G.J.I.S.S.,Vol.5(4):29-40 (July-August,2016) ISSN: 2319-8834

GLOBAL JOURNAL OF INTERDISCIPLINARY SOCIAL SCIENCES
(Published By: Global Institute for Research & Education)

www.gifre.org

Can Africa Decarbonise their Economies According to COP21?

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Abstract

The consequences of signing the COP21 Agreement must now be spelt out not only for the rapidly developing economies in Asia, producing lots of greenhouse gases, but also for the poor nations in Africa, having much less CO2 emissions. Yet, the African governments have bound themselves to respect a 40% reduction by 2030 in CO2:s. Is this major objective in the effort to halt climate change implementable? Anthropogenic greenhouse gases are generated mainly by the consumption of energy, and this is vital to economic progress in Africa. Perhaps African countries could move to renewables in the short period of 10-14 years, but this would require an enormous amount of funds from advanced nations, if at all feasible. The conflict between economic growth and environmental protection will become ever stronger, as Africa struggles with underdevelopment and draughts and deforestation as well as desertification. Each country has its special situation, depending on the link between GDP-CO2 on the one hand and the actual energy mix in place today.

Key words: African continent, energy mixes, greenhouse gases, decarbonisation, logic of implementation, traditional renewables, modern renewables, fossil fuels, hydropower dams, state fragility.

Introduction

It is true that African countries are not among the big emitters of greenhouse gases like the CO2:s, but they still must abide by the COP21 framework in global governance against climate change. African governments must start conducting energy policies that take the COP21 objectives into account, while still achieving economic progress and protecting fragile environments – see Ecological Footprint Reports. Thus, they have to start implementing the key objectives of COP21:

- Halting the increase in CO2:s by 2020
- Decreasing the CO2:s by 40% by 2030
- Moving towards a carbon free economy in the second half of the century.

One may talk about objectives in two different ways:

- *Desirability*: *Ex ante*, goals are imagined states of affairs that constitute the motivation or drive behind behavior for an individual or a group. Ends may have a special attraction, calling for adherence by many people, like climate sustainability or environmental soundness. Thus, governments and organization speak much about them, making reference to them in order to legitimate action. Whether the goals in question are realistic or not is an entirely different matter. Objective like intentions are real although they may never be accomplished.
- *Feasibility*: *Ex post*, objectives become outcomes in social systems, i.e. the occurrence of real events. It is an open question entirely whether the goals *ex ante* correspond to the outcomes or goals *ex post*, leading to the crucial questions in the social sciences about goal accomplishment:
  i) Were the stated goals achieved?
  ii) How were the goals implemented?
  iii) Was there implementation success or failure?
  iv) Were there outcomes were unintended and dys-functional for the objectives?
- Effectiveness: Examining the means employed for the accomplishment of these goals, policy analysts examine whether the means were efficient or whether other means should have been employed.

When African governments, business communities and civil societies now start approaching the implementation of the COP21 Agreement, they have to deliberate upon the above entities: desirability, feasibility and effectiveness. The crux of the matter is the second – feasibility – and the third – effectiveness, where there is lots of uncertainty. When enquiring into feasibility and effectiveness of climate change policies, one needs to have a framework of analysis, consisting of two legs: the GDP-CO2 link in each country and its special energy mix.

The Framework of Analysis

The COP21 process will prove very demanding for African governments and societies, both in the short-run and in the long-term perspective. As a matter of fact, the African continent today is experiencing fast population growth and rising demands for higher quality of life and public services. Of particular importance to ordinary

people is the access to electricity, which is nowhere entirely safe and predictable or universal. But electricity is often produced by burning the fossil fuels, resulting in CO2 emission. Now, the greenhouse gases must be reduced considerably on the African continent, despite rising demands. How?
To understand the logic climate change policy-making in a country, one needs to know two essential things:
<GDP-COP (GHG) link, Energy mix>

Where the first tells you how dependent the country economy is right now of emissions, and the second element informs you about the energy alternatives that are feasible for this country.
Generally speaking, one may wish to argue that:

- The closer the link between GDP and CO2 is positively, the more costly it will be to halt and reduce the rise in emissions;
- If this link is linear, then reductions in CO2:s may come at the cost of recession or economic decline;
- The fewer the alternative energy sources are, the most costly will be the implementation of an energy policy resting upon renewables;
- Countries that are poor tend to rely heavily upon some of the fossil fuels and will require massive help from the Super Fund in the COP21;
- There is a blatant risk of reneging on the part of African countries, meaning the occurrence of implementation failure.

The concept of implementation failure was introduced into policy analysis and public administration by the late Aaron Wildavsky, underlining the profound distinction between policy and outcome, programs and results, as well as promises and reality (Pressman and Wildavsky, 1973, 1984). Implementation being the process of carrying a policy into effect may fail, as the objectives stated do not surface in social life. Instead, polices may lead to irrelevant or even opposite outcome, when judges by the goals.
Successful implementation can only when a government has:

- Clear objectives
- Knowledge of the means
- Support from bureaucracy and society – "advocacy coalitions" with Paul Sabatier (1988, 1989).

I would like to state that decarbonisation policy-making does not fulfill these three essential and necessary requirements.

