

Energy transition in Sub-Saharan Africa

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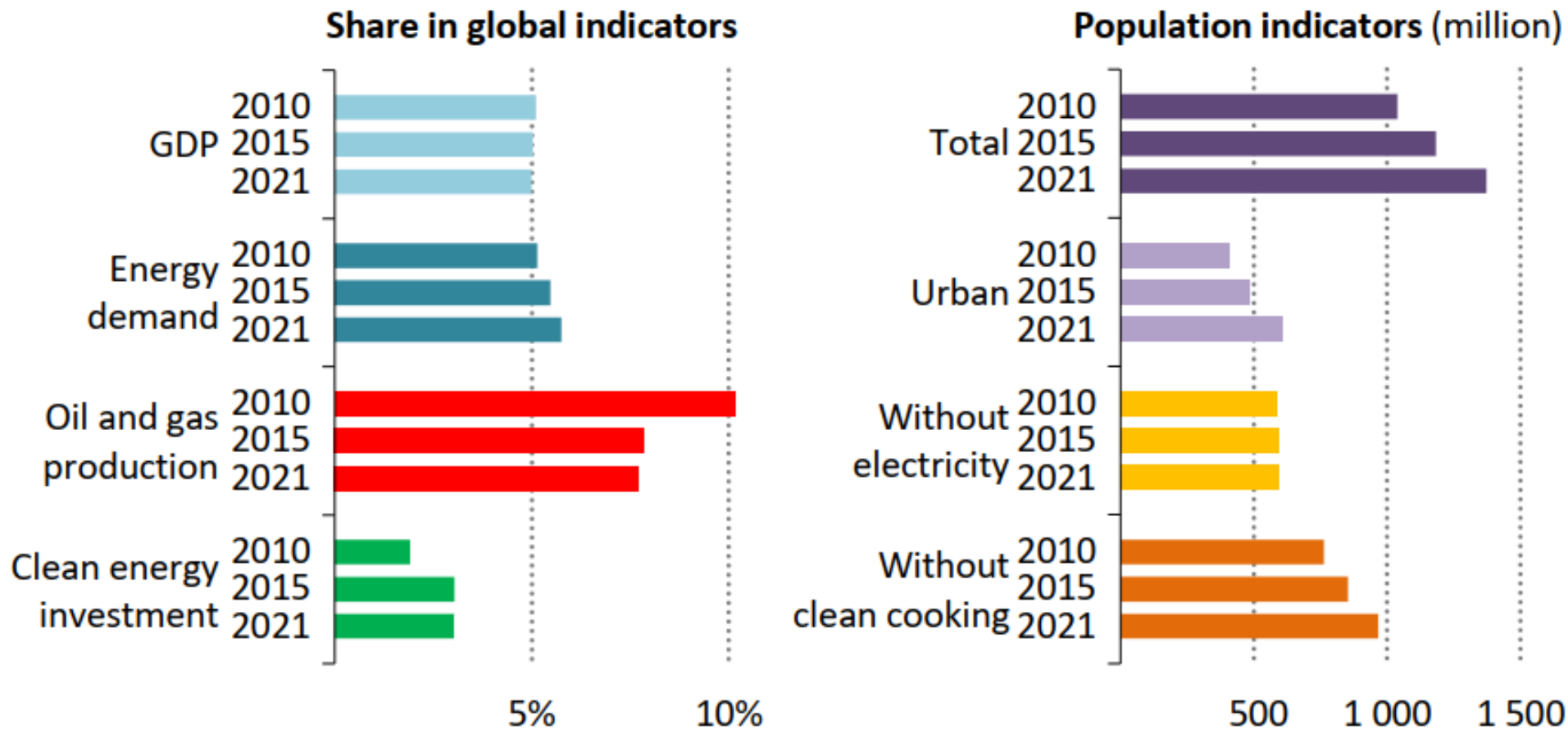
Sub-Saharan Africa



Sub-Saharan Africa – energy context

- Region rich with resources (both fossil and renewables) but poor with energy - accounts for 6% of global energy demand (3% of electricity), having 18% of the world's population. Over the past 30 years power generation per capita plateaued.
- 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).

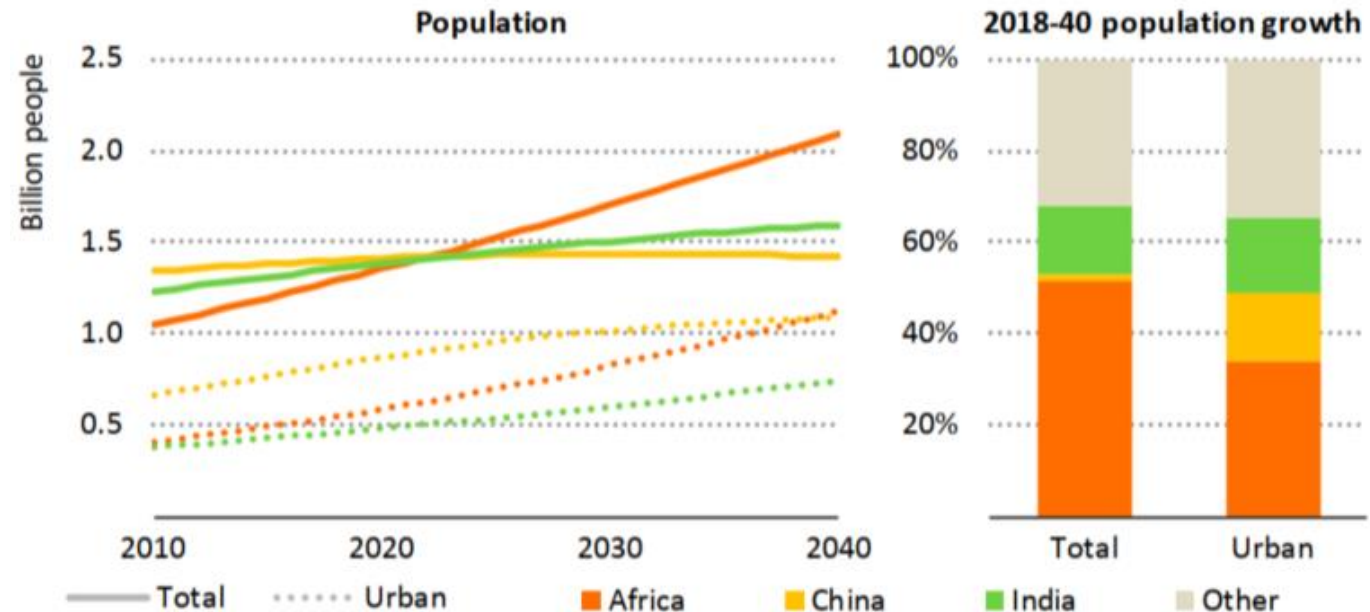
Africa's share in selected global energy and economic indicators and key population indicators, 2010-2021



