Capacity Building for Agenda 2030

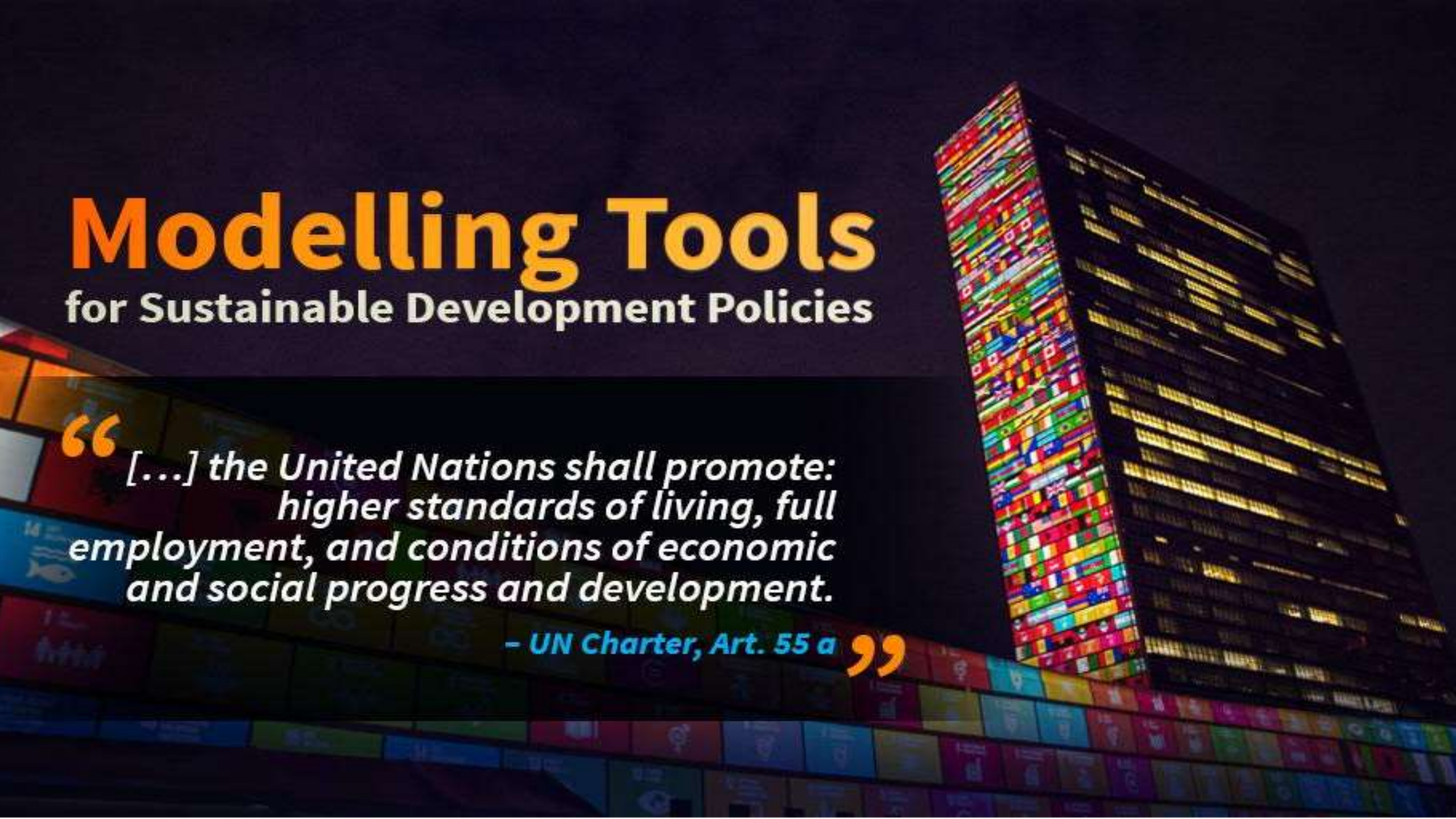
African Energy Renaissance – An Immense Investment, Technology and Sustainable Development Prospect

GETIT – The Global Electrification Tool
TEMBA – The electricity Base Model for Africa

Mark Howells, Dimitris Mentis, Francesco Fuso-Nerini, Oliver Broad, Constantinos Taliotis, Morgan Bazilian & Holger Rogner

Modelling Tools

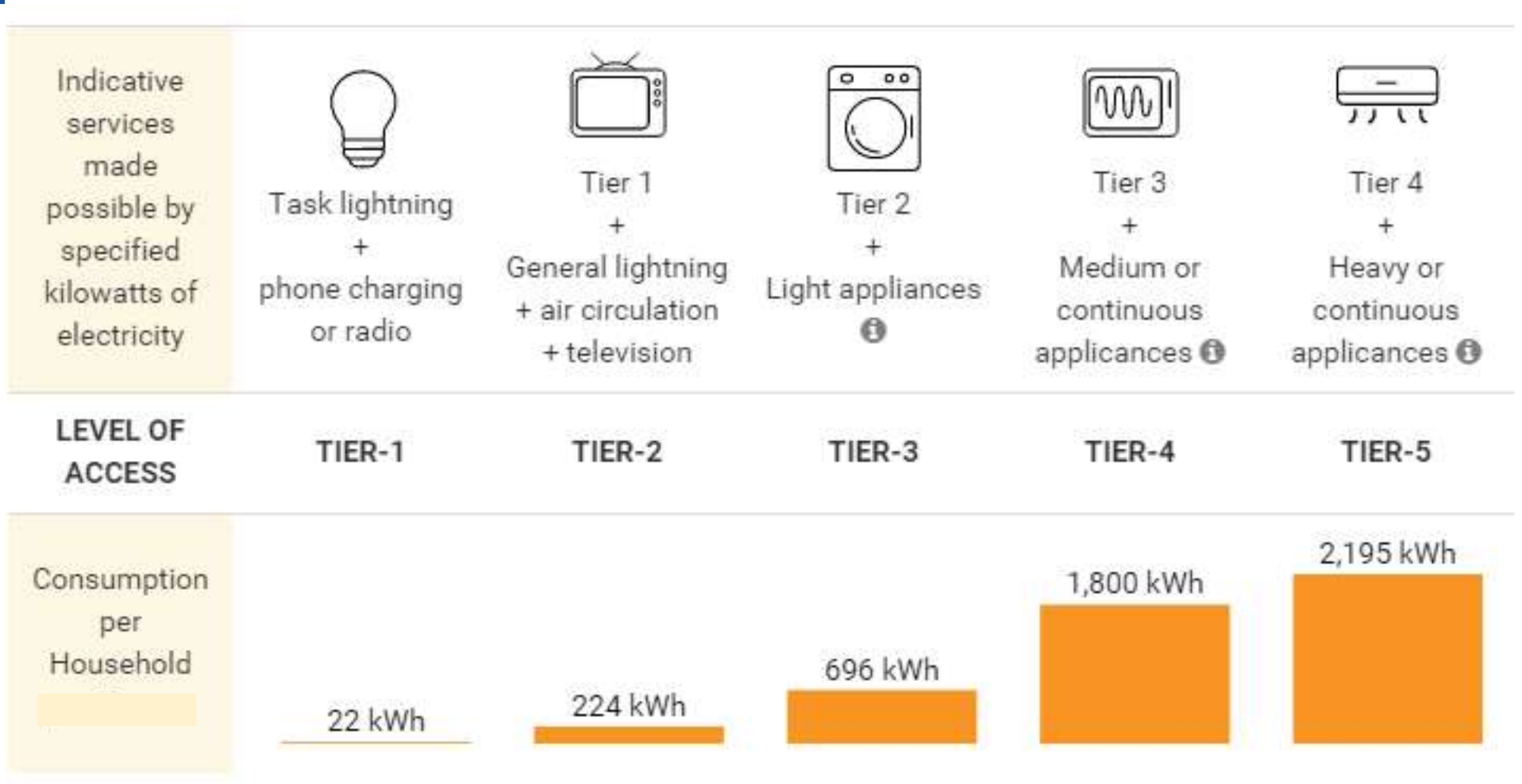
for Sustainable Development Policies



“[…] the United Nations shall promote: higher standards of living, full employment, and conditions of economic and social progress and development.”

– UN Charter, Art. 55 a

Electricity for all – What does it mean?

