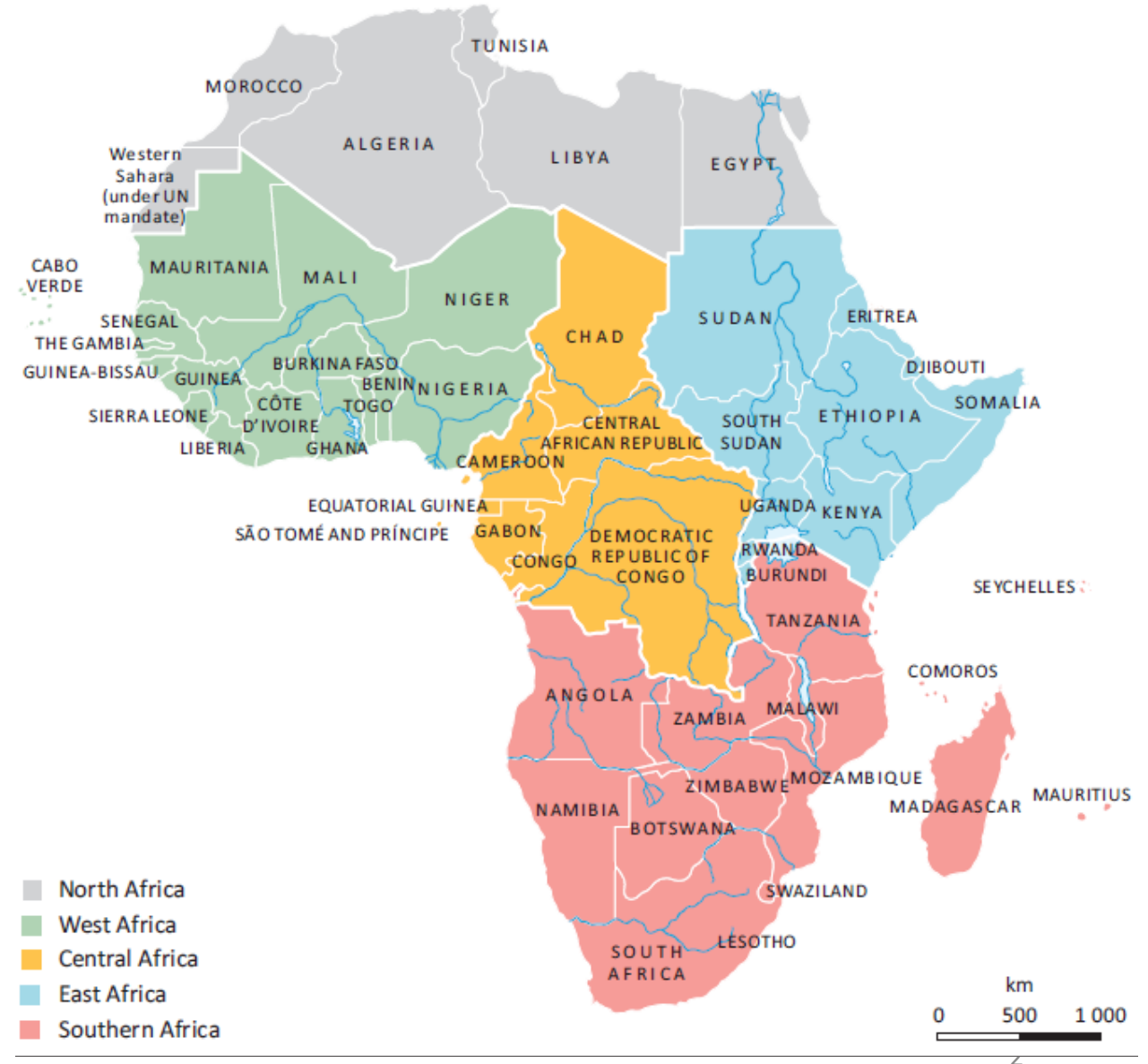


Energy transition in developing world – sub-Saharan Africa

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Sub-Saharan Africa



Fundamentals

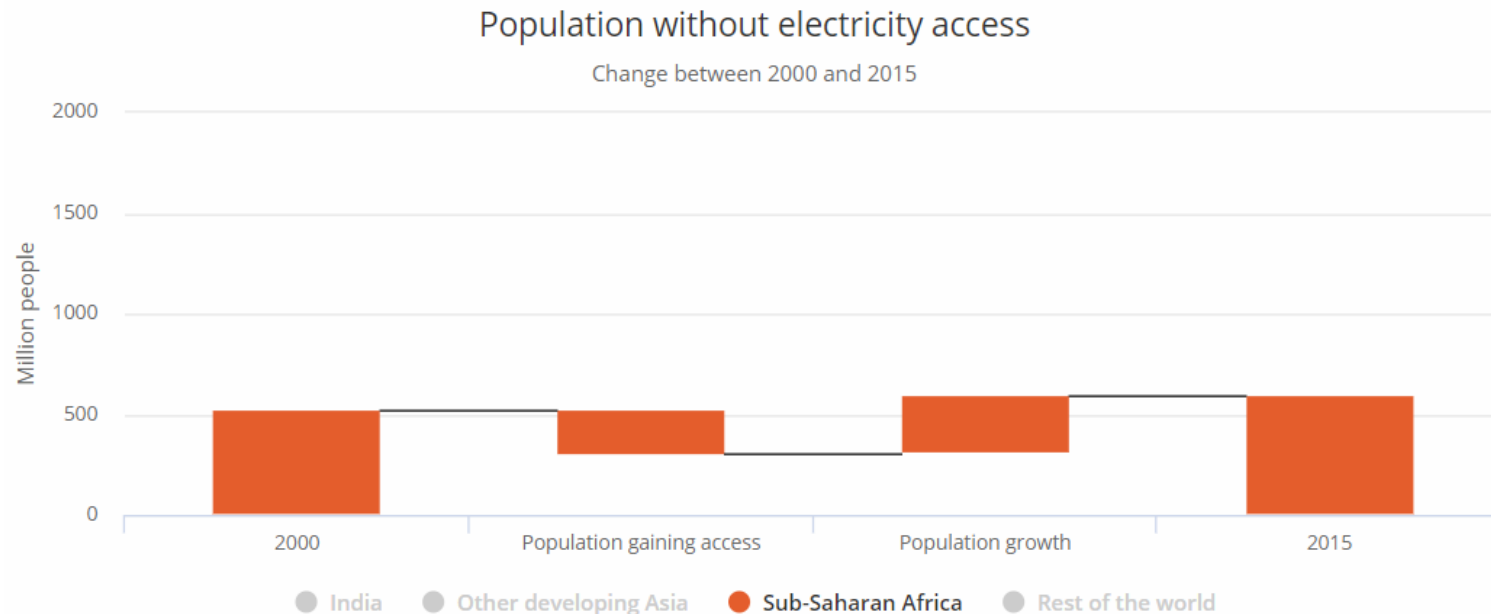
- Sub-Saharan Africa accounts for 4.5% of global energy demand, having 14% of the world's population.
- Rapid population growth -180 million in 2050; 1.05 bn. in 2017; (expected) 2.2 bn. in 2050, and (expected) 3.9bn in 2095.
- Urbanisation – by 2030, more than 50% of people in cities, by 2050 more than 60%.
- Region is rich with resources (both fossil and renewables) but poor with energy.
- Potential advantage is growing working-age population.
- The economy of the region is still smaller than that of Germany (sic). Agriculture 65% of employment, mining for export.