Trends

1) Growing population

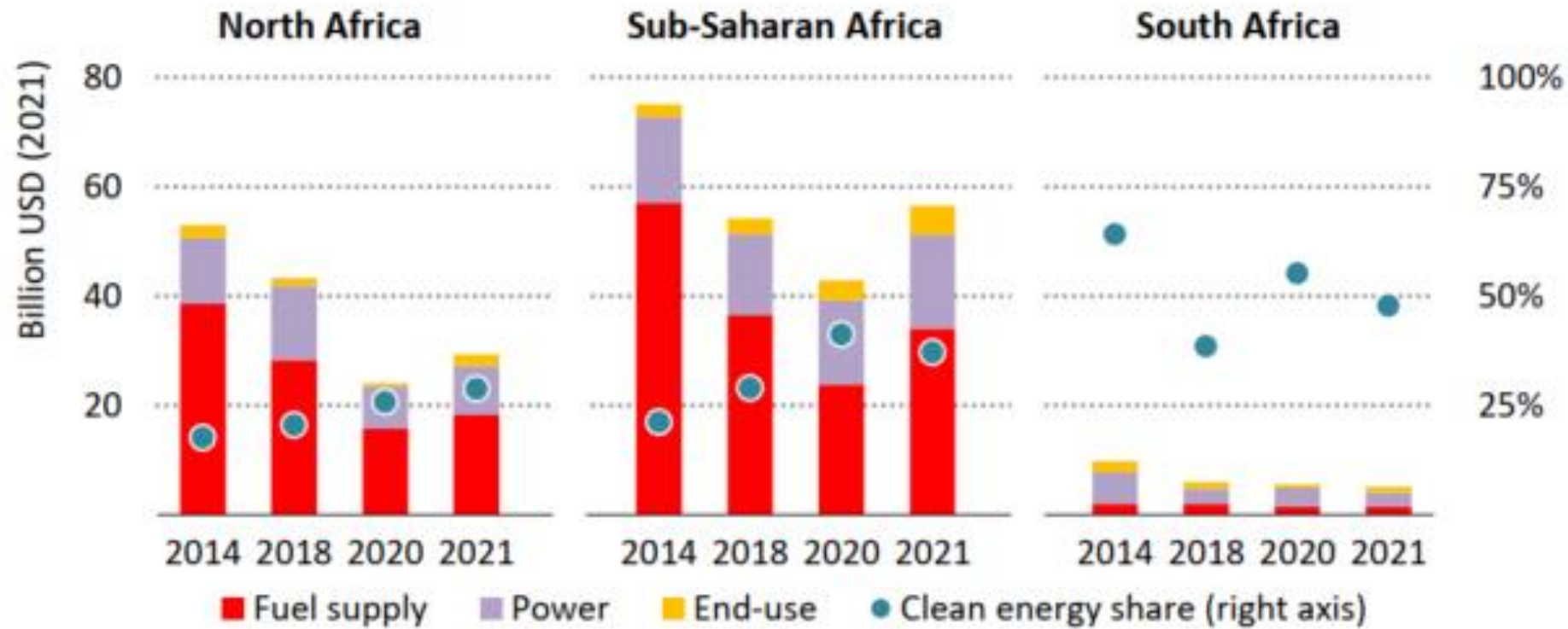
- Rapid population growth -180 million in 1950; 1.3 bn. in 2018; 2.2 bn. in 2050, and 3.9 bn in 2095.
- Urbanisation – by 2030, more than 50% of people in cities, by 2050 more than 60%. By 2040 about 580 additional million people in the cities.
- Potential advantage (but also source of tension) is growing working-age population (42% below 15 years). Nearly 40% of the population below poverty line.



2) Investments and economy

- In 2018, around USD100 billion invested in energy sector = about 5.5% of the global total. Less than 3% of global clean energy investment over the decade to 2020.
- The economy of the region is still smaller than that of Germany (sic). Agriculture 65% of employment, mining for export.
- Share of population living in poverty decreases while absolute number increases.

2) Investments and economy



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- Governance shortcomings preventing foreign investments – low-quality institutions.

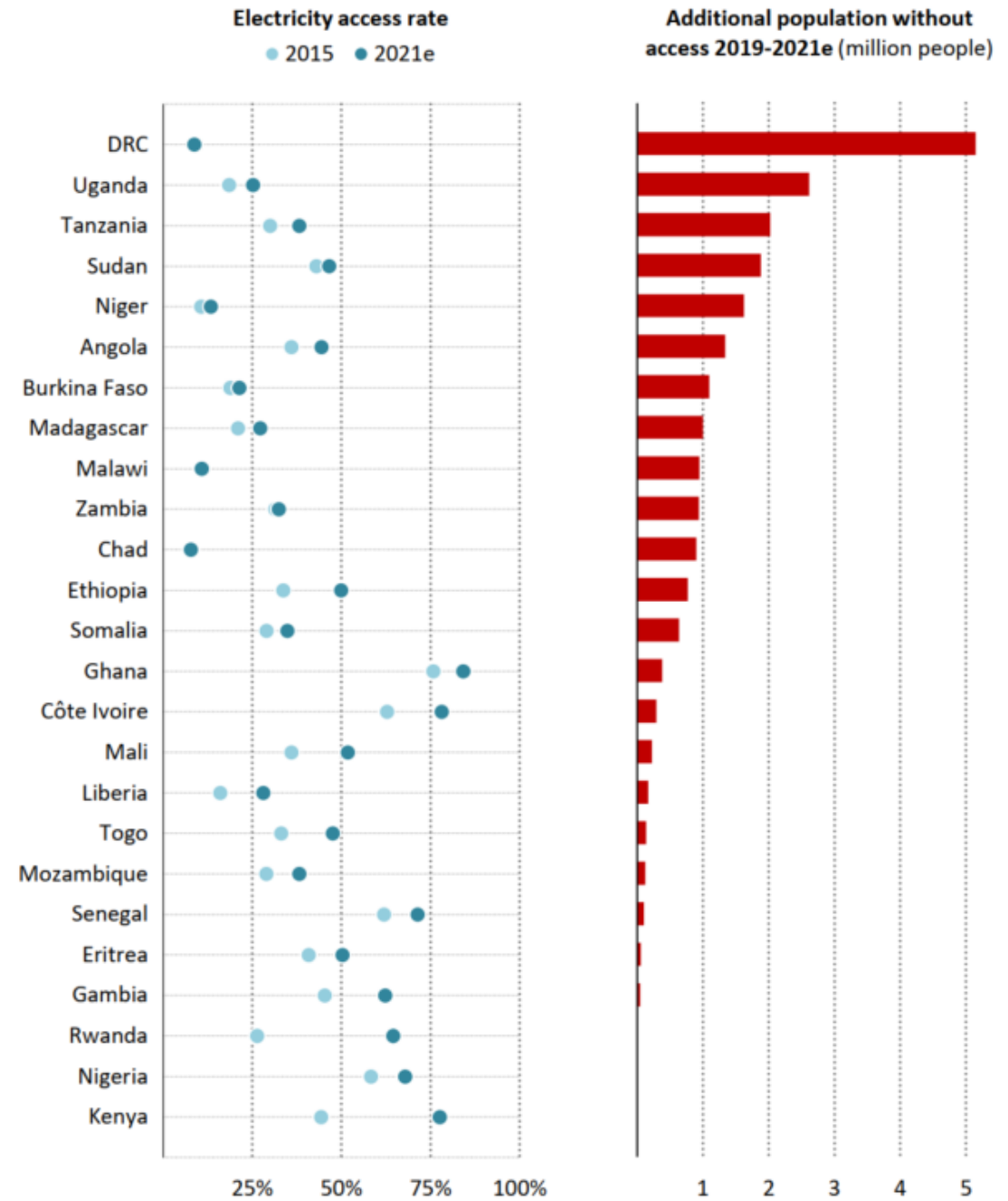
2) China's investments

- Investments of USD 60 bn in 2015, around 10 000 Chinese companies operating in the region.
- Export of commodities, import of electronics and industrial goods. (Tecno – 25% of the whole smartphone market).
- Predatory loan practices or investments in infrastructure?
 - China lent at least USD 95.5 billion between 2000 and 2015 – 40% for power generation and transmission, 30% for infrastructure.
 - Example of Djibouti – in two years debt from 50% to 85% GDP. Similar in Angola, Kenya...