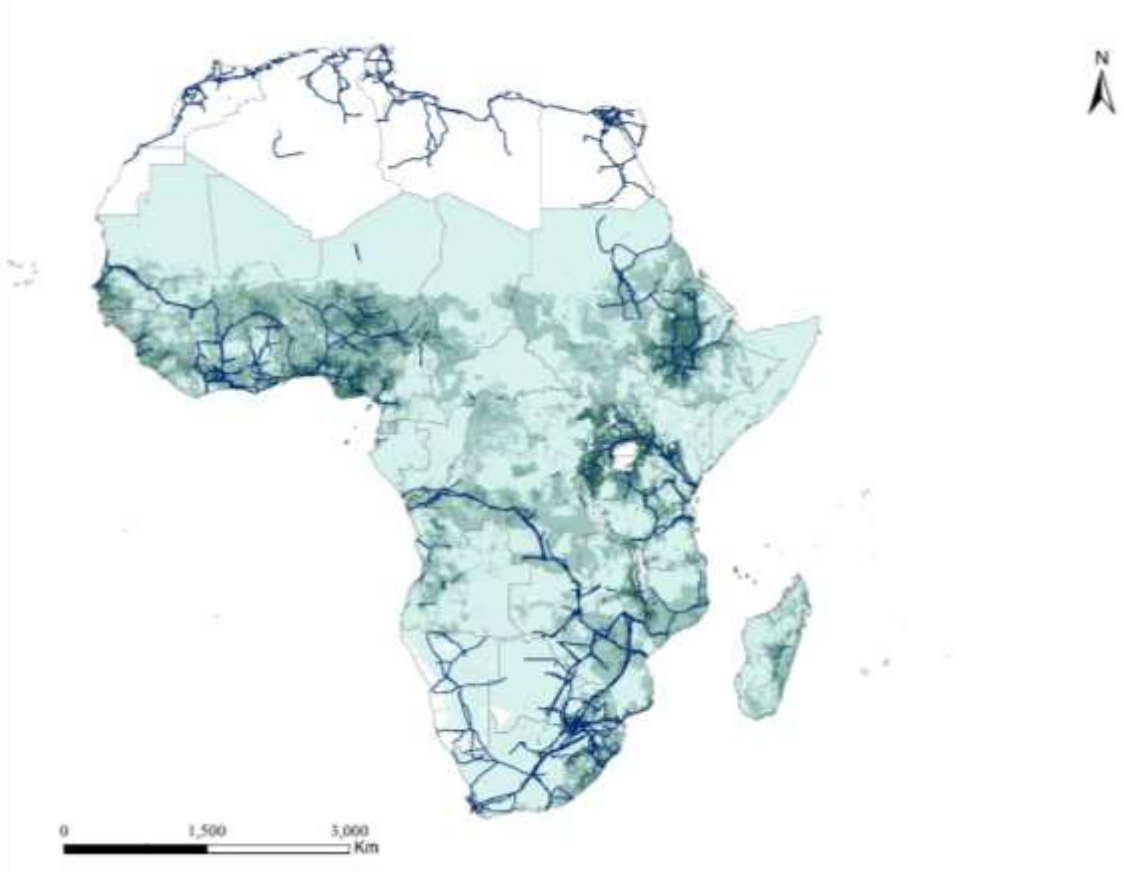



GRID


MINI GRID


STANDALONE

Population current



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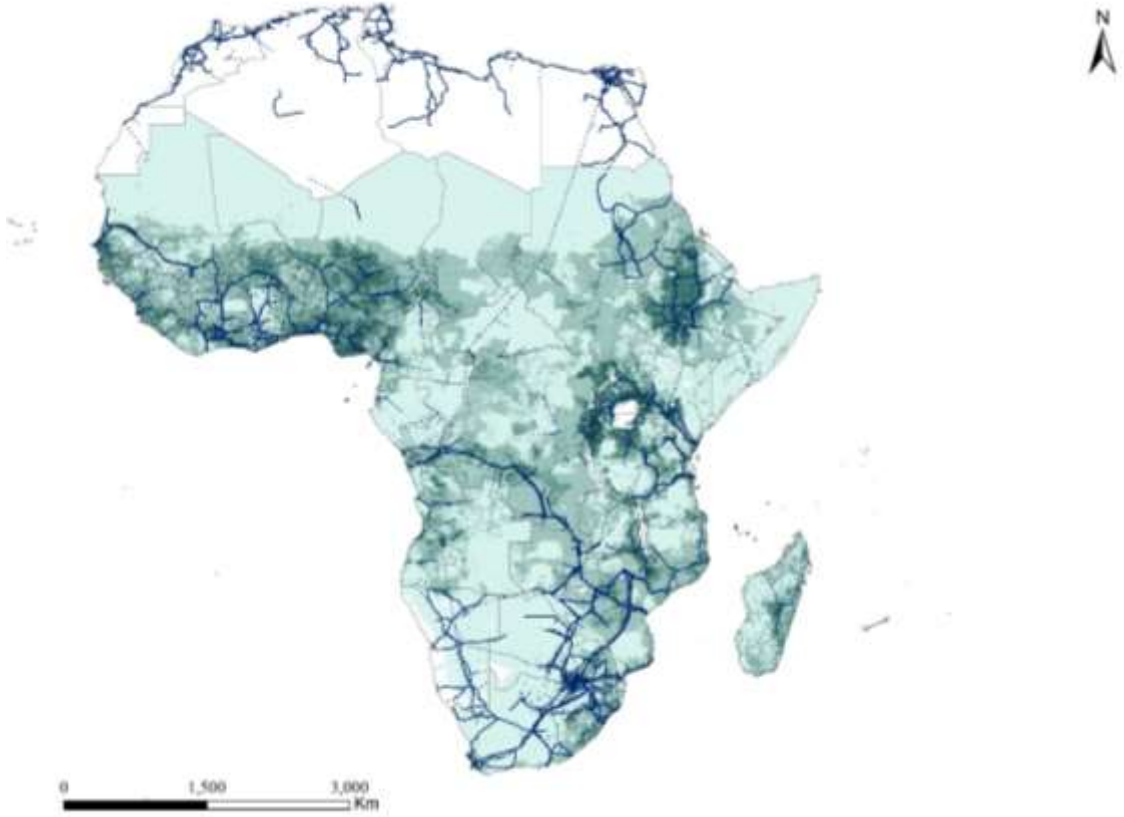
Population 2030



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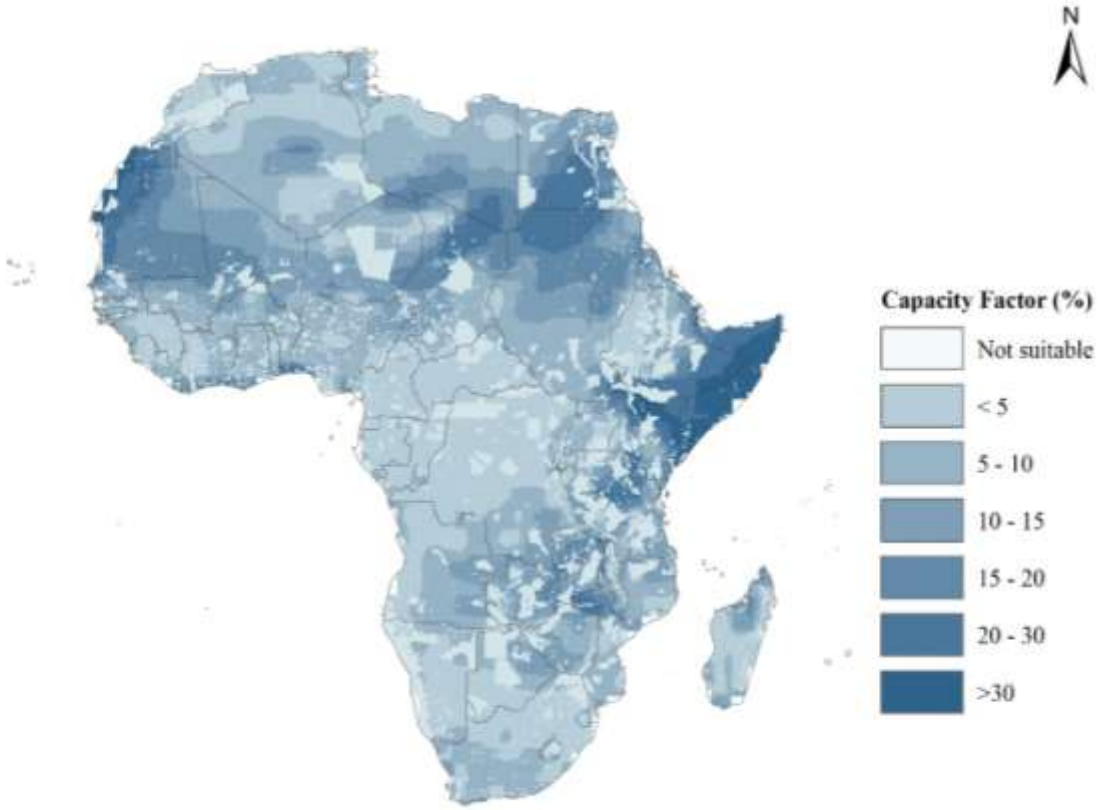
Wind potentials



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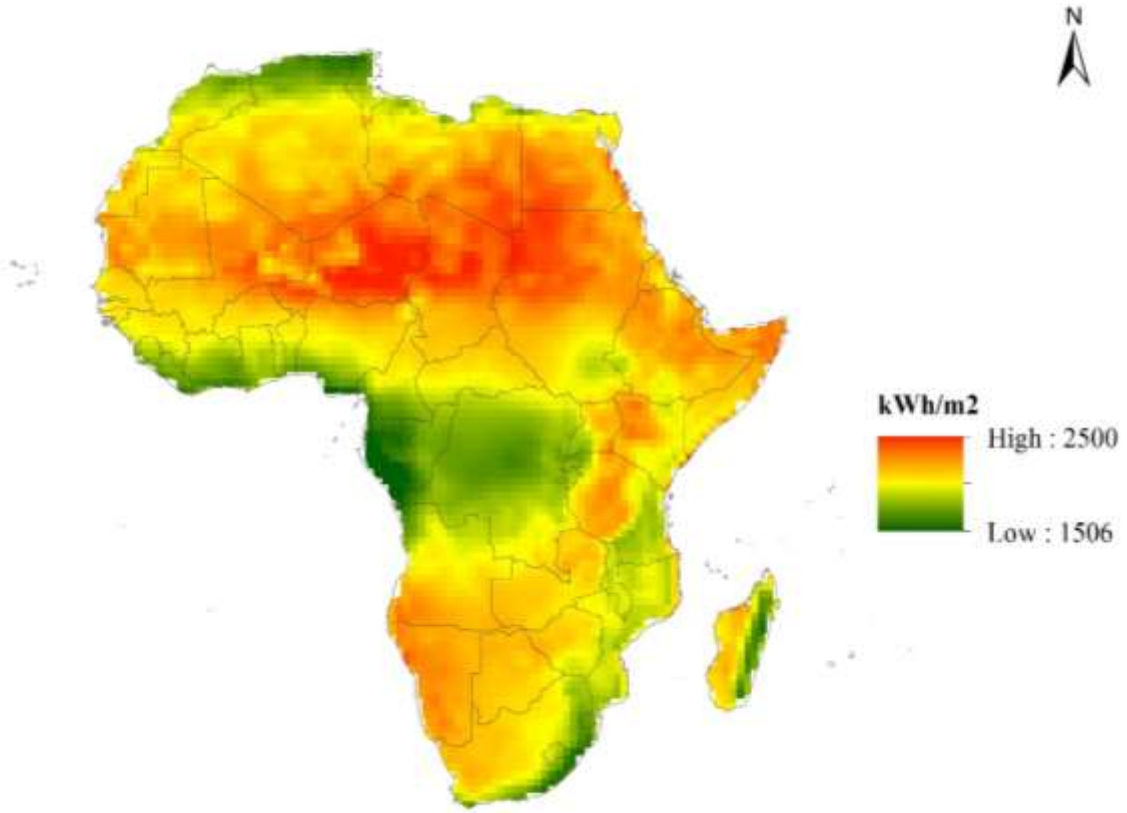
Solar Potentials



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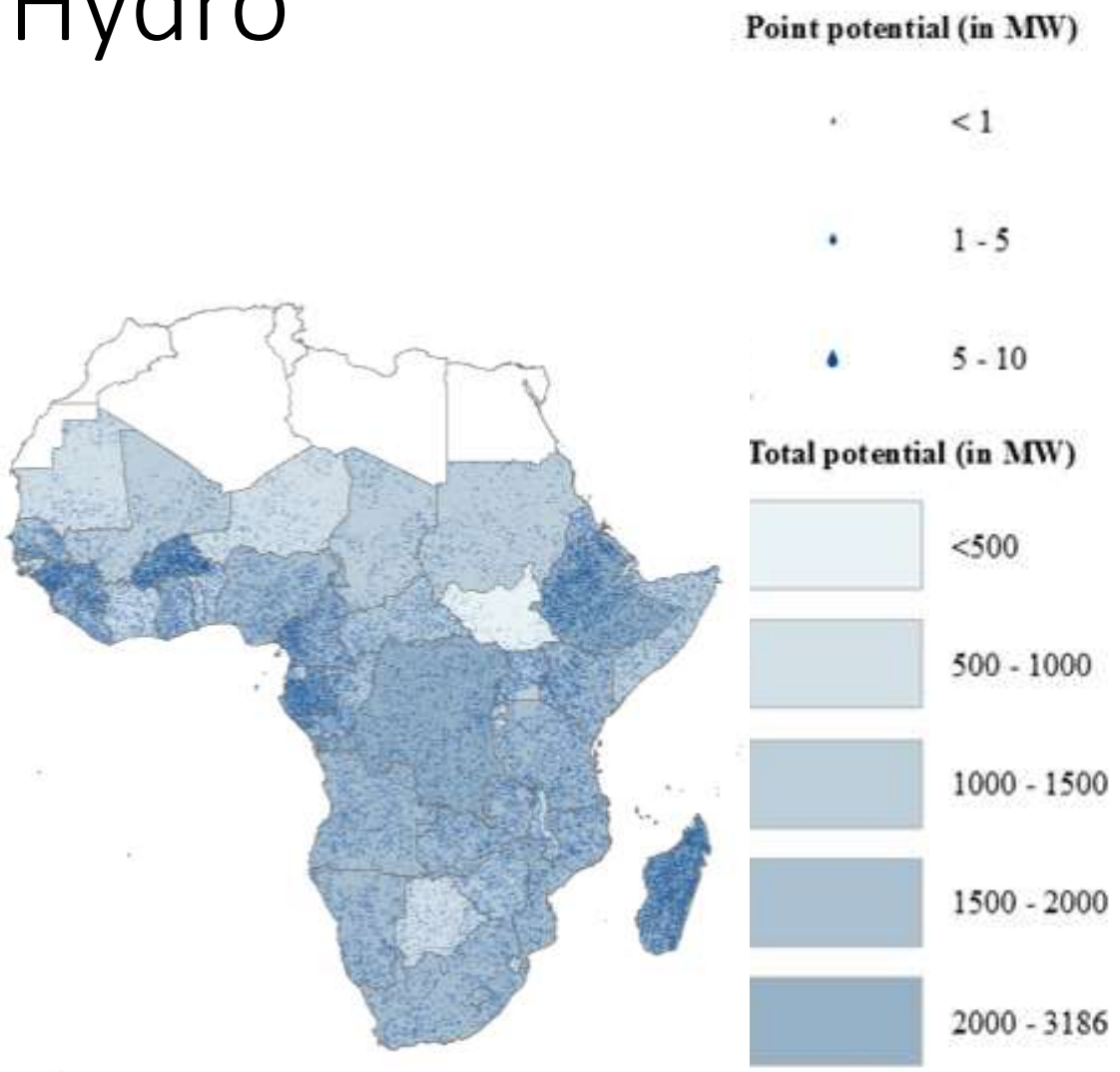
Small/Mini Hydro