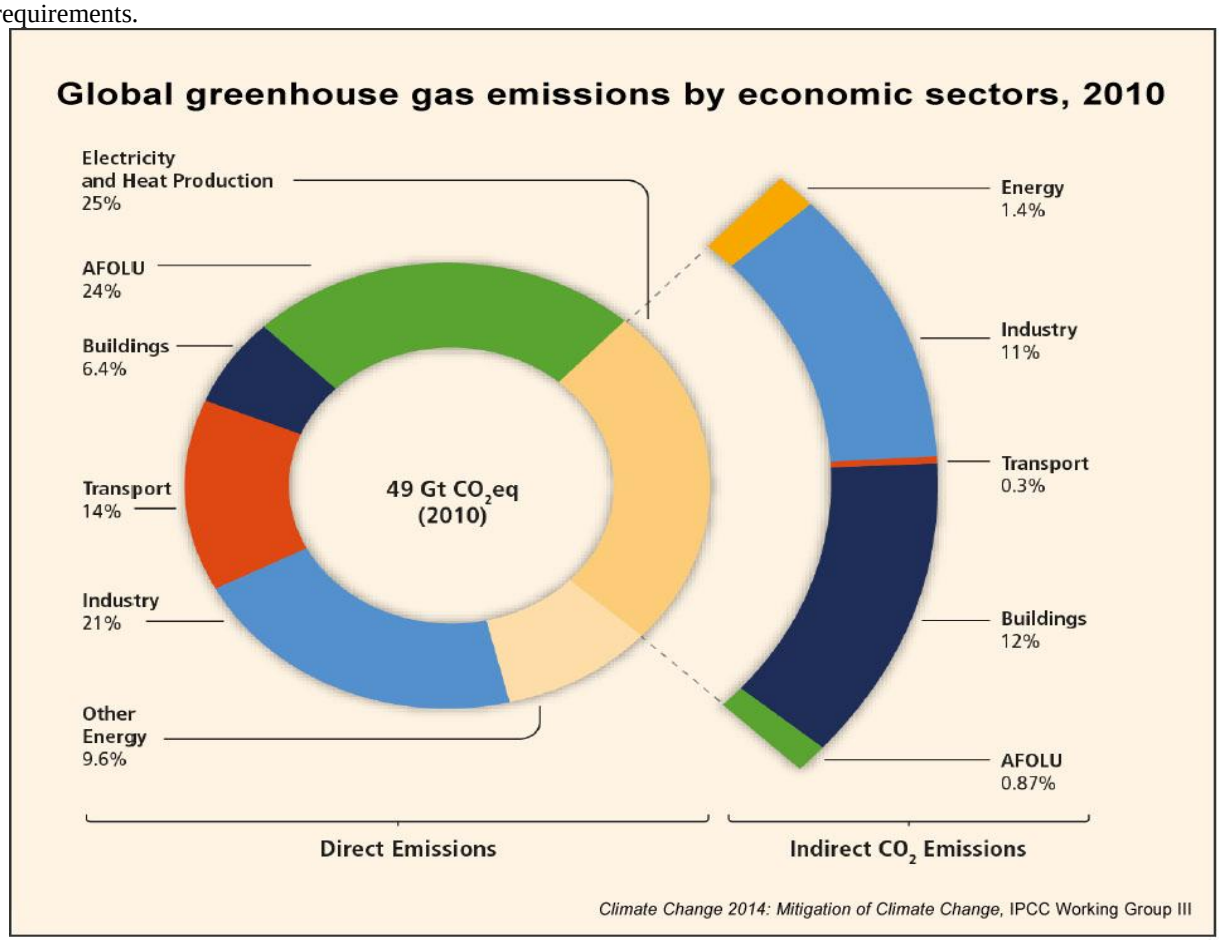


Figure 1 indicates the unavoidability of greenhouse gases in the economies today.

On the African continent, we find traditional and modern economies, sometimes in one and the same country. Where does energy come from and how about greenhouse gases?

Findings

The African Continent: Some major countries

The purpose with this inquiry is only to map energy related emissions for a few countries in order to get a glimpse at what African governments and societies face when starting to implement the COP21 Agreement.

a) ***Hydro power***

One of the promising nations in Africa is Ghana, housing both democracy and positive economic development. Figure 2 shows its GDP-CO2 picture for the last two decades, when things have gone well and peacefully.

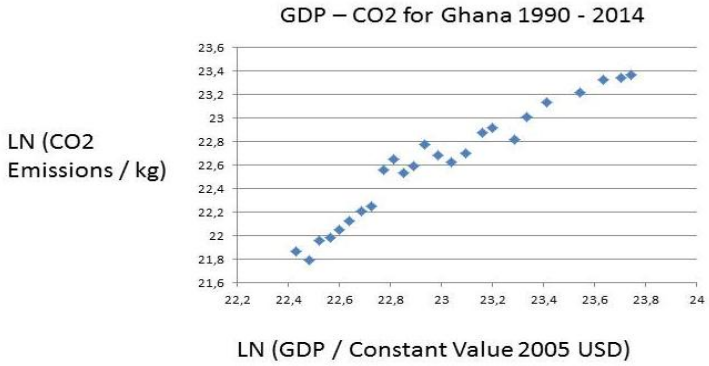


Figure 2.Ghana: GDP-CO2: y = 1,17x, R^2 = 0,94

There is a very strong connection between GDP and CO2 emissions in Ghana. One would like to examine its energy mix in order to understand this. Figure 3 present the energy consumption pattern in Ghana.

