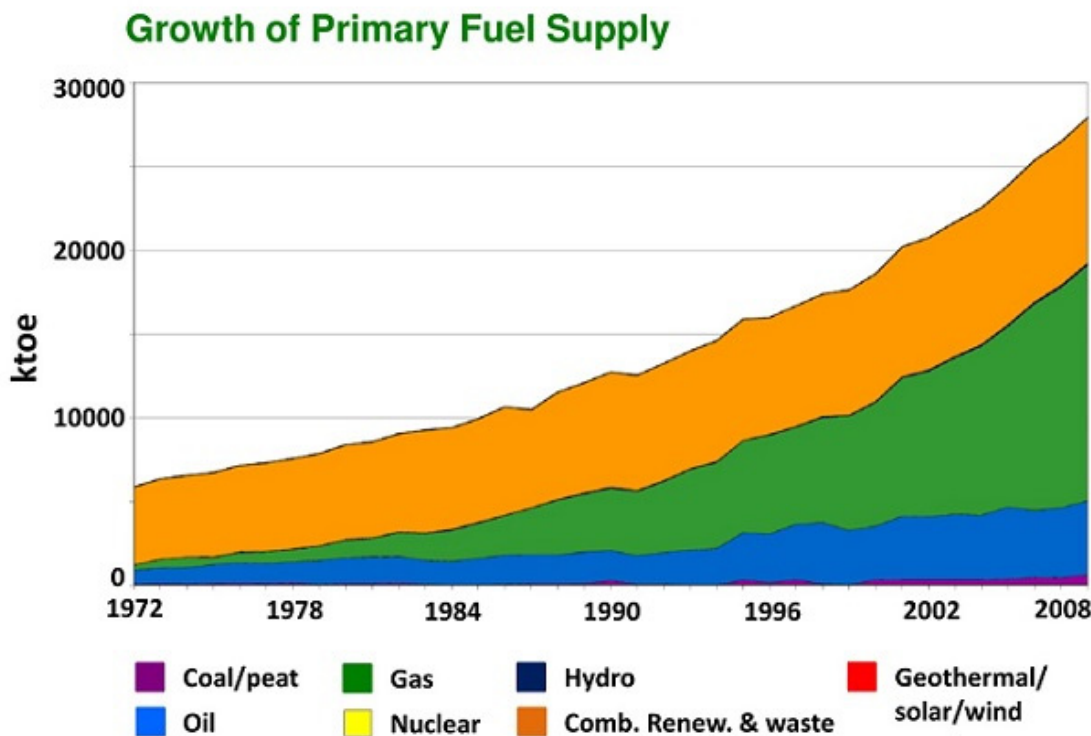


Figure 48. Bangladesh

Yet energy consumption is based on a different energy mix, compared with India. Figure 8 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 49.

6. Conclusion

The preconditions for the largest management task in history – the decarbonisation of the world economy and all countries that signed the COP21 Agreement are hardly promising. Only a small set of countries have started to have a declining GDP-CO₂ curve, and they need to do much more to arrive at the 40% goal. Most countries are still producing enormous amounts of GHG:s, especially the major Asian economies and the large Third World countries as well as the oilproducing ones. Can the Super Fund make the difference?

How all this money promised for this Super Fund is to be raised is all but clear, but even if it could be done somehow, the choices it would face would be extremely difficult. We have distinguished five sets of countries here:

- 1) those with declining GHG:s
- 2) the industrialising giants
- 3) the developed Third World countries with lots of CO₂s
- 4) the oil producing countries with lots of CO₂s
- 5) the poor Third World countries with traditional renewables.

Where and how to manage the decarbonisation of these five sets?

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