- Significant role (FDI, trade) of the EU, growing role of China (oil-related investments in Angola, Chad and Uganda, gas investment in Mozambique, or hydro in Ethiopia and Nigeria).
- Governance shortcomings preventing foreign investments – low-quality institutions.

Energy sector

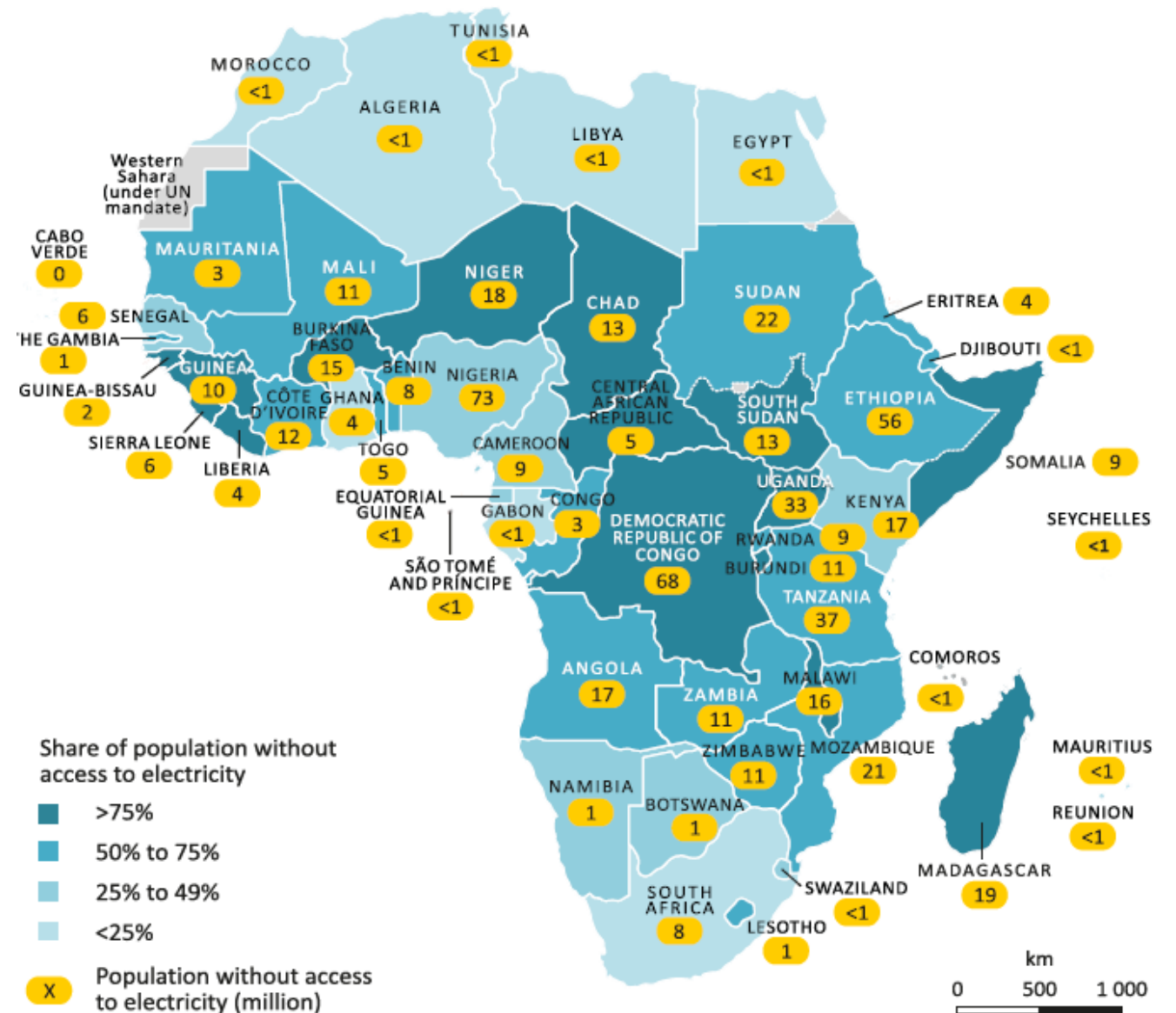
- Solid biomass (incl. charcoal in urban areas) makes up over half of total primary energy demand (mainly household cooking).
 - Coal (largely concentrated in SA) and oil account for roughly equal shares, together they meet about 1/3 of total primary demand.
 - Modern RES (incl. modern use of biomass) 18%.
 - Natural gas about 4% (2/3 in Nigeria).
 - Significant role of back-up diesel generators.
- ...(data for 2016).