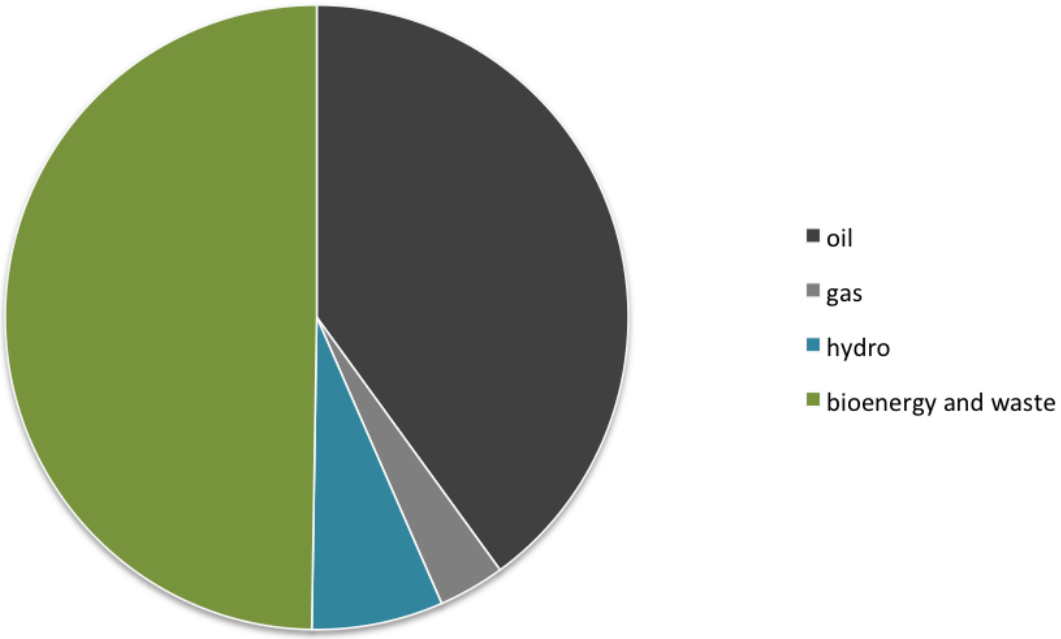


FIGURE 3: Total Energy Mix Ghana 2012.

Source: http://climateanswers.info/2015/10/ghana-climate-and-energy-statistics/

Ghana needs both electricity and petrol. Figure shows that oil is used abundantl, but there is also much hydro power. Yet, 50 per cent of the power comes from bioenergy and waste, which is classified as renewables. These kinds of *traditional* renewables are to be found in almost all sub-saharan Africa countries. And they create large CO2 emissions, which is why there is this close link between GDP and CO2:s here. Look now at Kenya in Figure 4.

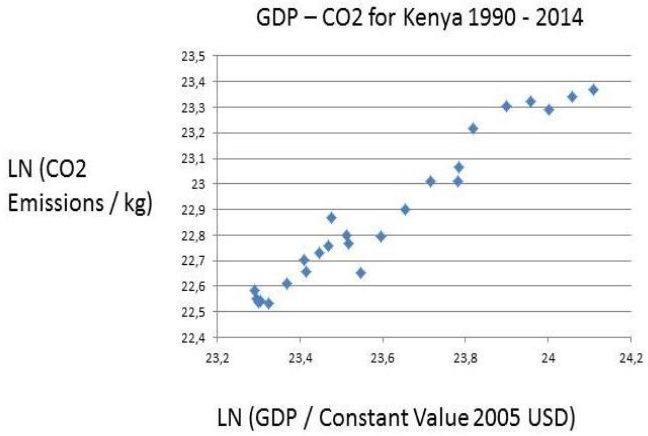


FIGURE 4. Kenya: $y = 1{,}08x$, $R^2 = 0{,}95$

As a matter of fact, Kenya:s curve for GDP and CO2:s resembles that of Ghana, both countries experiencing economic progress. The basic energy resources are also the same: renewables, hydro and petroleum – see Figure 5.