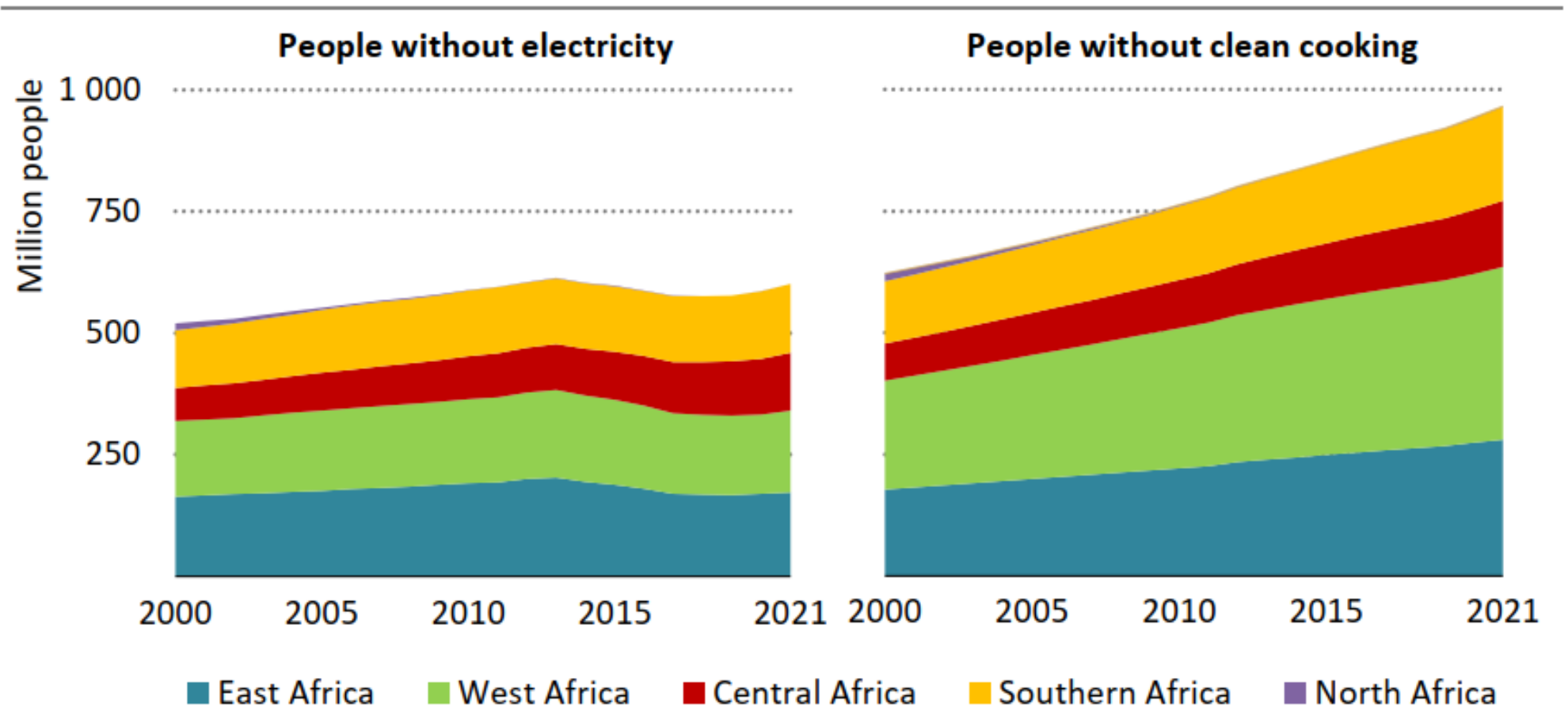
3) Electricity access

- In 2021, 43% of Africa's population (about 600 million) lacked access to electricity, 590 million of them in Sub-Saharan Africa. Covid and Russian war reversed a positive trend.
- Increasing role of renewables. Decentralized systems, off-grid systems?
- Reliable supplies of electricity essential for economic development.
- Electricity prices very high by world standards, despite being often below the costs of supply (subsidies for oil).