Energy access

- Reliable supplies of electricity essential economic development. (590 million people without electricity, 80% of them in rural areas).
- Electricity prices very high by world standards, despite being often below the costs of supply (subsidies for oil).
- Number of people without access to electricity stopped increasing in 2013, is decreasing slowly.

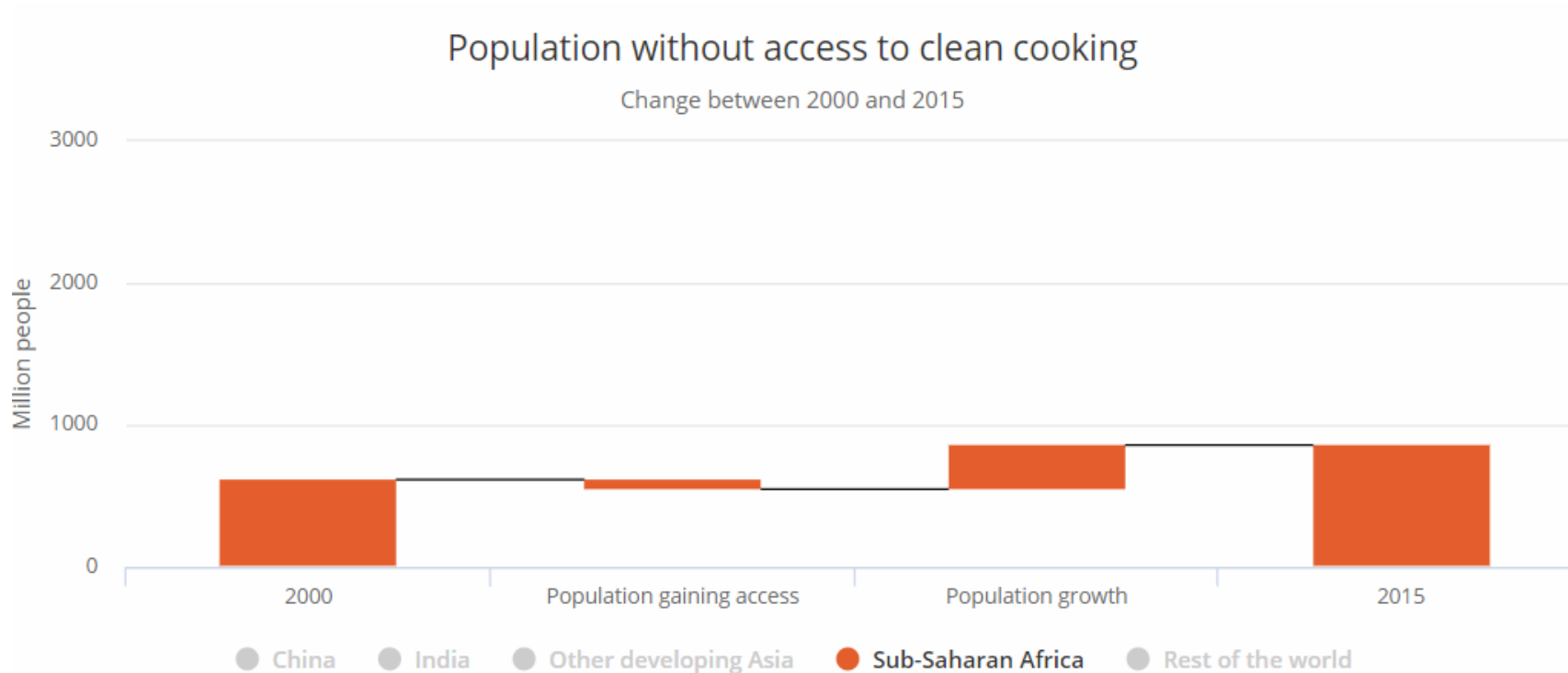


Population without access to electricity, 2016

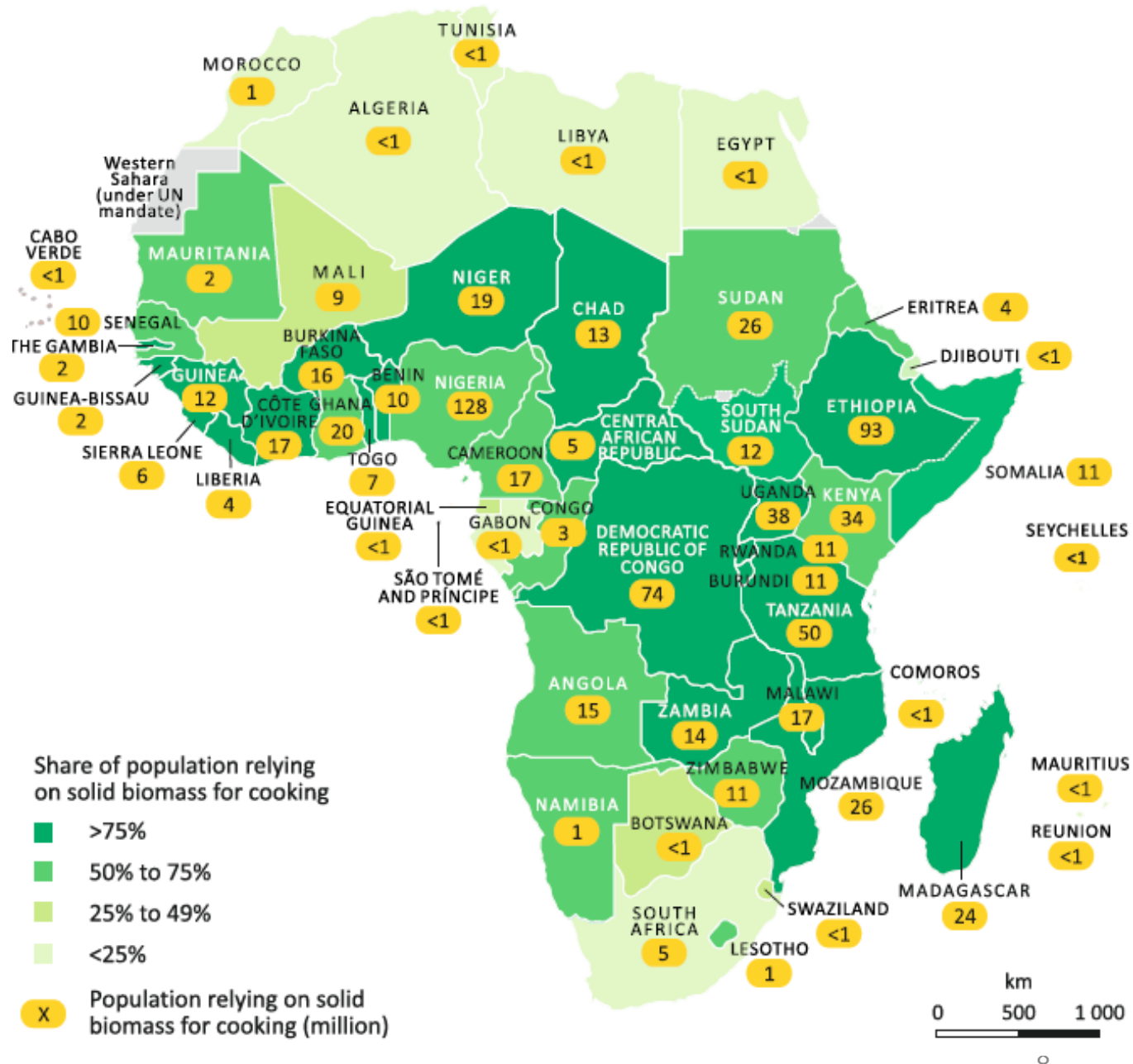


Energy access

- Clean cooking – health and environmental improvements, economic opportunities for women. (4/5 of the people rely on solid biomass for cooking now, 780 million).
- This increased by nearly 50% since 2000.
- 6% of people using kerosene.



Population relying on solid biomass for cooking, 2015



Hydrocarbon resources

- Niger Delta Basin – oil and gas; Nigerian waters, Cameroon and Equatorial Guinea. 12th richest basin in undiscovered oil resources in the world.
- East African Rift – Uganda, also Kenya, DR Congo, Rwanda, Burundi, Tanzania and Ethiopia.
- East African Coastal – over 5 tcm of gas resources in waters off Mozambique and Tanzania.
- West African Transform Margin – Ghana, Liberia, Sierra Leone, Cote d'Ivoire.
- West Coast Pre-Salt – Gabon, Congo, Angola. Natural gas primarily.