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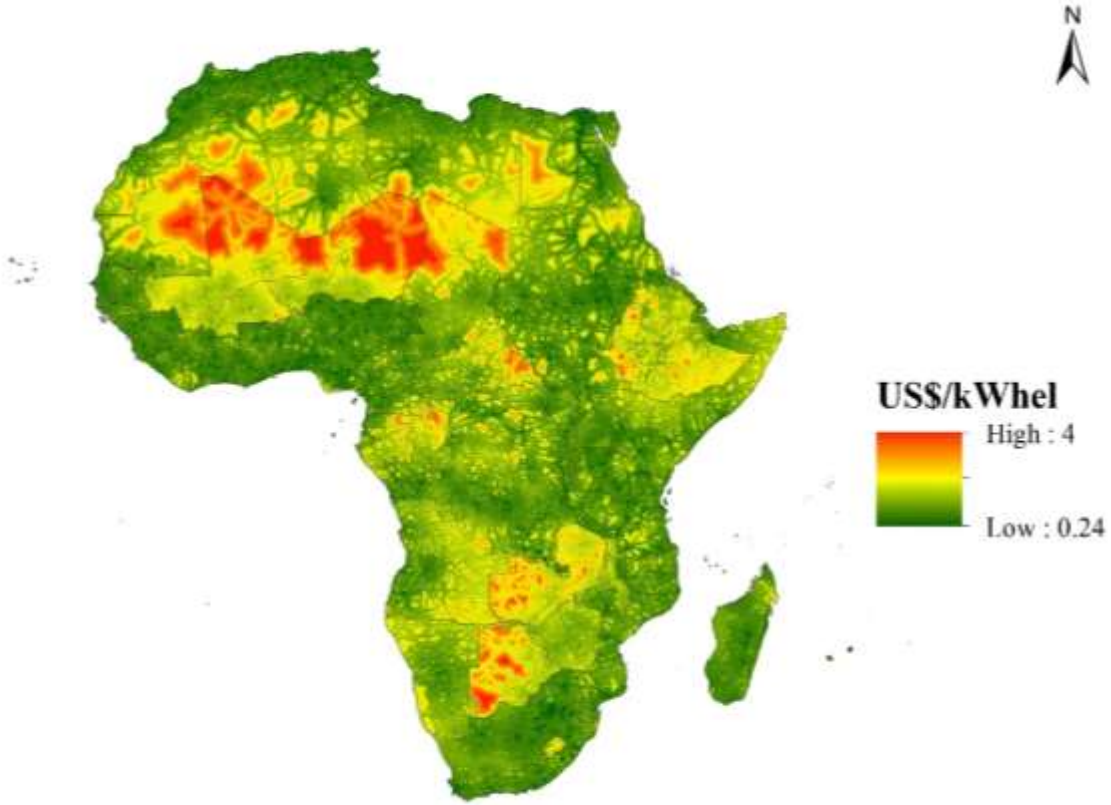
Diesel generation costs

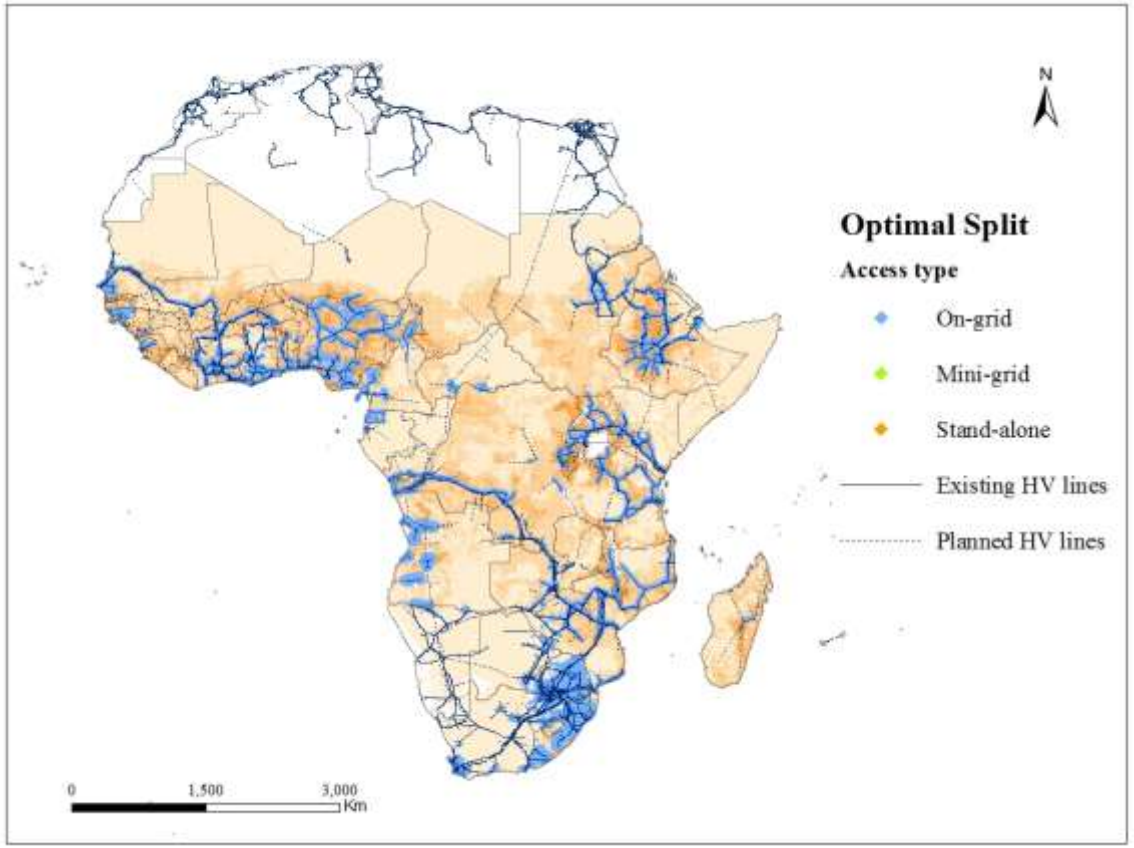


Capacity Building for Agenda 2030

Access: Tier 1 (lighting)

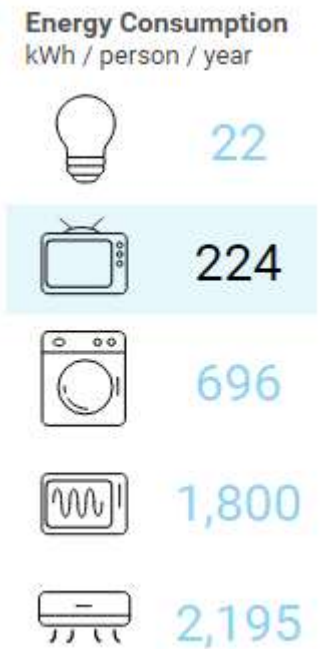
Energy Consumption
kWh / person / year

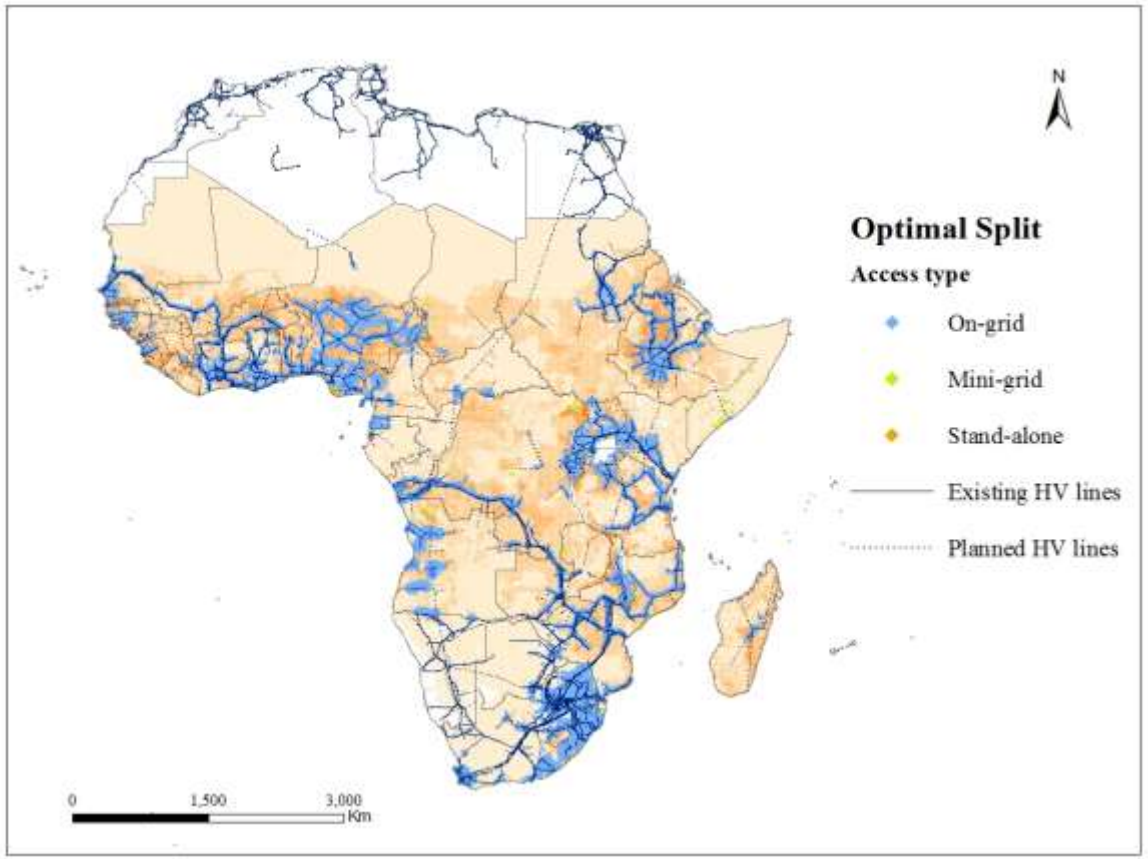
	22
	224
	696
	1,800
	2,195



Capacity Building for Agenda 2030

Access: Tier 2 (lighting, fan, TV)