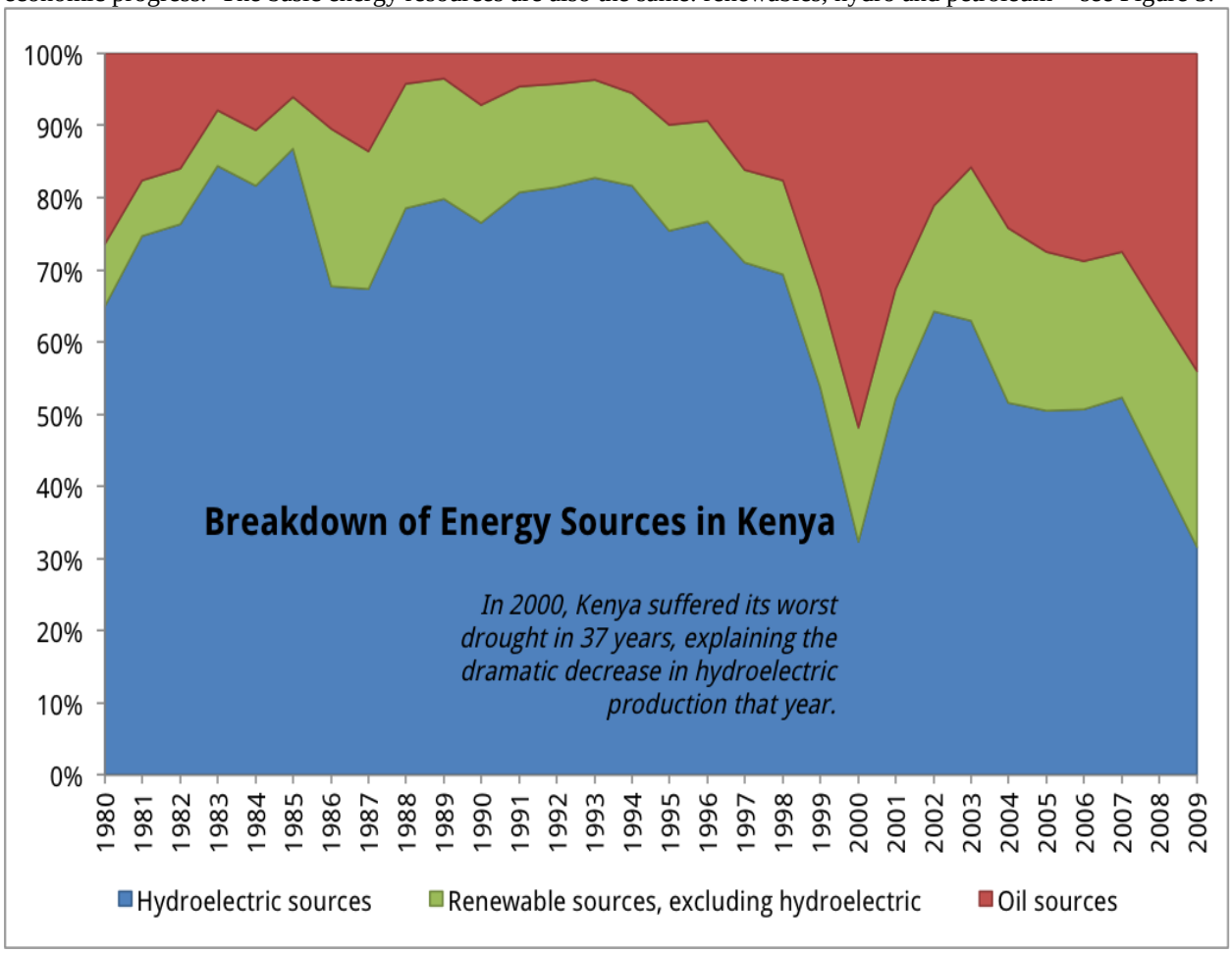


FIGURE 5. Kenya

Source: http://investeddevelopment.com/blog/2012/08/energy-in-kenya-and-the 6-potential-for-renewables/

However, these renewables are not all carbon neutral: charcoal and dung besides the normal renewables like solar, wind and thermal power.

One may expect that countries with the possession of big rivers resort to hydro power, like Senegal, Kongo, Angola and East African states. Figure 6 substantiates this observation by showing that hydro power matters for the generation of electricity in East Africa.

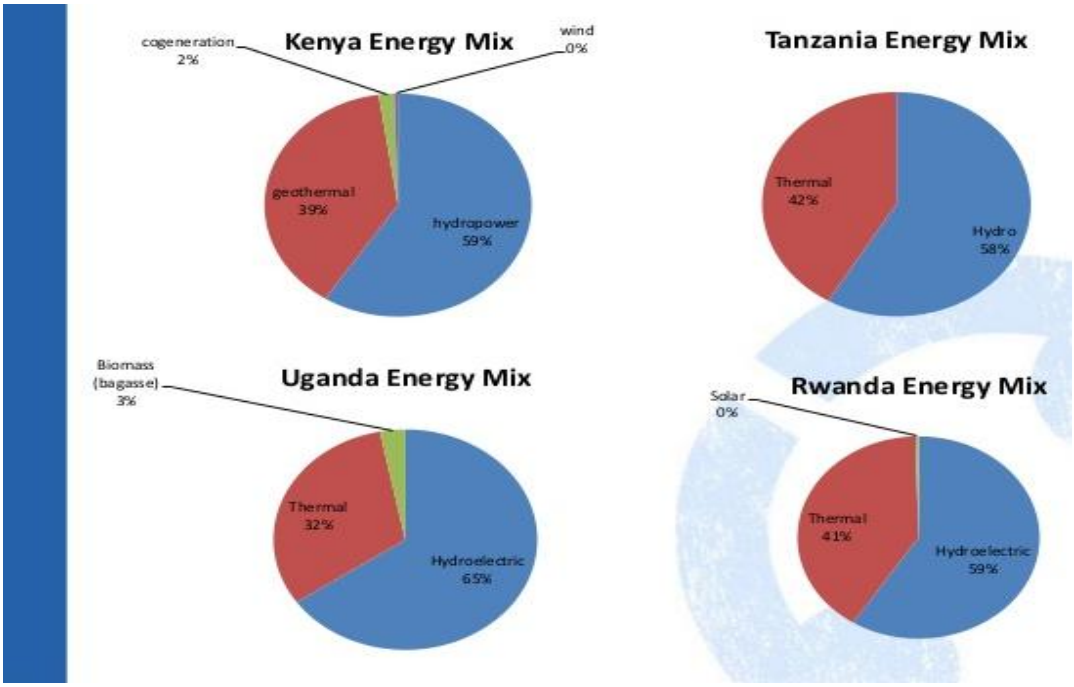


FIGURE 6. Sources of electricity in East Africa

Sources: http://www.slideshare.net/e4sv/12-smart-villages-energy-access-in-ea-summary

However, hydro power is nowhere dominant as general energy source. Many poor African nations employ traditional renewables that are far from carbon neutral. An example is the giant Democratic Republic of Congo, where wood and charcoal dominates very much. It is of course a matter of deforestation and desertification when wood and charcoal are used so heavily.

One may speculate as to why hydro power isnot more used in several African countries. One reason has already been mentioned, anarchy. Another is of course the enormous investments costs. Hydro power should be more used in countries like Nigeria, Angola and Kongo. But it is not without risks, namely water shortages.

b) **Traditional Renewables**

A general teent in the climate change debate is that renewables should be preferred over non-renewables. 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.