3) Access to electricity and C19 related impact in selected African countries

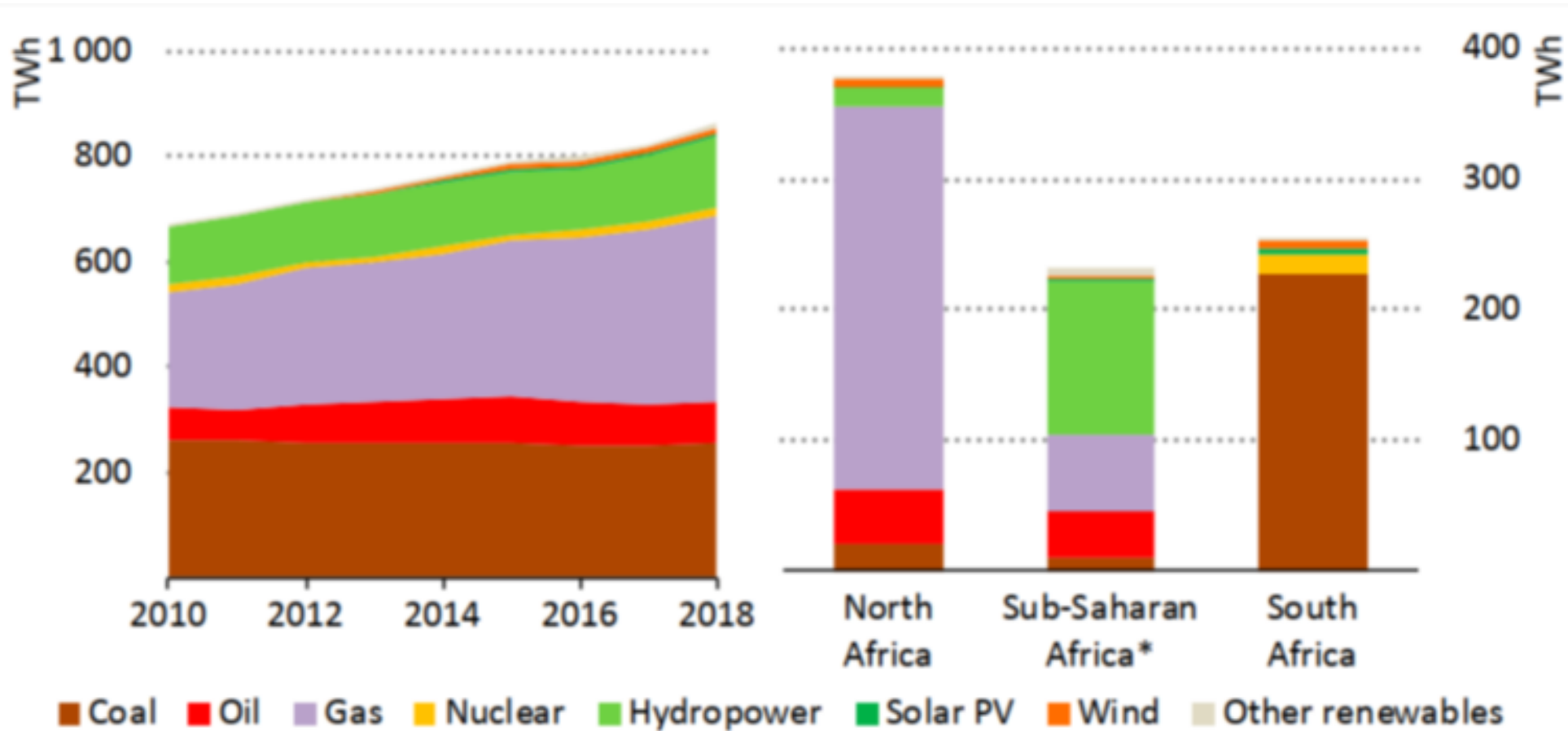


3) Access to electricity

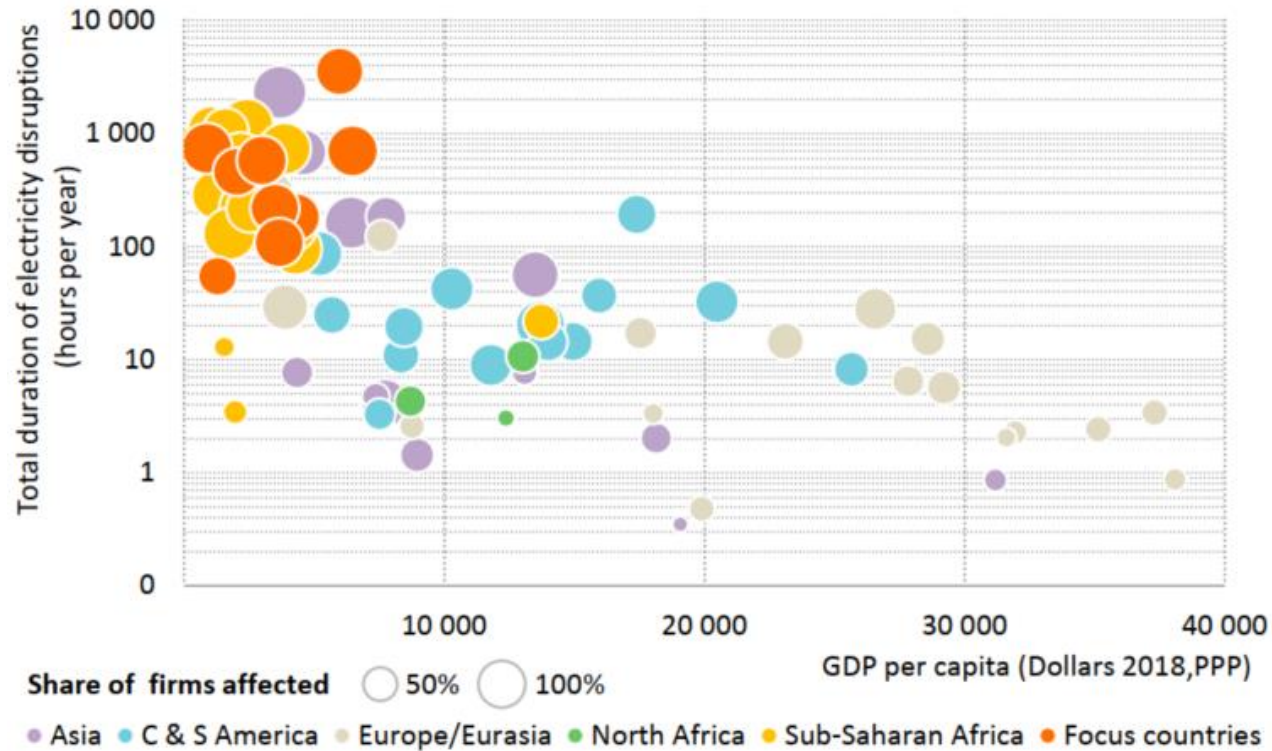


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3) Electricity generation by fuel, 2010 - 2018



3) Electricity outages and GDP per capita in selected regions, 2017



- Diesel generators used as a back-up to unreliable grid.