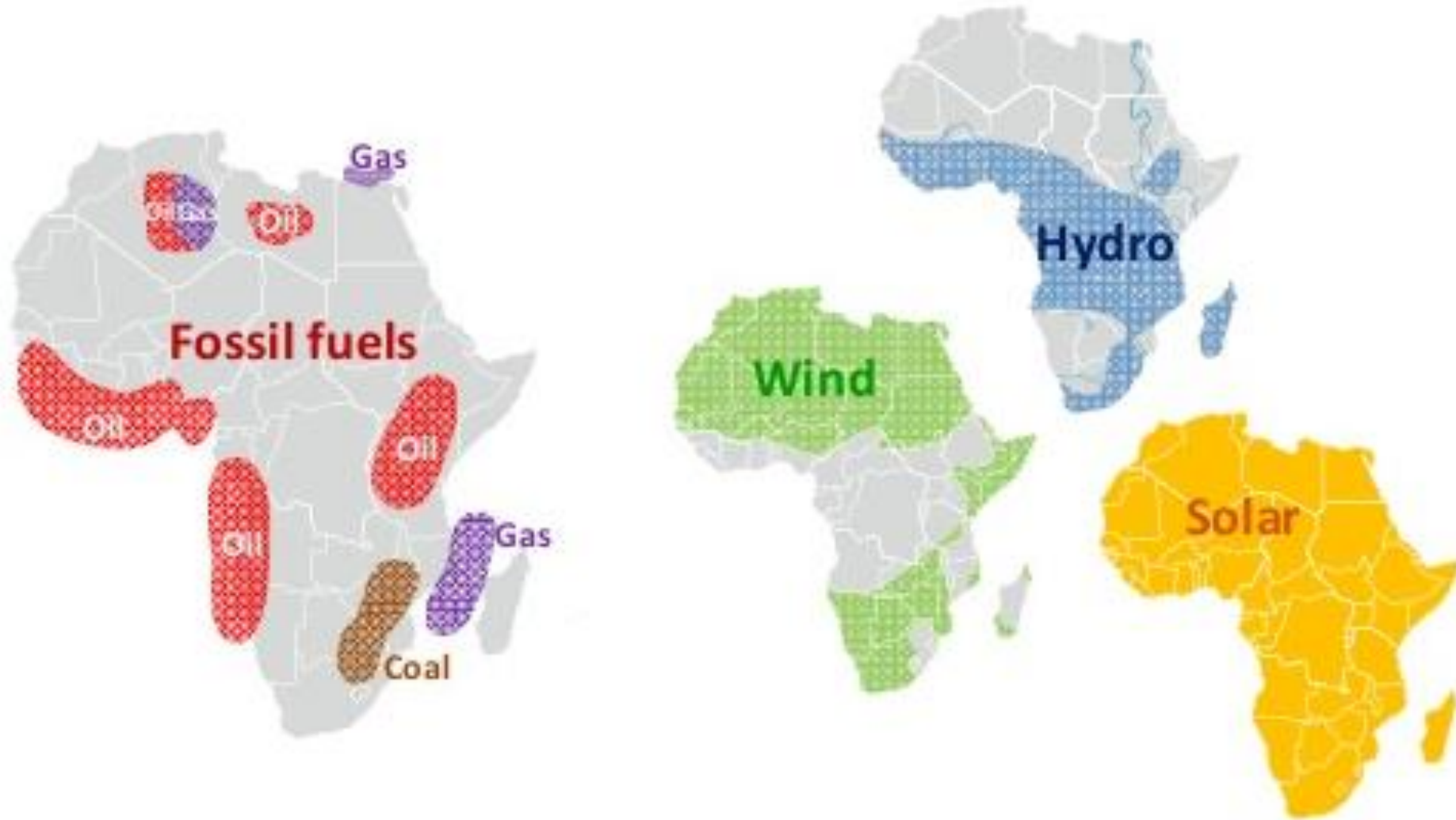
= The whole region around 65 bn. barrels of proven oil reserves (about 5% of the world). $\frac{3}{4}$ in Nigeria and Angola.

= 9 tcm (5% of the global total) of natural gas, often flared (1/3 of the whole production).

= estimated 120 bn. tons of coal (less than 1% of world reserves) in the southern part of the continents, lack of exploration and data. SA, Mozambique etc.

= Uranium resources in Namibia, Niger, SA.