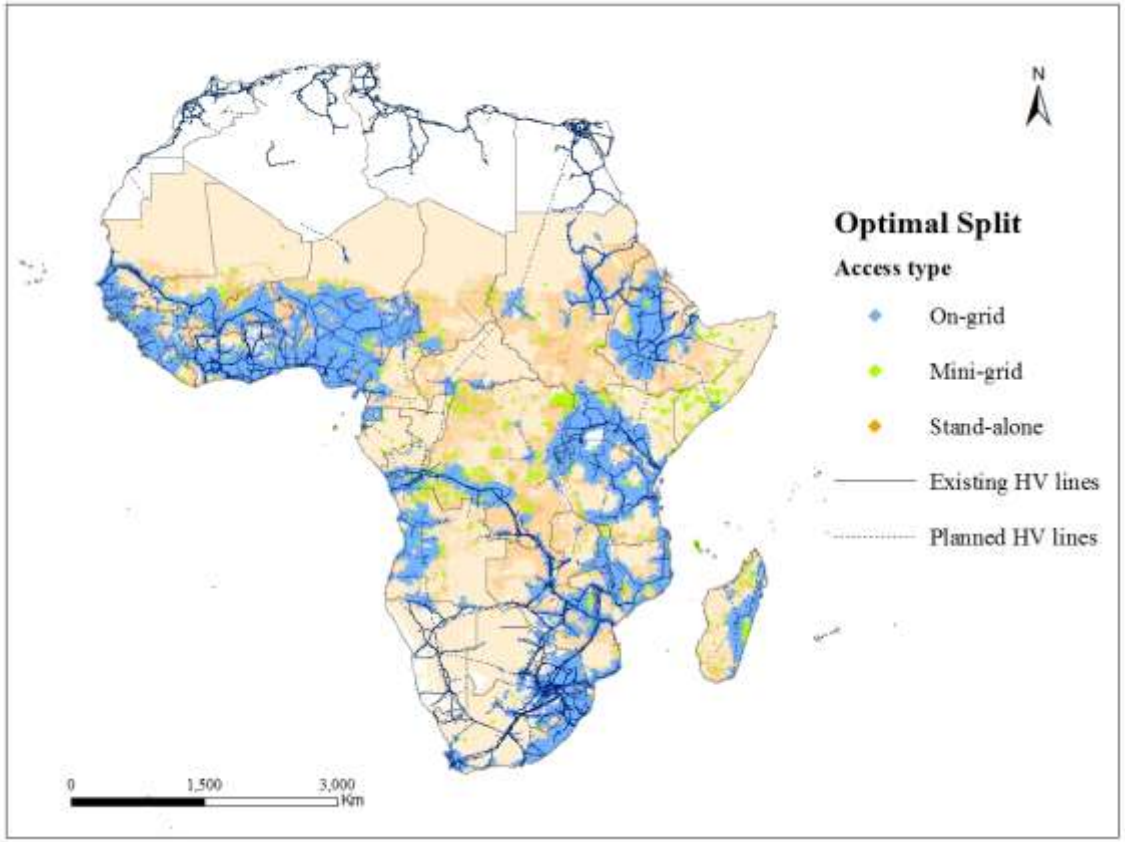


Capacity Building for Agenda 2030

Access: Tier 3 (light appliances)

Energy Consumption
kWh / person / year

	22
	224
	696
	1,800
	2,195

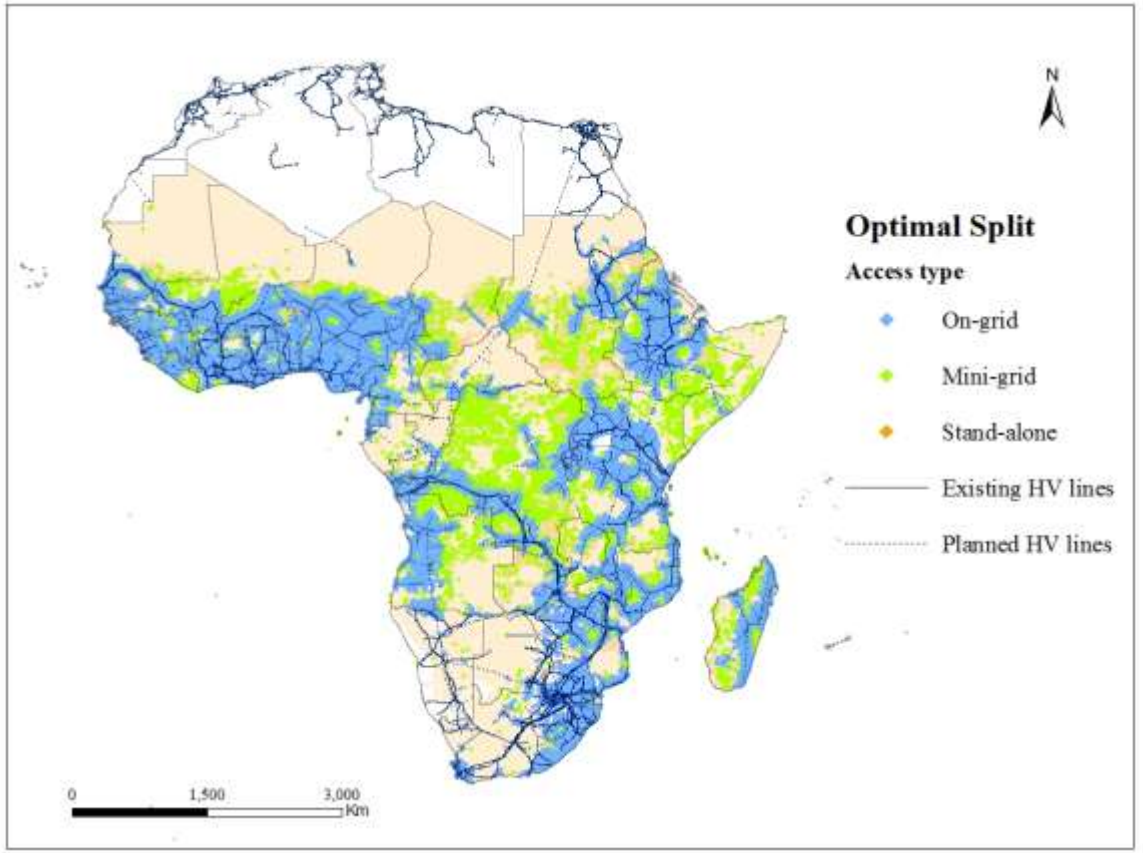


Capacity Building for Agenda 2030

Access: Tier 4 (medium appliances)

Energy Consumption
kWh / person / year

	22
	224
	696
	1,800
	2,195

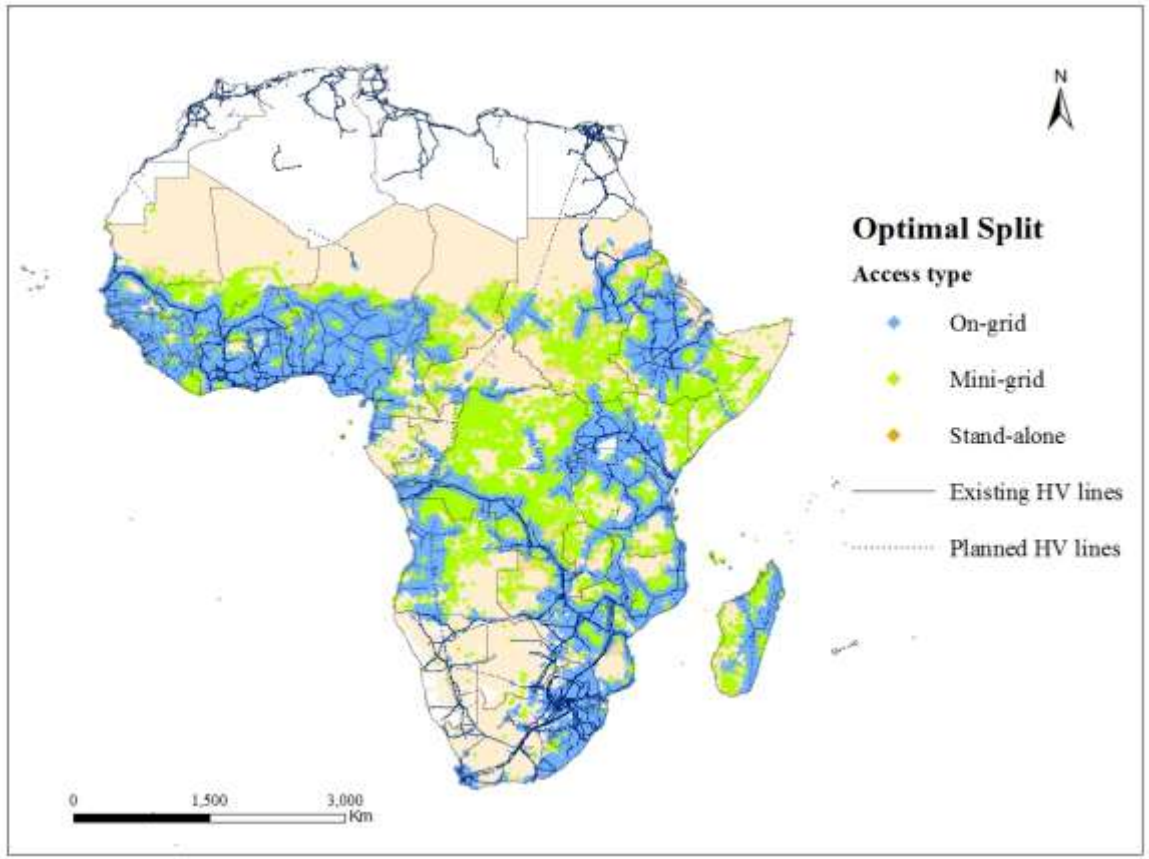


Capacity Building for Agenda 2030

Access: Tier 5 (heavier appliances)

