



## Peak Oil and Senegal

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For whom is peak oil the most critical, the developed world of America, Europe and similar or the developing world of sub-Saharan Africa? Clearly the West's oil consumption, both absolute and per capita is far greater than Africa's but how will peak oil affect oil availability in the two areas and what will the impact be?

I recently spent a week in Senegal, the most westerly African country. Here I'll share some observations from Senegal with comparisons made to the UK.



	<b>Senegal</b>	<b>UK</b>
Population	12 million	60 million
GDP per capita	\$1,800	\$31,400
Annual oil consumption per capita	0.9 barrels	10 barrels
Proportion of oil imported	100%	~0% and rising
Annual electricity generation per capita	192 kWh	6600 kWh
Electricity generation fuel mix	76% oil, 13% hydro, 11% comb. Renew & waste	37% coal, 39% gas, 18% nuclear
Vehicles per 1000 inhabitants	20.6	~500

Senegal is a poor country with all per capita metrics of conventional wealth far lower than western standards however the many Senegalese I met seemed, outwardly at least to be very happy people. There are certainly more smiles on the street in Dakar than in London. This does raise the question of whether conventional economic metrics tell the whole story, clearly they don't but in absence of any standard "wellbeing" or "happiness" index they are all we have.

Oil consumption is extremely low at 0.9 barrels per capita per year. This is some 10 times less than the UK. Not only is the absolute usage significantly less but also the distribution of usage is different. Oil is almost exclusively used for transport in the UK, there being little alternative, most other potential uses of oil have been substituted.

In Senegal 37% of the nation's oil supply is used in electricity generation which in turn represents approximately 76% of the nations electricity supply. As noted above, all of Senegal's oil is imported. IEA energy statistics available [here](#).



*Oil storage tanks at Dakar.*

This is a critical vulnerability, a vulnerability that was realised last year with price rises and frequent blackouts. The [New York Times](#) ran this story in October 2006:

Senegal has increased the price of electricity by 15 percent, infuriating consumers already angry with President Abdoulaye Wade's government after months of chronic power cuts. Regular blackouts, lasting days in some areas, have disrupted the economy and fueled public anger against Mr. Wade's government. The power cuts are largely due to problems purchasing increasingly expensive fuel to run oil-fired generating plants. Residents deprived of fans and refrigerators during the hottest part of the year, when daily temperatures rise above 90 degrees, were shocked by an unannounced price increase on their latest electricity bills. "I thought it was a mistake," said Tidiane Tairou, who runs a small hairdressing boutique equipped with two electric razors. "Sometimes they cut from morning to night, and at the end of the month you still get a bill even though you haven't been able to work."

It is likely that it won't take very much of a price hike for other countries to out bid the Senegalese on the international crude market. The situation could arise where the price of oil doubles with relatively little impact in the West as such a small proportion of total income is actually spent on oil but with massive impact in Senegal. The UK alone will be importing many times Senegal's total imports of ~30,000 barrels per day in just a few years time. Imports, at the expense of poorer countries, that could be avoided with relatively minor changes to UK usage. The lights could go out across large parts of Africa as a direct result of oil scarcity whilst the West continues to drive inefficient cars and frequently fly.

Why does Senegal generate electricity from oil, a practice all but abandoned in the West? In fact a 2004 UK report from The Royal Academy of Engineering titled *The Costs of Generating Electricity* ([pdf available](#)) concluded:

...it is clear that under the Government's existing fiscal policy, fuel oil cannot compete with other types of fossil fuel used to generate electricity. It is our view, therefore, that

the scope for future fuel oil-fired generation is very limited, other than for use as a back-up fuel in plants which have the capability to burn more than one type of fuel.

As we know, since then the price of oil has risen still further.

Generating electricity from oil is an expensive business. For example a barrel of oil contains approximately 1,680 kWh (37MJ/L) and costs \$60. Generating electricity at 40% efficiency results in a fuel cost of 9 cent per kWh. In reality it will be a little more as this does not include the refining costs to produce the fuel oil from the crude. The fuel component of generating costs may represent as much as 70% of the total cost suggesting a total cost of approximately 14 cent per kWh.

The IEA calculate electricity generation costs resulting from a survey of 130 power plants ([pdf available](#)) with a 5% capital discount rate as:

- Nuclear: 2.1-3.1 cent per kWh
- Coal: 2.5-5.0 cent per kWh
- Gas: 3.7-6.0 cent per kWh
- Wind: 3.5-9.5 cent per kWh
- Solar: 15 cent per kWh for high activity factors

It would appear that not only is Senegal vulnerable to oil supply shocks but even if supply can be maintained it still represents a horrendously expensive method of generating electricity. I expect oil is used due to the low capital costs and historically robust global market for oil. Gas is not as attractive as the gas market isn't robust and coal isn't attractive due to high up front capital costs. Coal and even renewables, could be cost competitive with oil if only suitable financing could be arranged.

Having highlighted this vulnerability to oil supply here's one thing the Senegalese do exceptionally well. The cars especially the taxis were triumphs of repair with vehicles the West would have given up on perhaps a decade earlier still struggling on. Sure they were in bad shape, many with no electrics, mirrors, lights, handles, glass cracked, every body panel dented but they continued to work. The majority of the vehicles were Toyotas or French Peugeots or Renaults.

Whilst driving through the country I passed through a few villages which seemed solely based around keeping the cars going, shops selling used car components lined the road and I spotted a horse drawn trailer carrying all the components of a dismantled engine. This degree of reuse and repair is unheard of in today's developed economies.

This observation is backed up by the vehicle age data from the Ministry of Transport:

Age in yrs	Less than 5	>5 and <10	>10 and <15	>15 and <20	>20
Senegal	8.9%	8.1%	22.4%	30.4%	30.3%
Dakar	10.5%	9.4%	23.2%	29.0%	27.9%
Rest of the country	2.8%	4.8%	22.3%	32.6%	37.4%

Source: Performance and Impact Indicators for Transport in Senegal ([pdf available](#))

The statistics reveal that around 60% of motor vehicles are at least 15 years old, however it possible that a significant proportion of the vehicles, especially those over 20 years old are no longer in circulation.



*Is this car counted in the statistics?*

## Conclusion

The sorry truth of the situation is that poor countries with little or no fossil fuel resources of their own often rely on imported oil for electricity generation. If peak oil results in substantial and prolonged price hikes, demand destruction from these poor countries is the obvious result. However this won't only result in the reduced transportation services we typically associate with oil shortages but more critically will result in reduced electricity availability effecting communications, refrigeration, lighting etc. services that are perhaps more important than internal combustion engine transportation, especially in a country with only 0.02 cars per capita anyway.

Here is a video I shot from the taxi driving through the centre of Dakar.

And here is my Flickr photo album from the trip: [Senegal Photos](#)



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