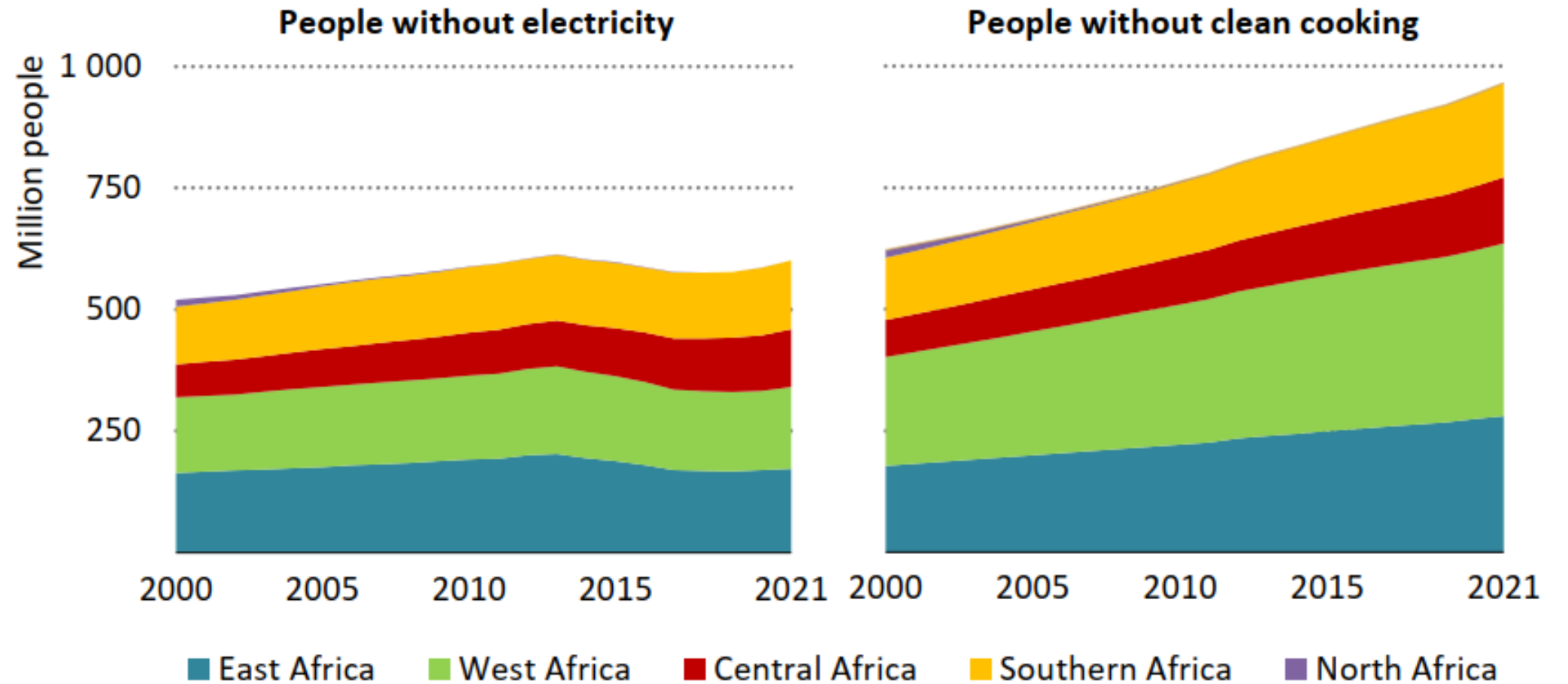
4) Clean cooking

- More than 970 million people (almost $\frac{3}{4}$ of the population) lacks access to clean cooking in 2021, with rapid population growth outpacing efforts to increase access. Again, accelerated by Covid and Russian war.
- Clean cooking – health and environmental improvements, economic opportunities for women.
- 500 000 premature deaths due to the household air pollution.
- 6% of people using kerosene. Deforestation for charcoal for cities. Increase in LPG.

4) Biomass in cooking

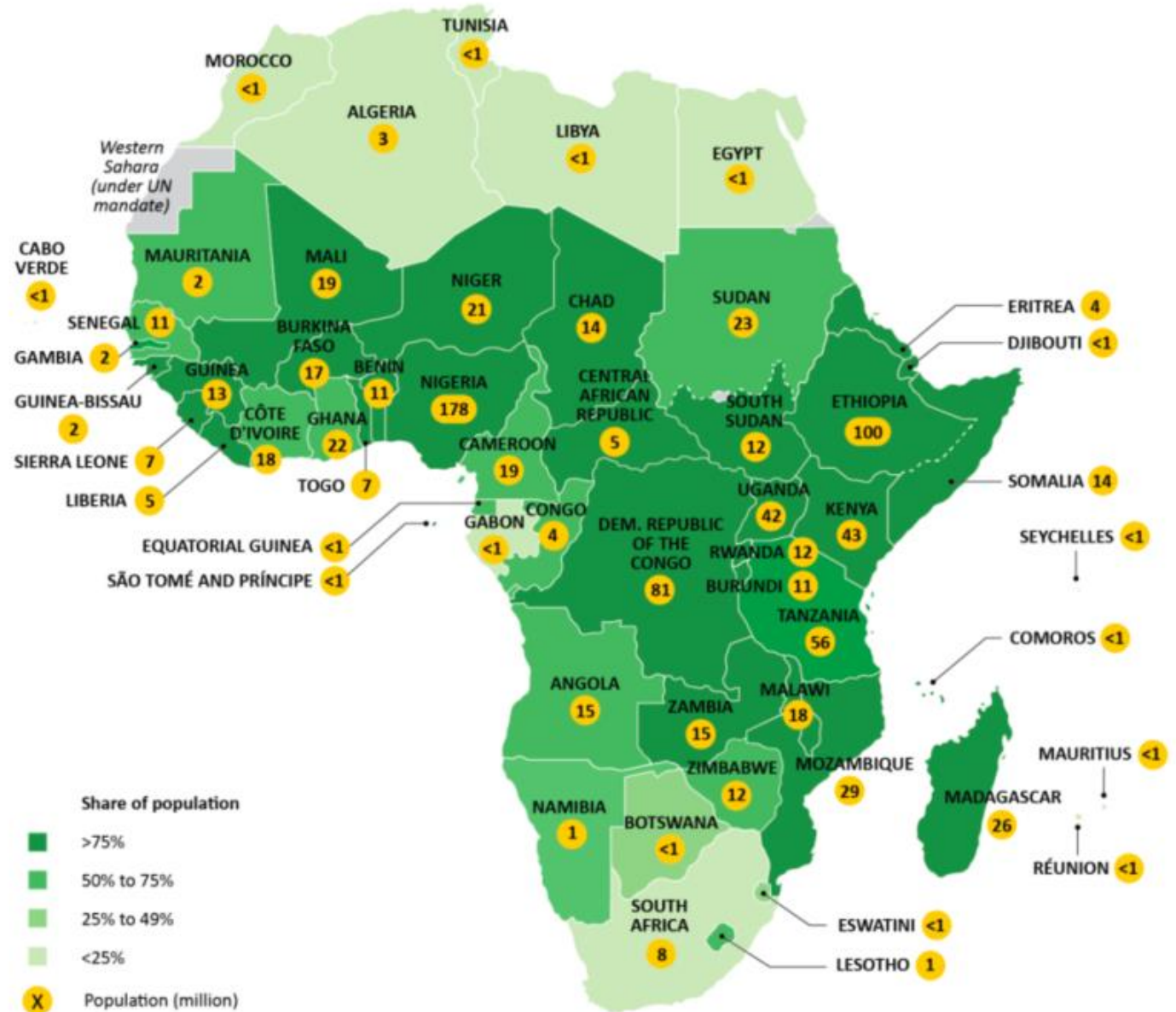
	Investment cost (\$)	Efficiency	Daily hours for cooking	Consumption per household (toe/year)
Traditional cookstoves				
Charcoal	3 - 6	20%	2 - 4	0.5 - 1.9
Fuelwood, straw	0 - 2	11%	2 - 4	1.0 - 3.7
Alternative cookstoves				
Kerosene	30	45%	1 - 3	0.1 - 0.2
LPG	60	55%	1 - 3	0.08 - 0.15
Electricity	300	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