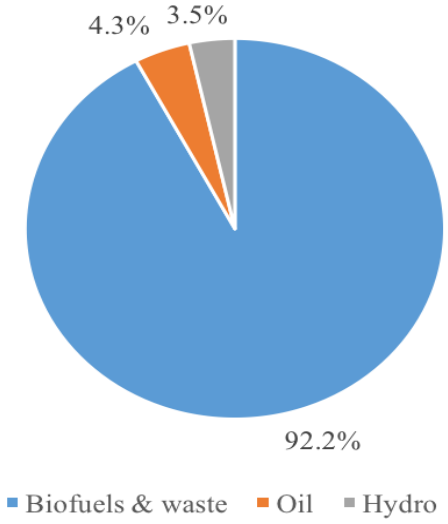
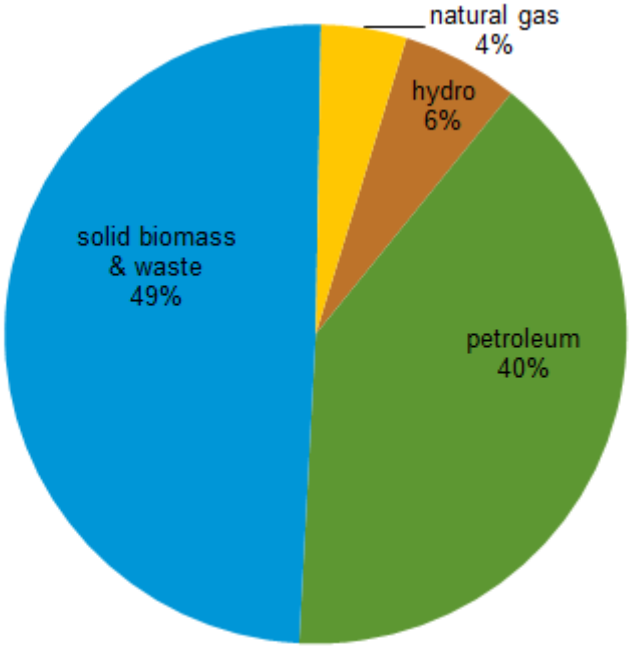


FIGURE 7. DR KONGO

Source: Democratic Republic of Congo - Energy Outlook, Kungliga Tekniska Hoegskolan

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 time, 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.

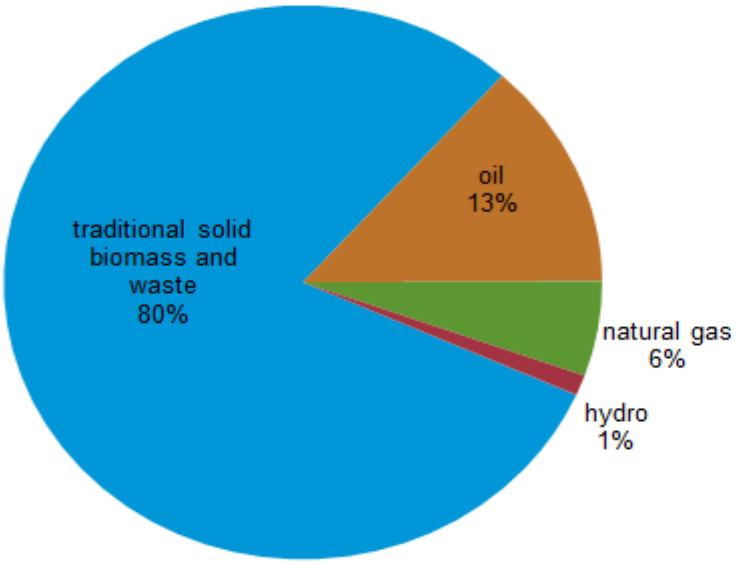
This enormous reliance upon traditional renewables is to be found also in Angola and Nigeria, although both have access to both hydro power and fossil fuels. Figure 8 describes the energy mix for Angola.



eia Source: U.S. Energy Information Administration and International Energy Agency

FIGURE 8: Angola's primary energy consumption, 2012.

Angola like Kongo has suffered from long and terrible civi 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 elit family may prefer to export these resources instead of using them for electricity generation. Giant Nigeria has a resembling energy mix – see Figure 9.



eia Note: Nigeria also consumed 35,000 short tons of coal in 2012.
Source: U.S. Energy Information Administration, International Energy Agency

FIGURE 9: Nigeria's total primary energy consumption, 2012.

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.

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 Etiopian 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 droughts is a real one for all countries trying to exploit the Nile.

The energy consumption of Sudan reflects this situation – Figure 10. The countries that rely upon traditional renewables to an extent up to 50 per cent or higher will have to reflect upon how to bring these figures with modern renewables. It is an entirely different task than that of countries with too much fossil fuel dependency.

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 violence,resulting huge numbers of death from domestic violence?

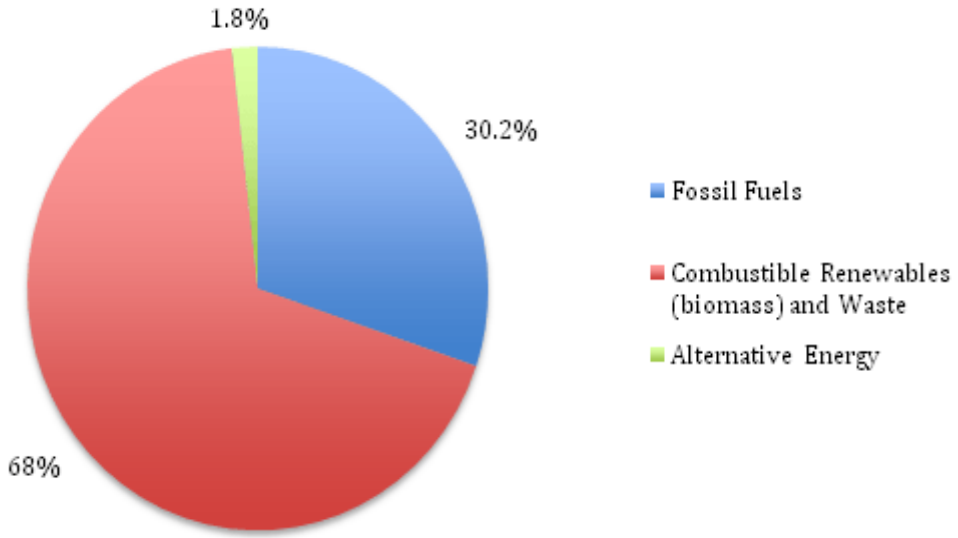


FIGURE 10: Sudan's Energy Consumption.