Energy Consumption
kWh / person / year

	22
	224
	696
	1,800
	2,195

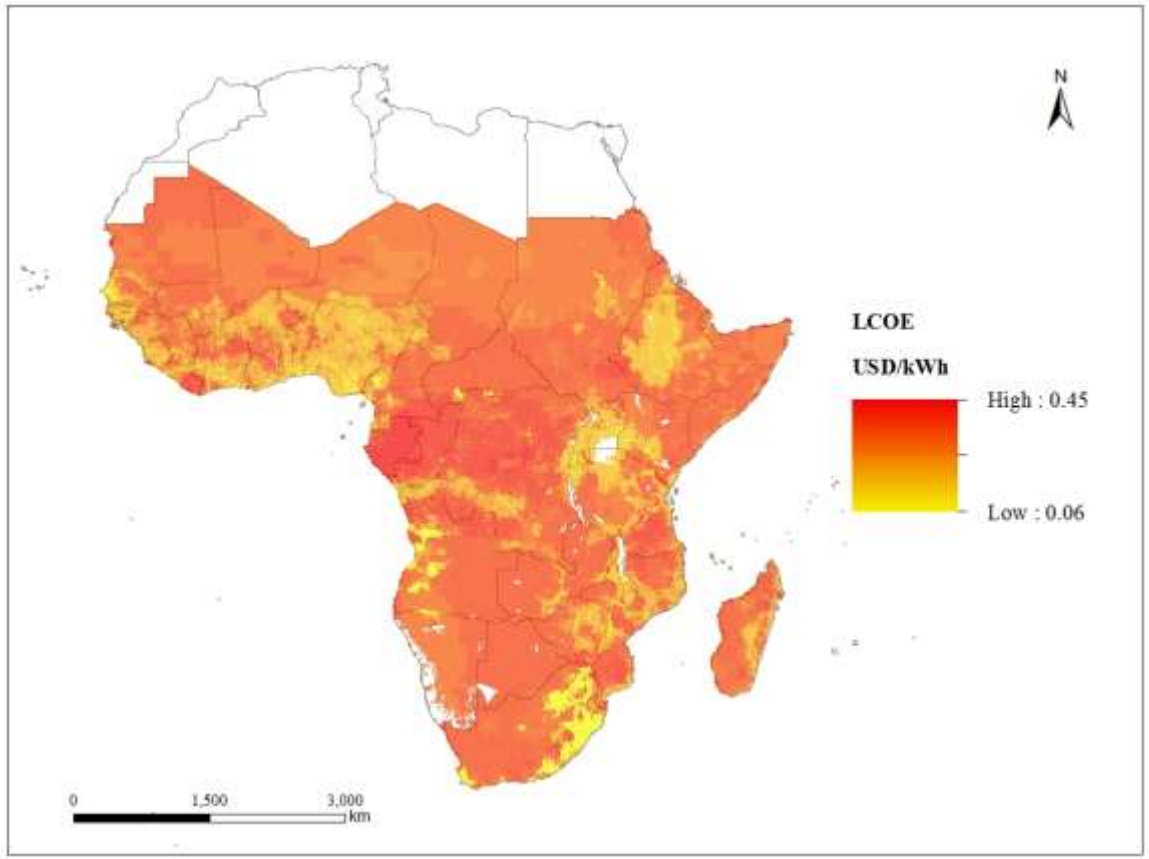


Capacity Building for Agenda 2030

Access: Tier 5 (heavier appliances)

Energy Consumption
kWh / person / year

	22
	224
	696
	1,800
	2,195

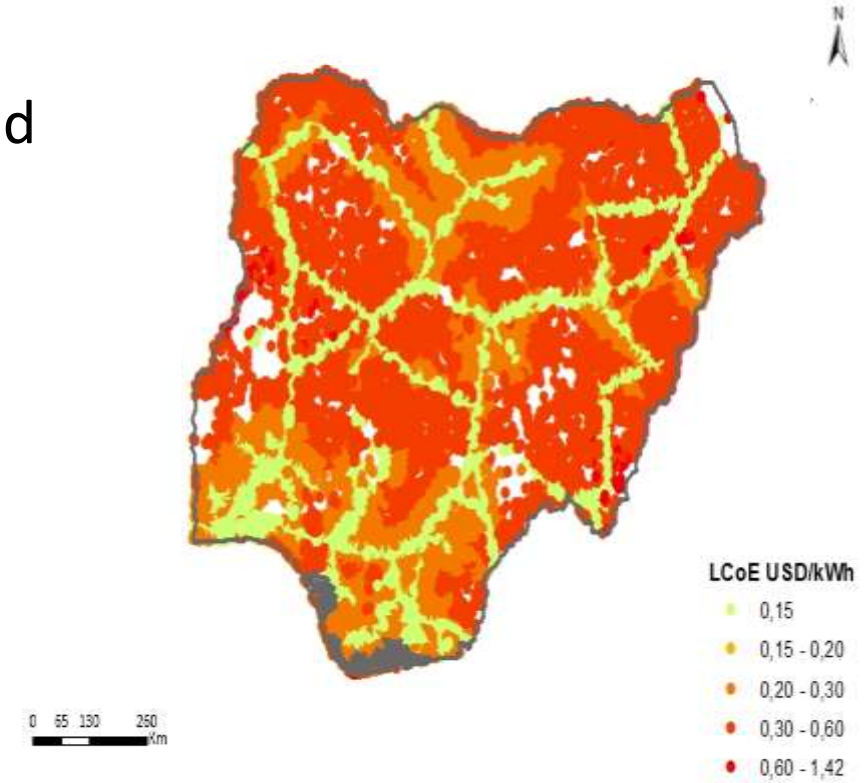


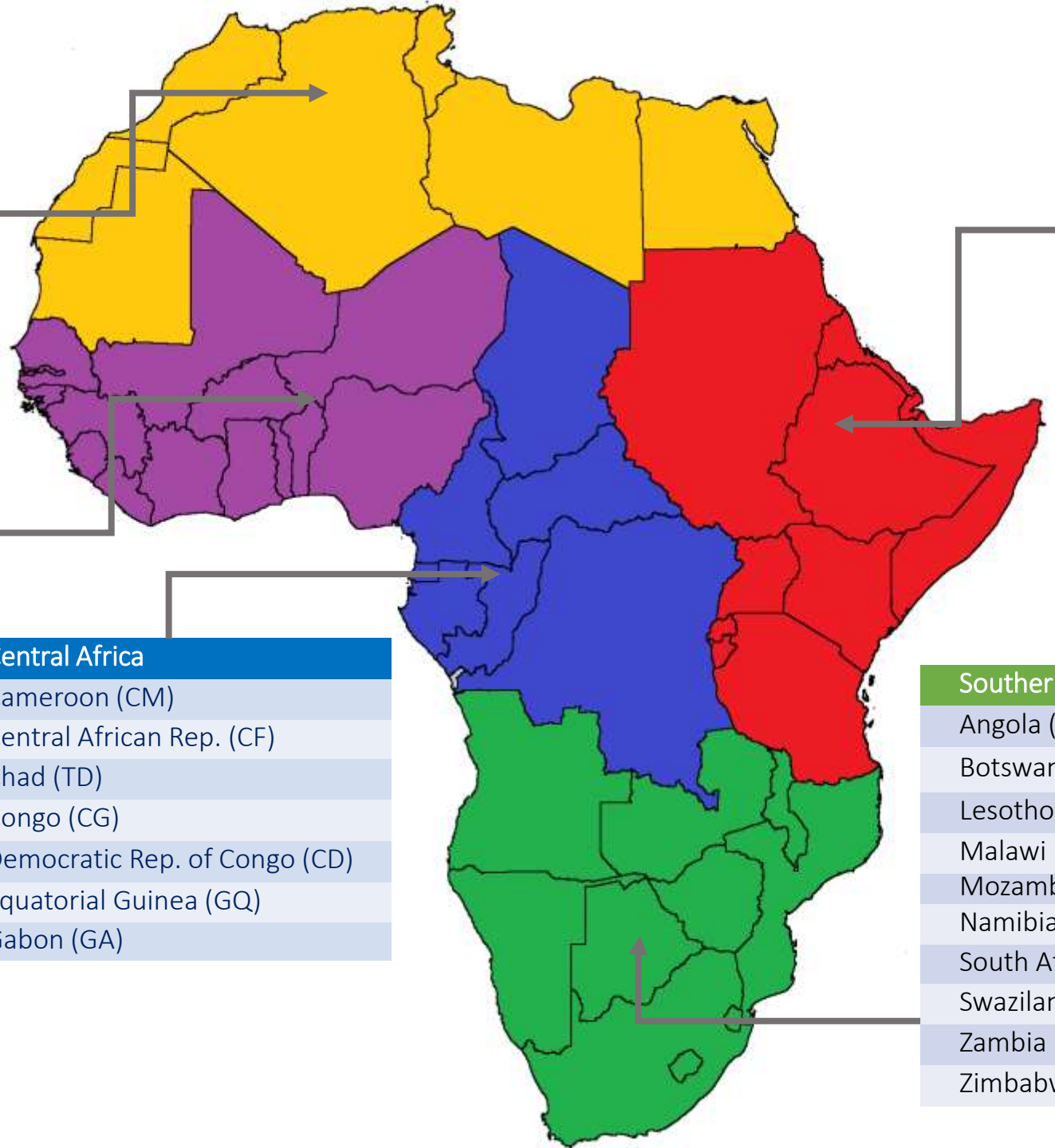
Capacity Building for Agenda 2030

National Capacity Building for Agenda 2030

National dialogue

- Administrative areas
- Population data/Demand
- Existing Transmission Network
- Power plants & Mines
- Expansion of HV/MV
- Resources potentials
- Optimal Split
- LCoE
- For EVERY country in the World …





Northern Africa
- Algeria (DZ)
- Egypt (EG)
- Libya (LY)
- Mauritania (MR)
- Morocco (MA)
- Tunisia (TN)