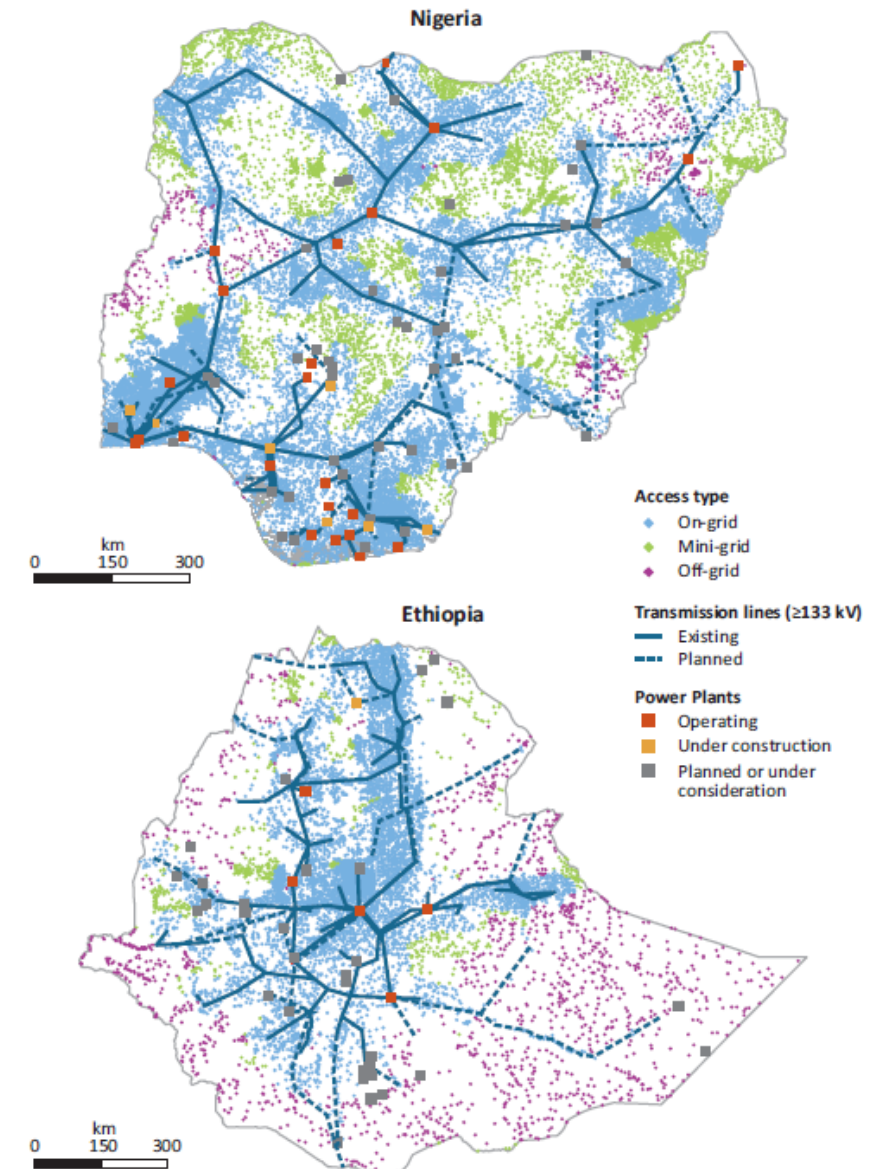
Renewable potential



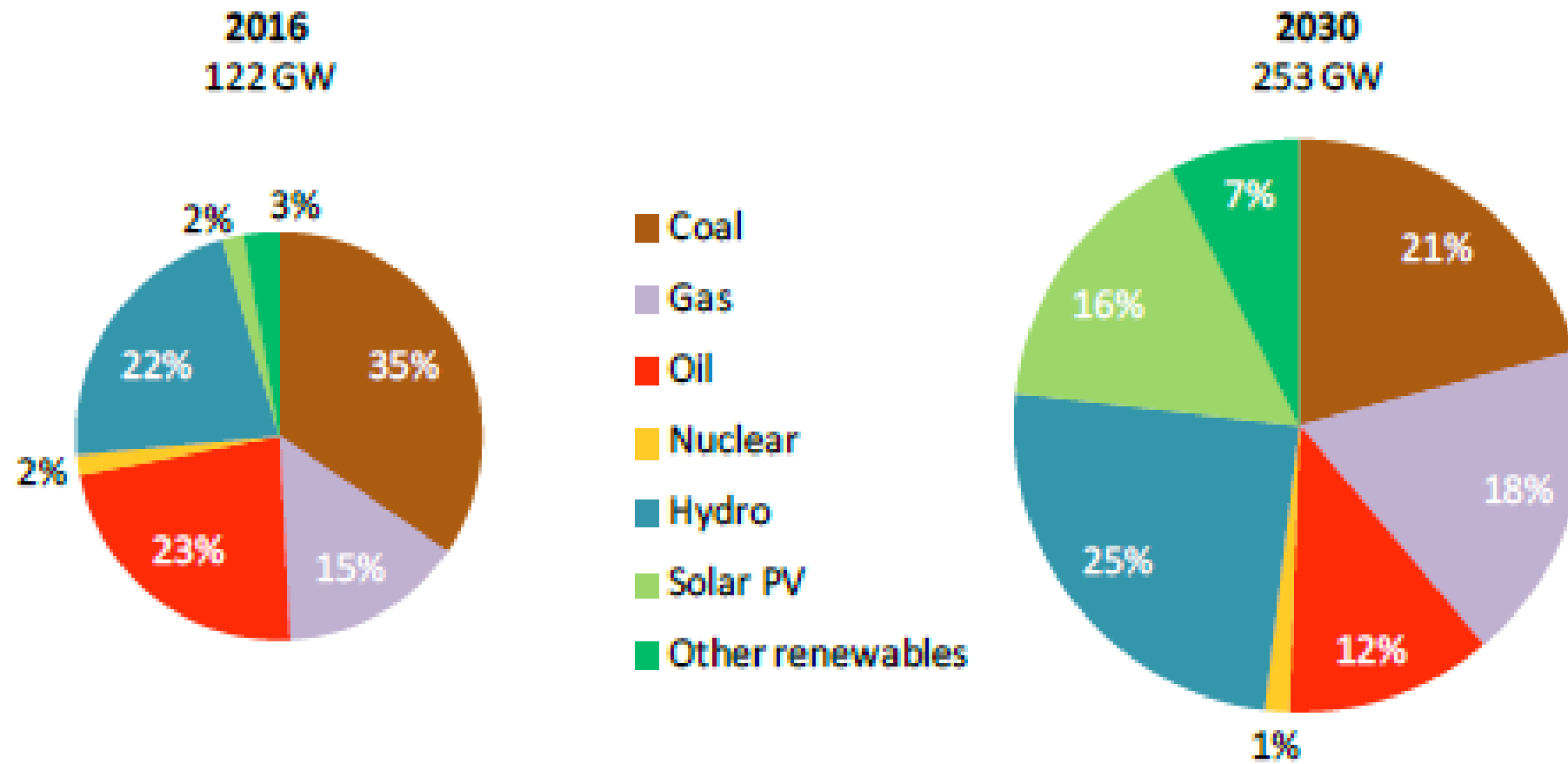
1) Electricity access

- In 2013 the trend of population growth outpacing electrification reversed.
- By 2040, 950 million people to gain access to electricity. Mainly in urban areas.
- Increasing role of renewables. Decentralized systems, off-grid systems?
- Still 530 million people in mainly rural areas without electricity by 2040.
- Electrification undermining development goals of clean energy and climate action?