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

The reliance upon traditonal renewables is so high in neighbouring Ethiopia that electrification must be very difficult to accomplish over the large land area. Figure 11 displays a unique predicament.

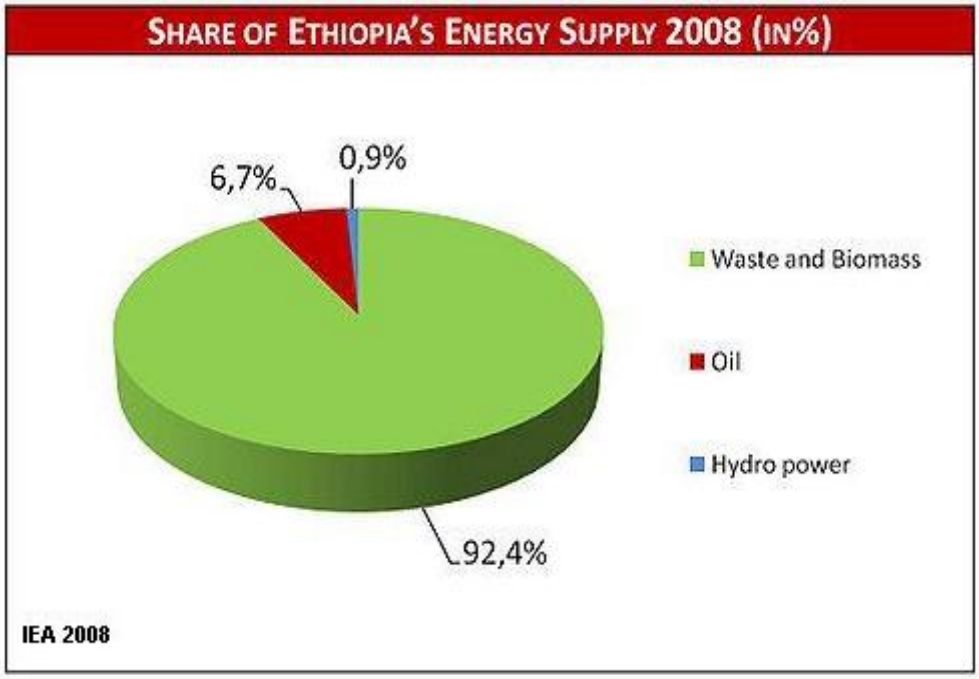


FIGURE 11. ETHIOPIA: Energy mix

Is there any advantages with such a skewed energy mix? No, becausee even mainly rural Ethiopia works with lots of CO2: - see Figure 12.

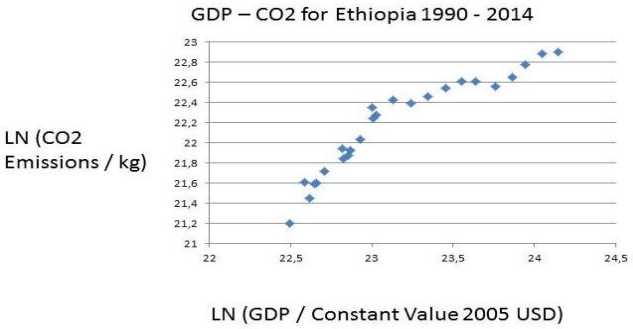


FIGURE 12. Ethiopia: GDP and CO2: y = 0,90x, R^2 = 0,88

The zest with which Ethiopia is pursuing its control over water resources becocomes flly understandable, when Figure 12 is consulted. What we see in the same smooth linear function plotting CO2:s upon GDP, as is obvious in countries based upon fossil fuels – see below. For Ethiopia, to comply with COP21 goals is goint to pose major challenges, especially if economic development is not going to be reduced. The country needs massive help, both finacially ad technologically.

c) ***Fossil Fuels: Oil and Gas***

When we turn to the already industralised countries in North and South Africa, the energy patterns is entirely different from above. As many African countries have reached their "take-off" stage, they need energy, especially electricity. Yet, the African scene is highly diverse, with on the one hand economic success stories and on the other hand the spread of anarchy and lawlessness. For the environment on the African continent, both energy exploitation and criminals', rebels' or terrorists' activities are negative events all the time, resulting in poaching and loss of animal habitat. Let us look at the emissions-energy situation in a few countries that are stable: Egypt, Algeria and South Africa.

C1) 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 13).