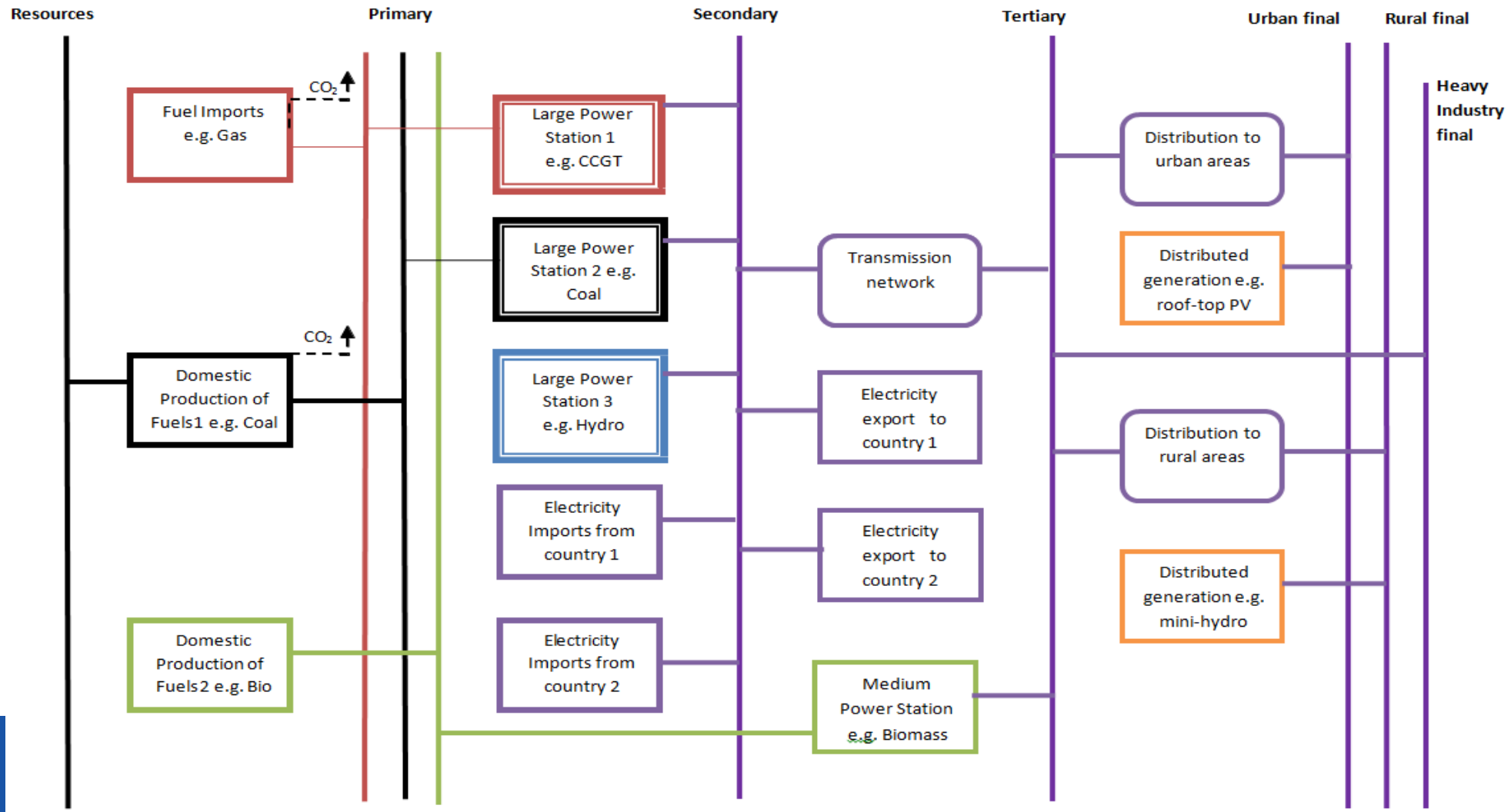
Western Africa
- Benin (BJ)
- Burkina Faso (BF)
- Cote d'Ivoire (CI)
- Gambia (GM)
- Ghana (GH)
- Guinea (GN)
- Guinea Bissau (GW)
- Liberia (LR)
- Mali (ML)
- Niger (NE)
- Nigeria (NG)
- Senegal (SN)
- Sierra Leone (SL)
- Togo (TG)

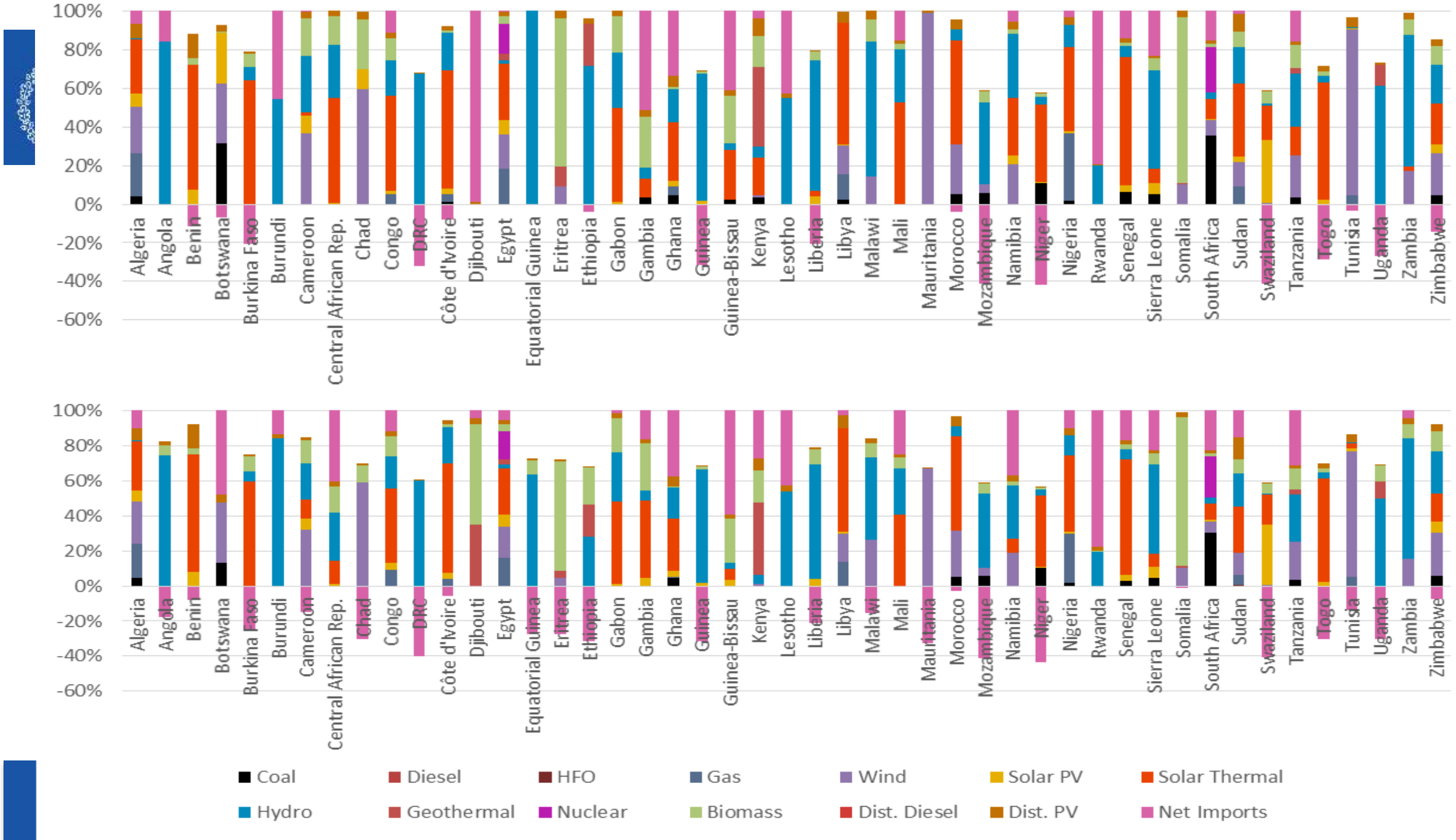
Central Africa
- Cameroon (CM)
- Central African Rep. (CF)
- Chad (TD)
- Congo (CG)
- Democratic Rep. of Congo (CD)
- Equatorial Guinea (GQ)
- Gabon (GA)

Eastern Africa
- Burundi (BI)
- Djibouti (DJ)
- Eritrea (ER)
- Ethiopia (ET)
- Kenya (KE)
- Rwanda (RW)
- Somalia (SO)
- Sudan (SD)
- Tanzania (TZ)
- Uganda (UG)

Southern Africa
- Angola (AO)
- Botswana (BW)
- Lesotho (LS)
- Malawi (MW)
- Mozambique (MZ)
- Namibia (NA)
- South Africa (ZA)
- Swaziland (SZ)
- Zambia (ZM)
- Zimbabwe (ZW)

Reference Energy System (RES)




100%
80%
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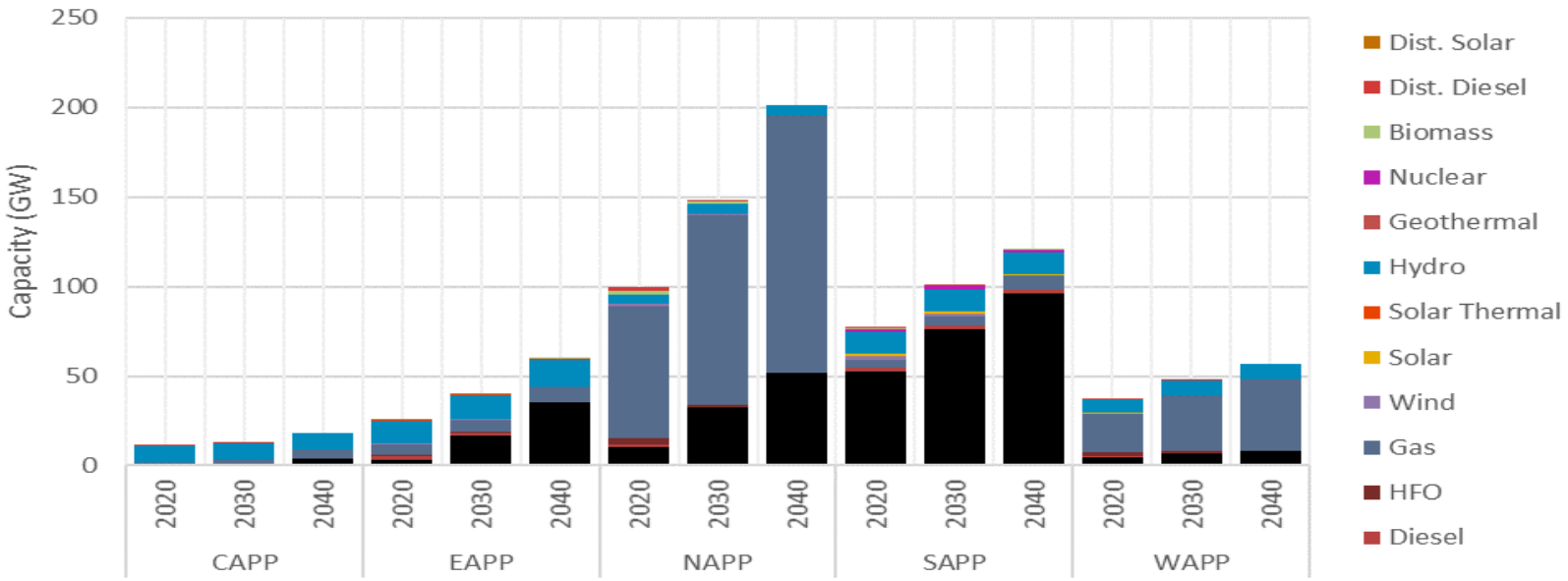
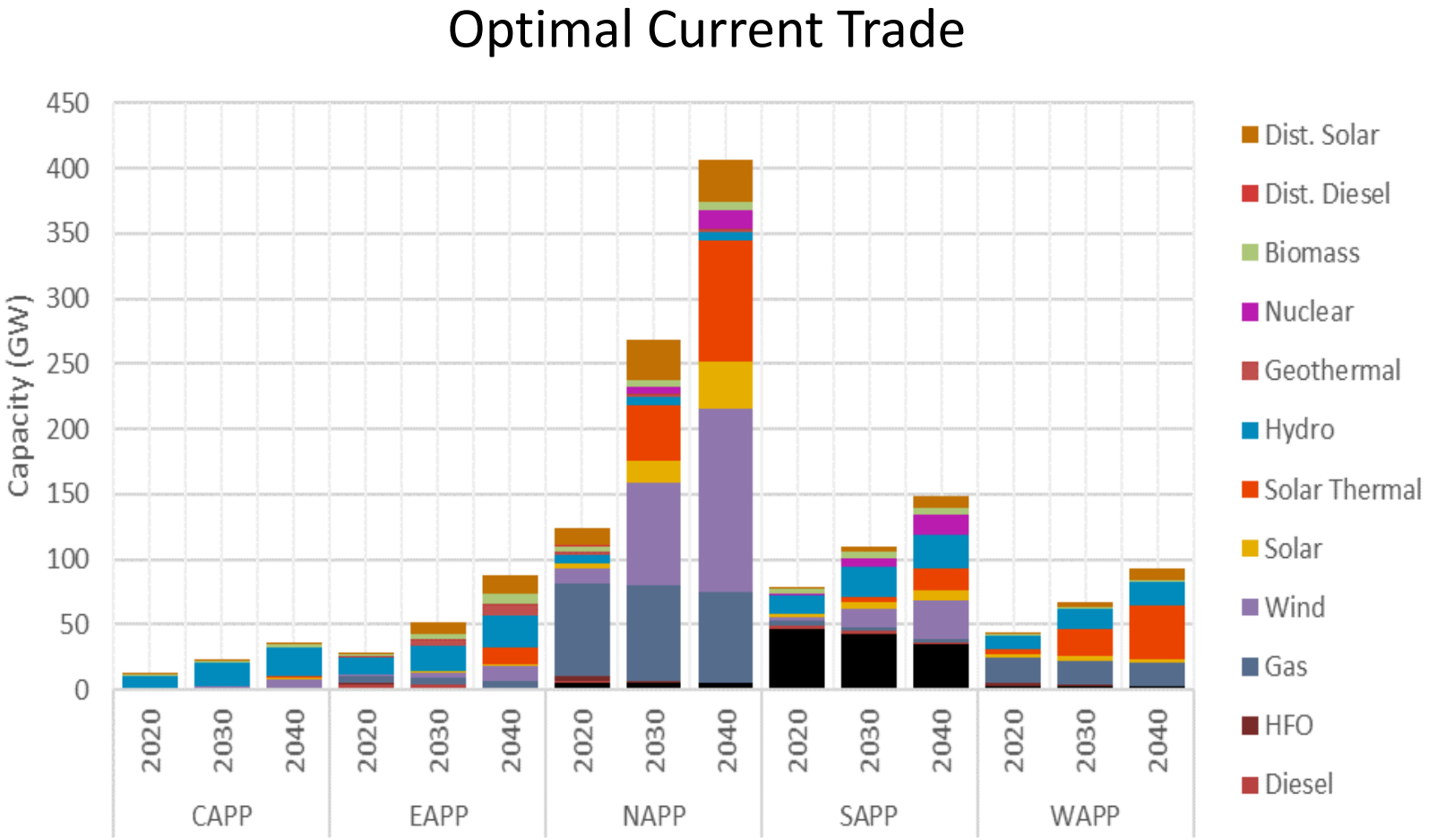
-40%
-60%
Algeria
Angola
Benin
Botswana
Burkina Faso
Burundi
Cameroon
Central African Rep.
Chad
Congo
DRC
Côte d'Ivoire
Djibouti
Egypt
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Liberia
Libya
Malawi
Mali
Mauritania
Morocco
Mozambique
Namibia
Niger
Nigeria
Rwanda
Senegal
Sierra Leone
Somalia
South Africa
Sudan
Swaziland
Tanzania
Togo
Tunisia
Uganda
Zambia
Zimbabwe
Coal
Diesel
HFO
Gas
Wind
Solar PV
Solar Thermal
Hydro
Geothermal
Nuclear
Biomass
Dist. Diesel
Dist. PV
Net Imports