Figure 3.4 ▷ Optimal split by grid type in Nigeria and Ethiopia, based on anticipated expansion of main transmission lines



Installed power generation capacity, New Policies Scenario of IEA



2) Future role of biomass

- Solid biomass (fuelwood, straw, charcoal, dried animal and human waste) accounts for about 70% of final energy use in the region (80% with SA excluded).
- Cooking primarily.
- Environmental consequences, health effect.
- Policy actions and wood scarcity may encourage usage of LPG and more efficient cookstoves, but 650 million people still cooking with biomass in 2040.

	Investment cost (\$)	Efficiency	Daily hours for cooking	Consumption per household (toe/year)
Traditional cookstoves				
Charcoal	3 - 6	20%	2 - 4	0.5 - 1.9
Fuelwood, straw	0 - 2	11%	2 - 4	1.0 - 3.7
Alternative cookstoves				
Kerosene	30	45%	1 - 3	0.1 - 0.2
LPG	60	55%	1 - 3	0.08 - 0.15
Electricity	300	75%	1.2 - 2.4	0.07 - 0.13
Biogas digester	600 - 1 500	65%	1 - 3	0.07 - 0.14
Improved cookstoves:				
Charcoal	14	26%	1.5 - 3	0.4 - 1.5
Fuelwood	15	25%	1.9 - 3.8	0.5 - 1.6

3) Nigeria and its oil

- Angola is overtaking Nigeria as the largest sub-Saharan oil producer.
- In Nigeria, regulatory uncertainty, militant activity, oil theft (bunkering) in the Niger Delta compromise production.
- Oil theft estimated at 150 kb/d plus oil spills due to sabotages (= 14% of output) – lost revenue of more than USD 5bn/y. Situation getting worse in the last two years.
- Nigeria as a rentier state – largest economy in the region but several key human development indicators (education, life expectancy) on the regional average.

4) South Africa, Mozambique and Tanzania

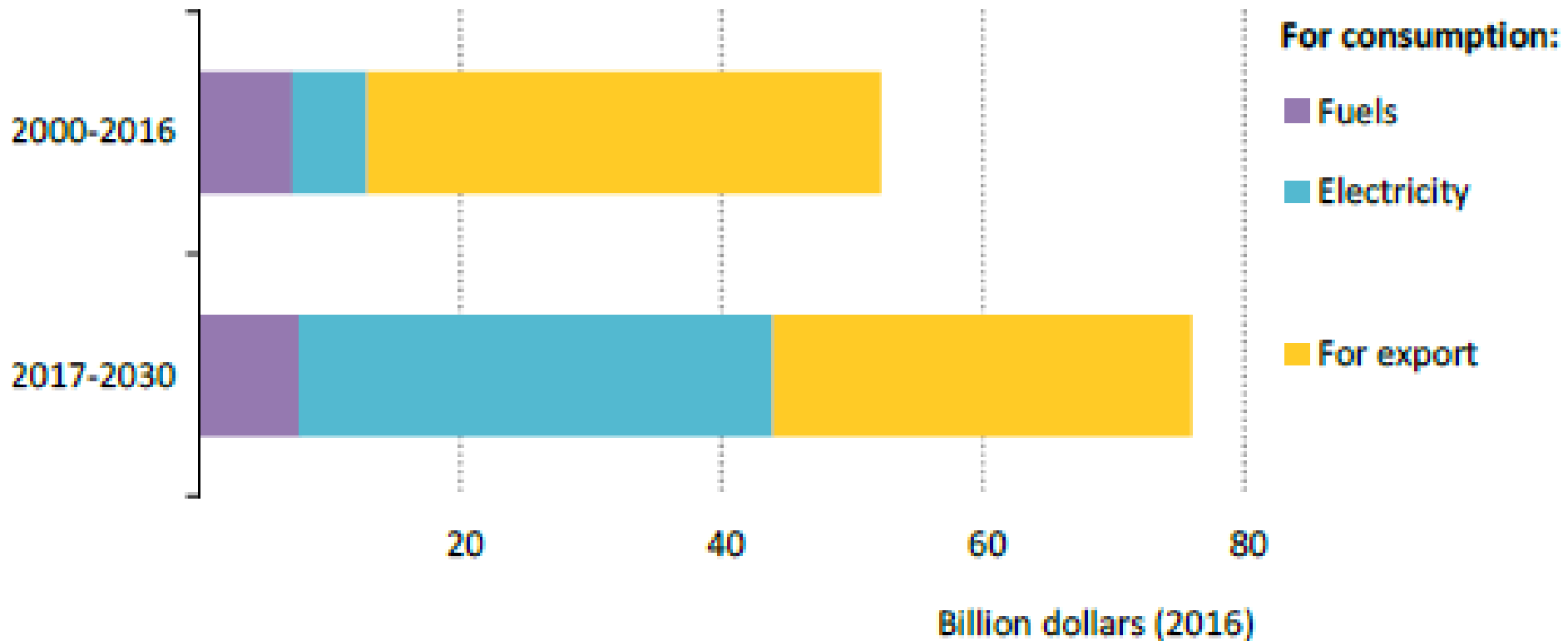
South Africa

- High dependency on coal – around 70% of primary energy demand and around 90% of electricity output (electricity prices used to be one of the lowest in the world). However, easily accessible reserves getting depleted, rising costs of transportation.
- Diversification efforts include renewables, natural gas and, potentially, also nuclear.