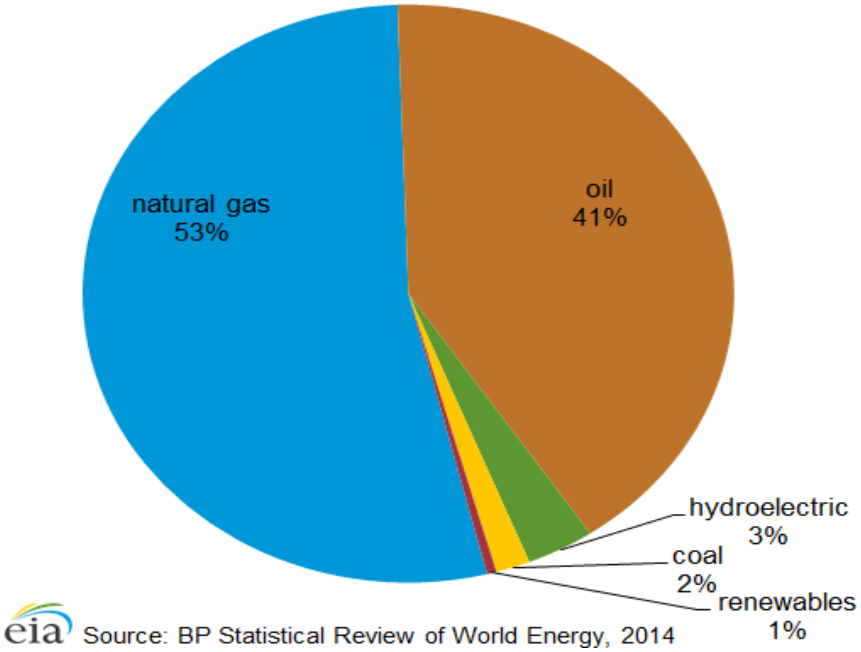


FIGURE 13: Primary energy consumption in Egypt, by fuel, 2013

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 14).

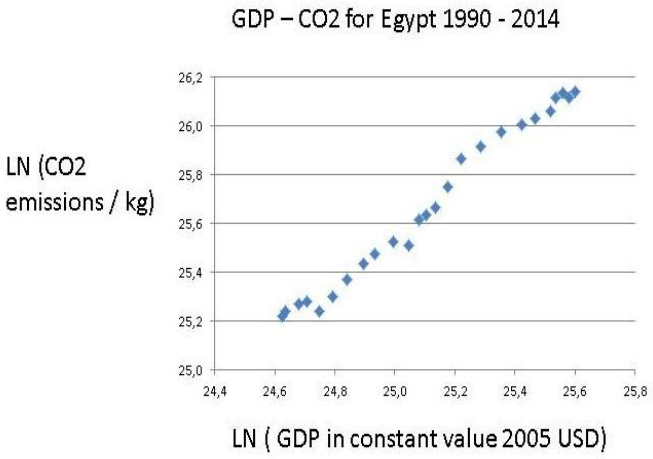


FIGURE 14. GDP-CO2 for Egypt: y = 1,02x; R^2 = 0,99

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?

C2) 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 15 verifies this expectation.

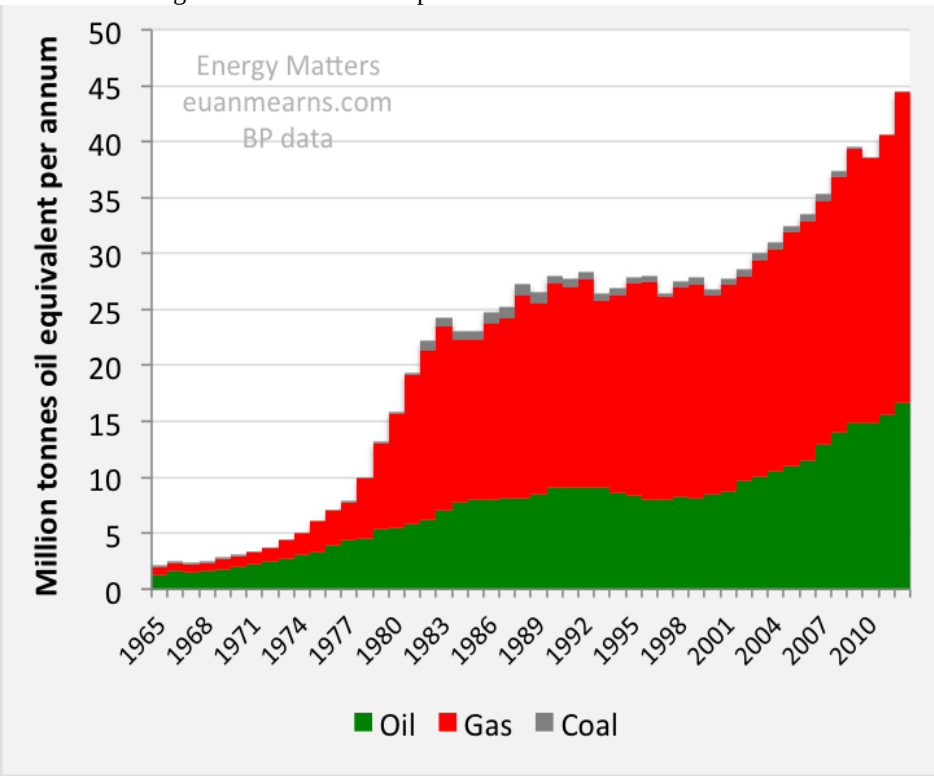


FIGURE 15: Algeria primary energy consumption.

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 farfollowed the economic progress – see Figure 16.

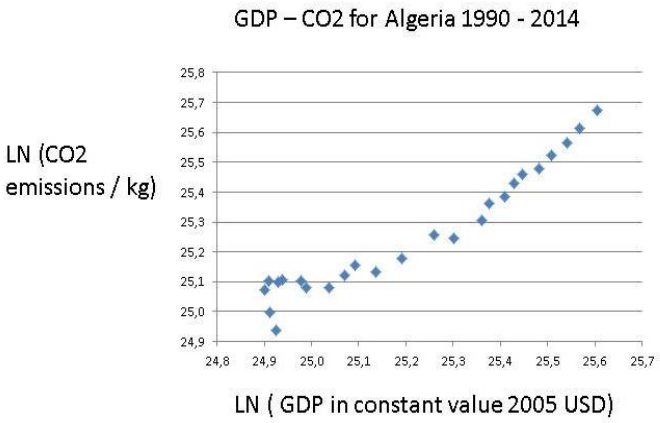


FIGURE 16. GDP-CO2 in Algeria: y = 0,81x; R^2 = 0,93

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.