Capacity per Power Pool & Fuel

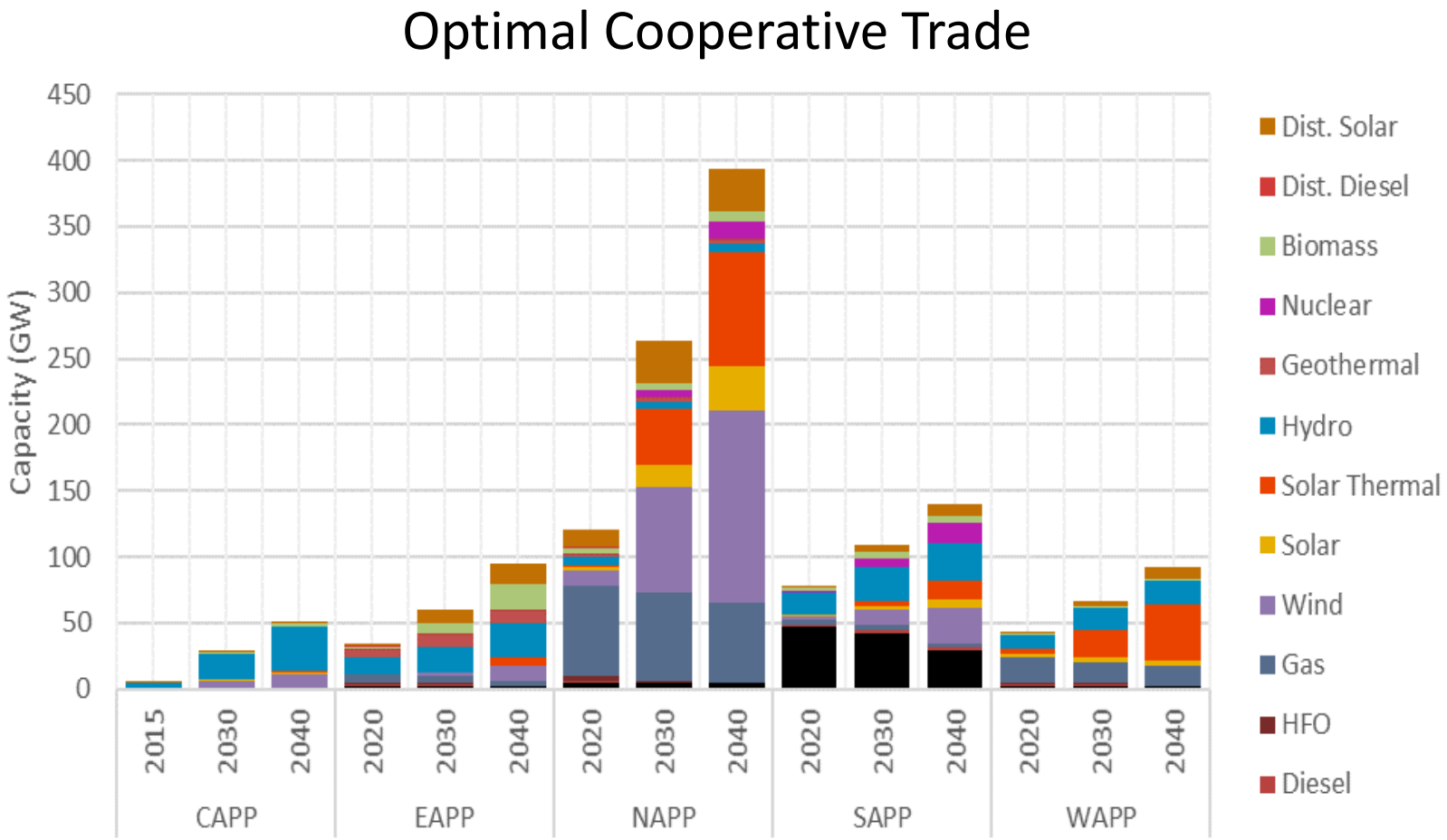
Fossil Future



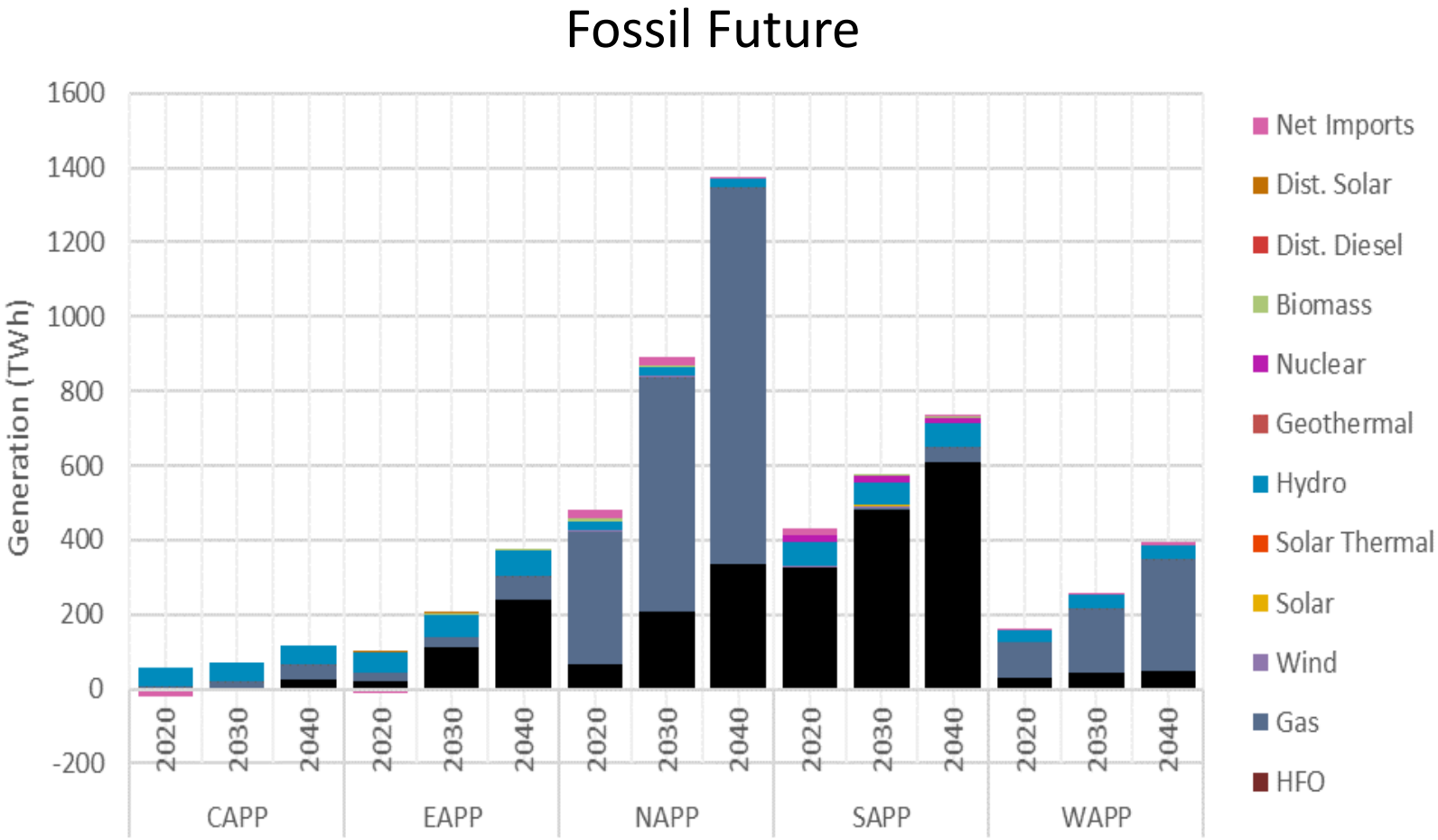
Capacity per Power Pool & Fuel



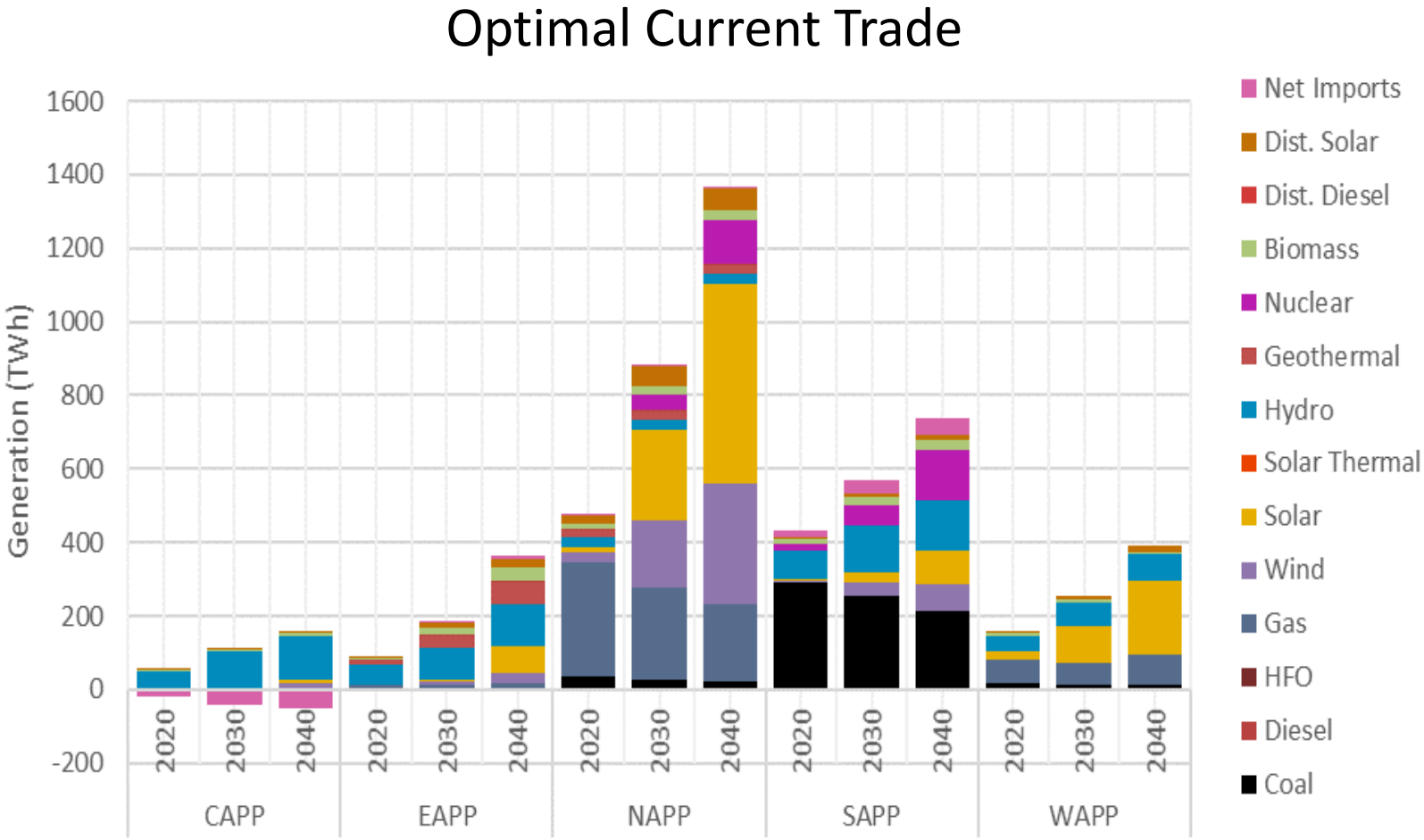