4) Clean cooking



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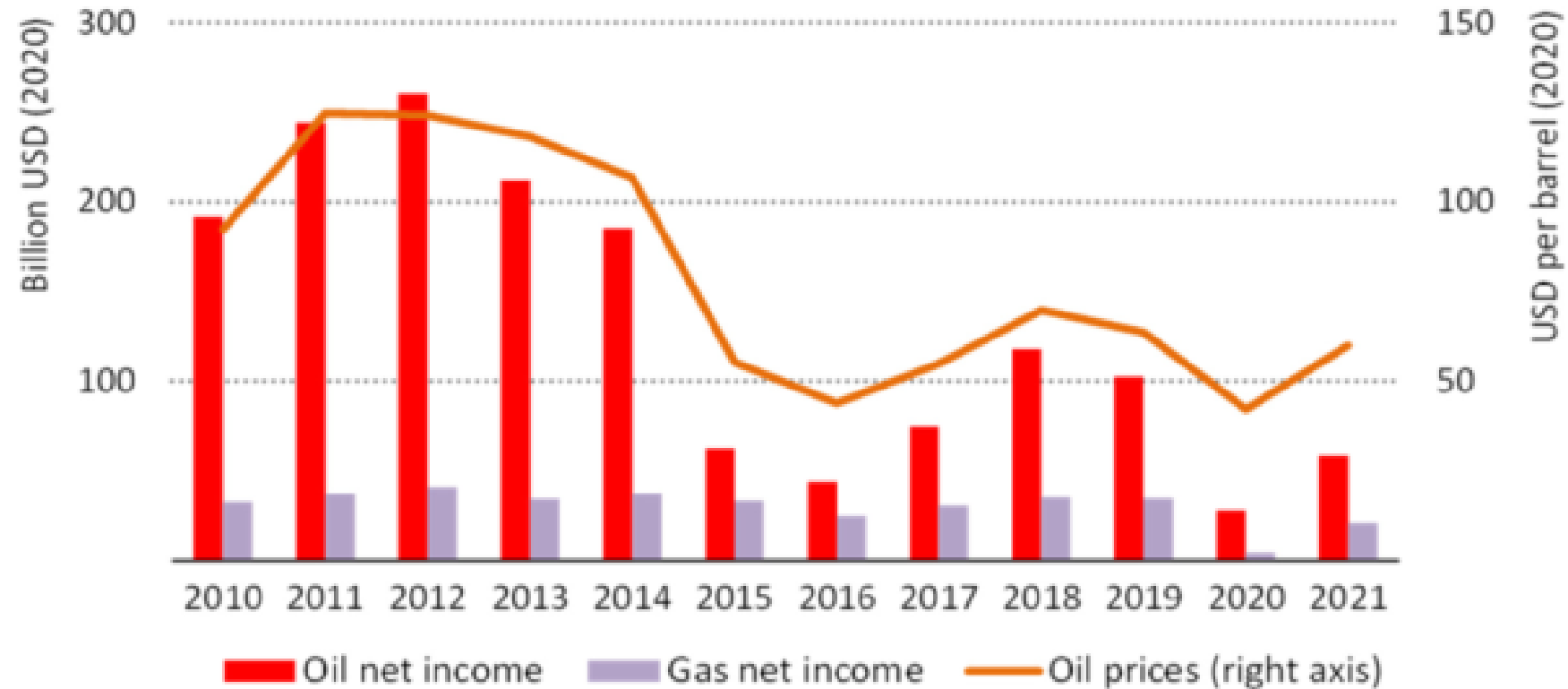
4) Population without access to clean cooking, 2018



5) Hydrocarbon resources

- The whole continent (incl. North Africa) - around 450 billion barrels of technically recoverable oil (about 7% of the world, mainly in Nigeria and Angola).
- Natural gas used sparsely – about 5% in energy mix. 100 tcm (13% of the global total) of recoverable natural gas, often flared (1/3 of the whole production). Plenty of new discoveries, prospects of increased consumption. Nigeria, Mozambique, Tanzania. Expensive infrastructure needed.
- 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 (20% of world reserves).

5) Oil and gas net income in Africa, 2010 - 2021



- In Sub-Saharan Africa half of total export value derived from fossil fuels.

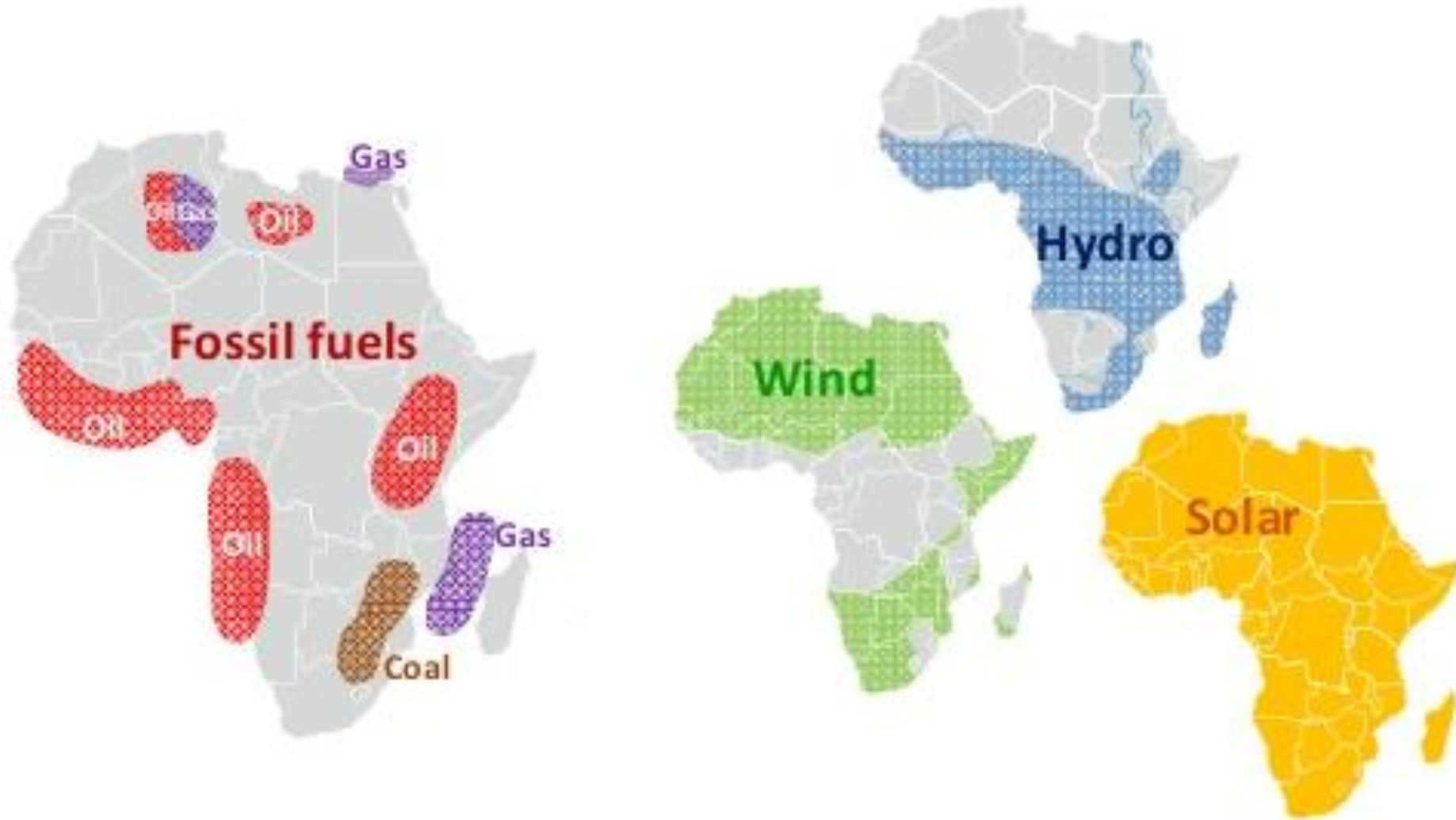
5) Nigeria and its oil

- 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 - 200 kb/d plus oil spills due to sabotages (some 7-8% of output).
- Nigeria as a rentier state – largest economy in the region but several key human development indicators (education, life expectancy) on the regional average.
- https://www.youtube.com/watch?v=KagZ76EXU_I