The COP21 framework outlines the three main goals for the 21rst 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.

d) ***Fossil Fuels: Coal***

The RSA has a modern economy running on mainly coal (Figure 17). 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?

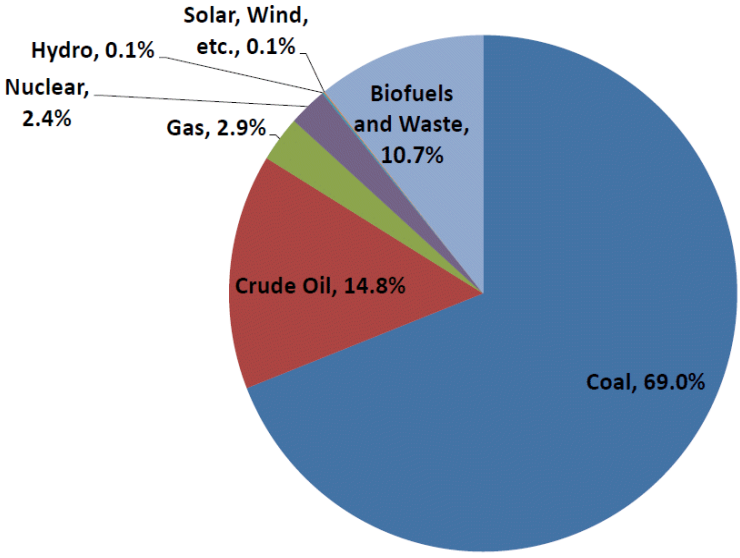


FIGURE 17. Energy consumption in RSA-Total Primary Energy Supply in South Africa 2012 (%TPES).

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?!
African countries have sometimes both a traditional and a modern economy. Take the case of Botswana, a democracy with a market economy and traditional chiefs! It has considerable CO2:s – see Figure 18.

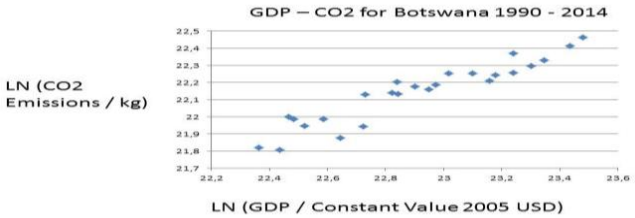


Figure 18. Botswana: GDP-CO2: $y = 0{,}51x$, $R^2 = 0{,}89$

Yet, Botswana relies mainly upon fossil fuels, oil and coal, to deliver its economic output from mining and minerals (Figure 19).

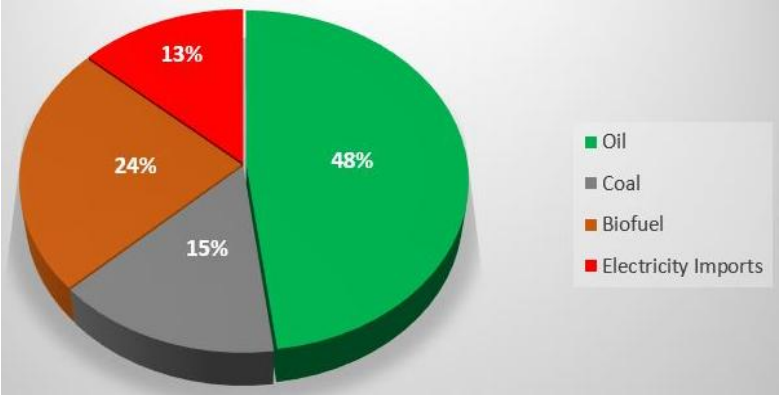


FIGURE 19: Botswana Energy Supply for 2012.

Complying with the CO2 objectives, Botswana can use solar power to diminish the scope of fossil fuels or that of traditional renewables. Botswana has peace, which is extremely important for energy policy-making.

Conclusion

Summing up the findings above this empirical enquiry into emissions and energy for African nations, one may emphasize three points, viz.:

i) Low per capita emissions: African countries except Maghreb are not heavily industrialized. Thus, total and per capita emissions are lower than for other continents. However, African governments must comply with COP21and its non-negotiable 40 per cent reduction of CO2:s.

ii) Traditional renewables play a big role in sub-Saharan Africa, except for the RSA. This is a major negative in relation to the environment and emissions problematic.

iii) Africa needs modern renewables in order to fulfill its obligations towards the international community, but that will require massive support in international ecology governance, promised within the COP21.

iv) The use of hydro is not as high as one may have expected, given the huge rivers on the African continent. Yet, constant draught is a real threat to the expansion of hydro power.

v) The least developed countries are the ones with *Hobbesian* condition: anarchy, anomie and civil wars. The making and implementation of energy policies is much hindered by the massive deaths from domestic violence in the stomach of Africa.

Solar and wind, perhaps more hydro and geo-thermal power offers opportunities for African nations to move towards the fulfillment of their COP21 promises. But support from the West and Asia – China, Japan - is a *sine qua non*. Political stability is a necessity, just as interstate cooperation. The African states lack an experience of the *rule of law*, the most precious export from the Western Europan cultural tradition, which European colonialism could not or failed miserably to introduce.. The sufferings of many African people from state instability *after independence* are almost beyond precedent in African history. except for the terible slave trade.

Energy policy-making cannot operate on the basis of state instability, whether as anarchy or as corruption and embezzlement. It is difficult to see how the African continent countries could comply with the COP21 framework on their own policy measures. But how is a massive transfer of money and technology for the goal of decarbonisation to be organised successfully - no one knows. Global warming carries the awful threat of huge droughts for several parts of the African continent, which is why a profound goal of decarbonisation may be simply too much to ask from African governments.

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