Mozambique, Tanzania

- Recent natural gas discoveries expected to facilitate economic development.
- LNG facilities for export, incentives to increase domestic consumption.

Average annual investment in energy supply, New Policies Scenario of IEA



Diesel generators vs. PV units

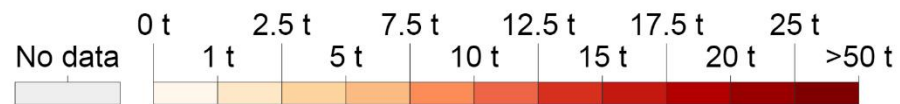
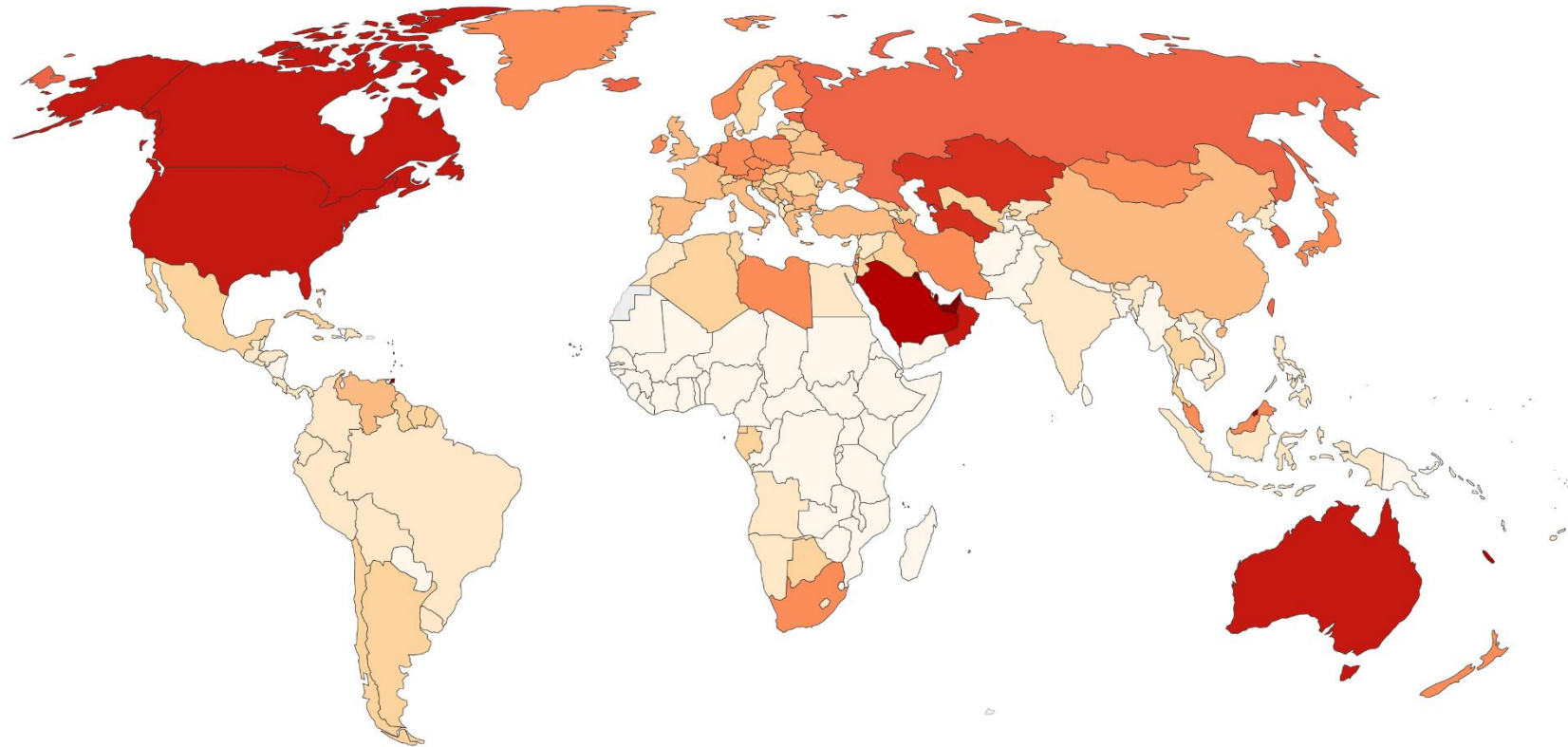
- Diesel generators used to back-up the (unreliable) grid – outages for 6% of the time on average, in some countries (Nigeria, Guinea, Central African Republic) much higher figures.
- Nigeria the largest African importer of the generators, spending almost USD 22 bn. for fuel only (5bn above the price of electricity).

Prospects?

- Energy is interlinked both with economic growth of the region and global climate.
- Socially, economically and environmentally sustainable growth needs stable and predictable institutions.
- Enormous investments needed. (Green climate fund?)
- Population growth challenge to economic stability.
- Energy transition to renewable energy? Is coal to be used in the energy mix?

CO₂ emissions per capita, 2016

Average carbon dioxide (CO₂) emissions per capita measured in tonnes per year.



Source: OWID based on Global Carbon Project; Gapminder & UN OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY-SA

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