6) Renewable sources

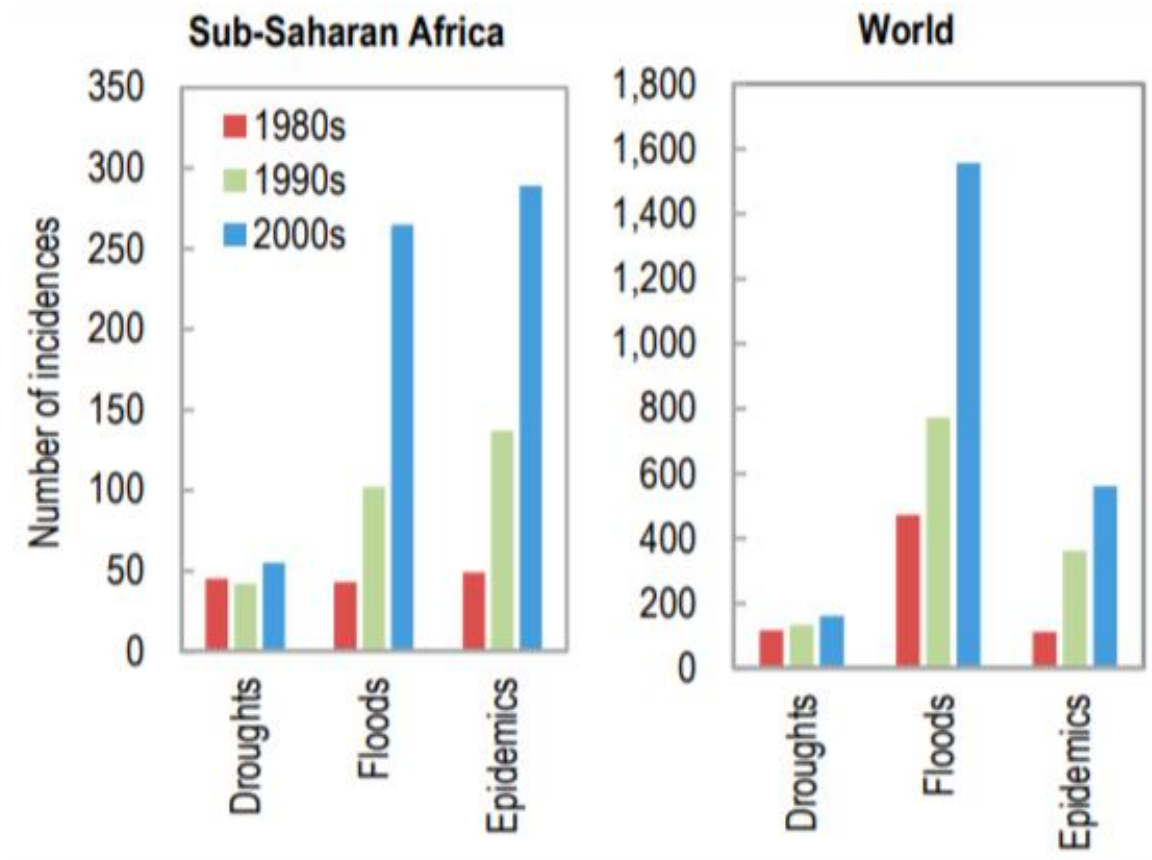
- Development limited by financing, underdeveloped grids and infrastructure, uncertain policy environment.
- Around 4 GW of solar PV added between 2010 and 2018.
- Total of 35 GW of hydro capacity across Africa. 60% of investments between 2010 and 2015 from China.
- About 5.5 GW of wind total.
- Bioenergy – 60% of primary energy use.
- Decentralized systems, off-grid systems?

6) Renewable potential



7) Climate change impact

- More than 680 million (more than half of the population) in areas where cooling is needed.

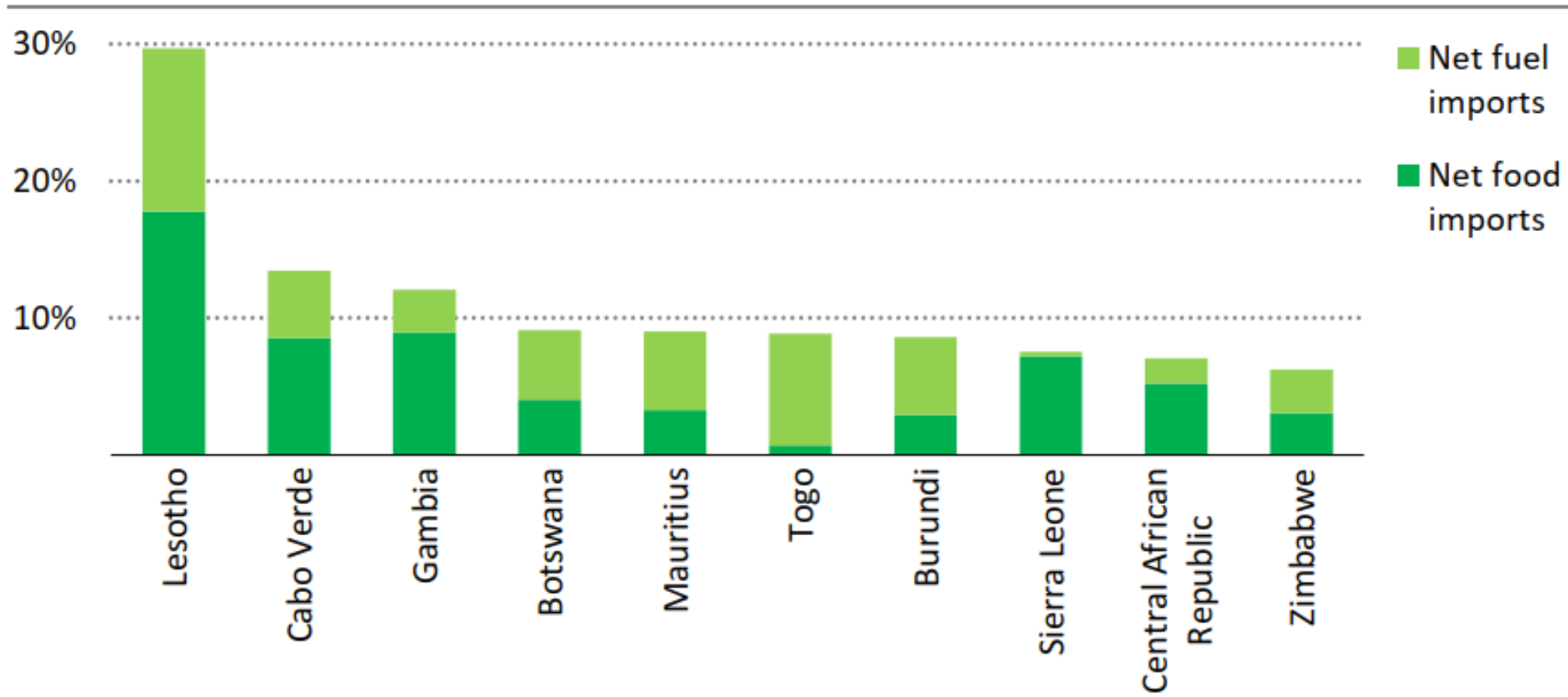


Incidences of natural disasters, 1980s-2000s

Latest development

- Covid pushed Africa into recession (income from fossil fuels – 20% drop in oil -> underinvestments, supply chains, foreign investments). Russia's invasion added increasing prices for energy and food importers.
- Money spent on Covid and war-related subsidies are and will be missing in (energy) investments.
- Number of people without access to electricity starts to increase again, situation even worse with clean cooking.
- 53 countries have submitted a Nationally Determined Contribution pledges. 12 countries, which together represent over 40% of those emissions, have also announced net zero emissions goals. Many African NDCs include targets that are conditional on financial support from developed countries, amounting to USD 1 200 billion in the period to 2030 (sic).

Net imports of food and fuel as a share of GDP in selected African countries, 2020



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Crossroads

Africa's energy transition challenges

„Africa today loses between \$7 billion and \$15 billion a year to climate change. And if things don't change, it will be \$50 billion a year by 2030. Africa doesn't have access to the financing it needs to adapt to climate change and meet nationally determined contributions. By 2030 Africa will need between \$1.3 to \$1.6 trillion.“ - Akinwumi Adesina, President of the African Development Bank.

- Africa's share on global CO₂ emissions – about 3-4% to date (vs. 18% of global population).
- Growing population (nearly 40% in extreme poverty), resource and economic potential.
- But climate demands (not to pollute) and pressures (loss and damages, mitigation, and adaptation).

Some extreme weather events, 2022

- Drought and famine killed 2,500 people in Uganda, affected eight million in Ethiopia this year.
- More than 600 people have died in Nigeria's worst floods in a decade.
- Southern African countries, including Madagascar and Mozambique, were battered by six severe storms this year, killing at least 890 people.
- Temperatures reached 48°C in Tunisia in July, fanning the flames of extreme wildfires.
- Nearly two million people in Chad were affected by floods in August and October.
- Just to name a few...

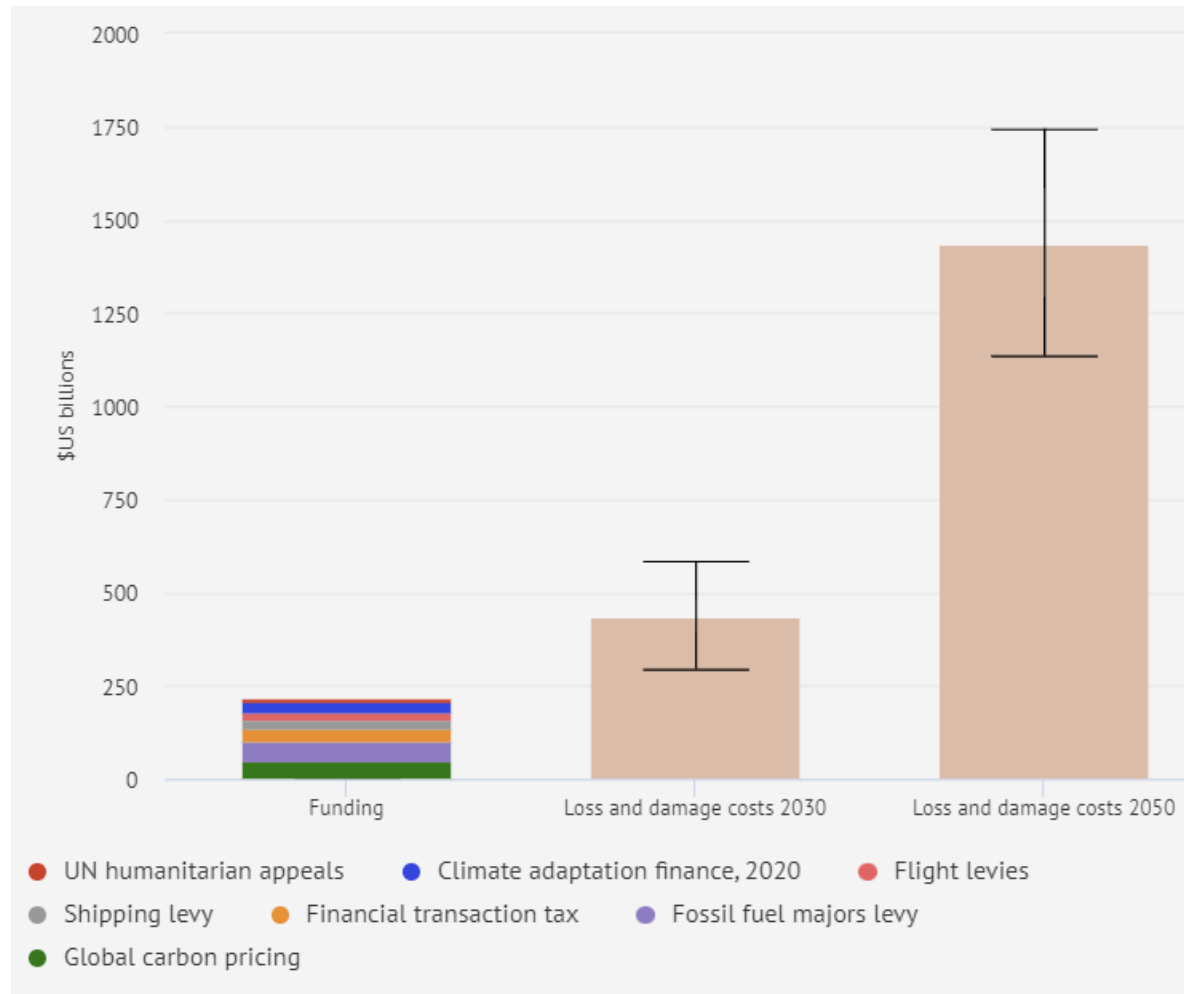
Climate justice

- It is usually the poor countries that are hardest hit. Without really contributing to the climate change.
- Who should pay the costs of mitigation, adaptation, and loss and damages?

Leapfrogging to...what?

- 1) Energy intensive manufacturing as a traditional way of countries moving (economically) forward. (Could Africa leap into a service economy without building industrial base, which needs massive supplies of energy?) -> Technology spillover (from technologically more developed countries).
- 2) What technologies and systems should be implemented? Fossil fuels? Renewables? Centralized? Decentralized?
- 3) Could complex systems, overlapping to multiple other areas, be easily implemented without previous buildup of technologies, education, cultural and social norms, legal system, financial system etc.?
- 4) Differentiation between partial improvements (solar appliances) and industrial scale production of goods.

Existing and planned mitigation and adaptation transfers to Africa



Sources

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- IEA (2014): Africa Energy Outlook.
- IEA (2017): Energy Access Outlook 2017: From Poverty to Prosperity.
- Hafner, M.; Tagliapietra, S.; de Strasser, L.(2017): Energy In Africa: Challenges and Opportunities.
- Oxford Institute for Energy Studies (2018): Electrifying Africa.
- IMF (2019): Regional Economic Outlook: Sub-Saharan Africa.
- CarbonBrief (2022): Analysis: Africa's unreported extreme weather in 2022 and climate change

Loss and damage

3. The Parties accordingly agree as follows:

- (a) The financial burden of loss and damage suffered by the most vulnerable small island and low-lying developing countries (hereinafter referred to as "Group 1 countries") as a result of sea level rise shall be distributed in an equitable manner amongst the industrialized developed countries (hereinafter referred to as "Group 2 countries") by means of a Pool;

Loss and damage

- Compensations vs. insurance
- Existing vs. new (additional) money.

Article 8

1. Parties recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage.

Average electricity losses in power systems, electricity demand served by back-up generators, and share of hours of electricity supply lost to outages, 2018