Capacity per Power Pool & Fuel



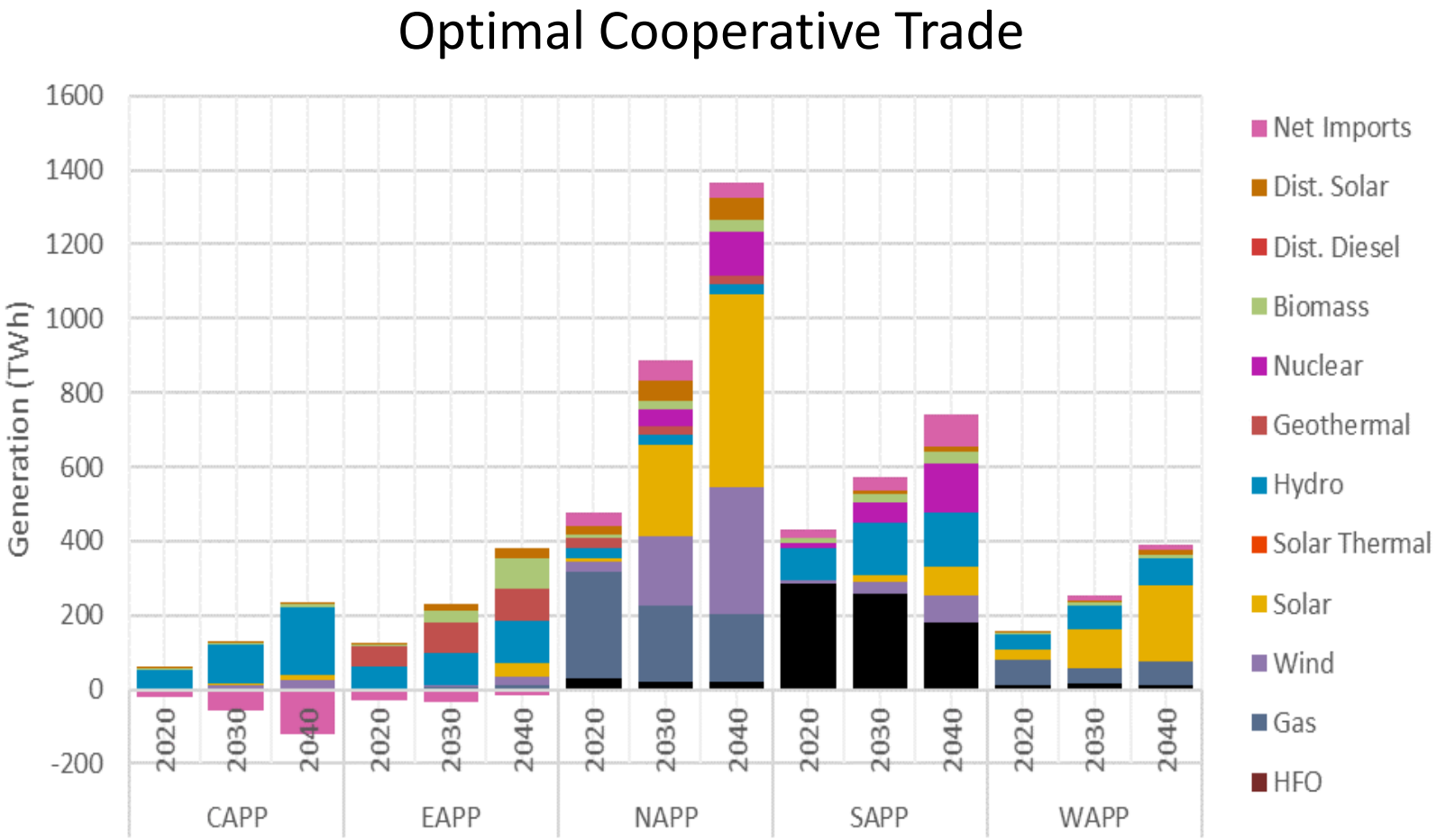
Generation per Power Pool and Fuel



Generation per Power Pool and Fuel

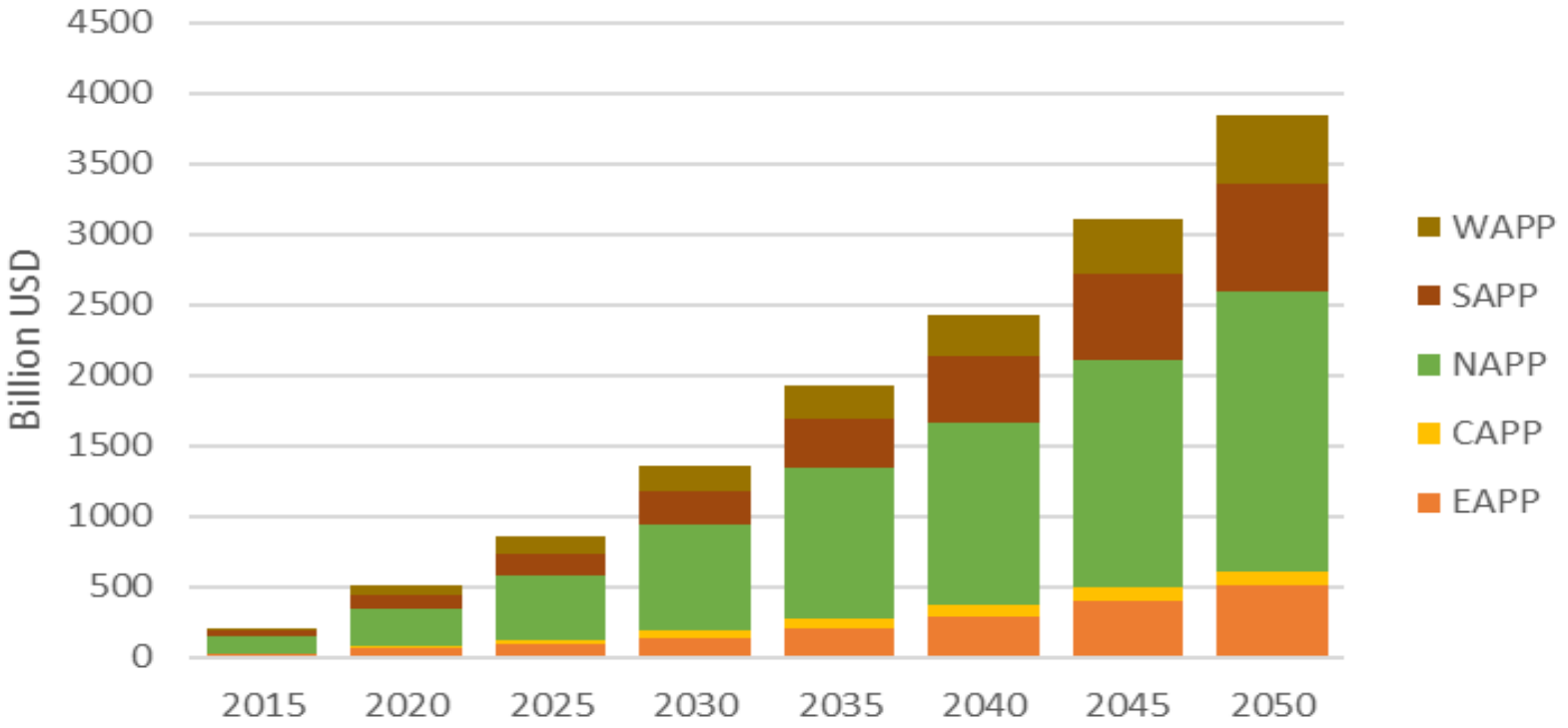


Generation per Power Pool and Fuel



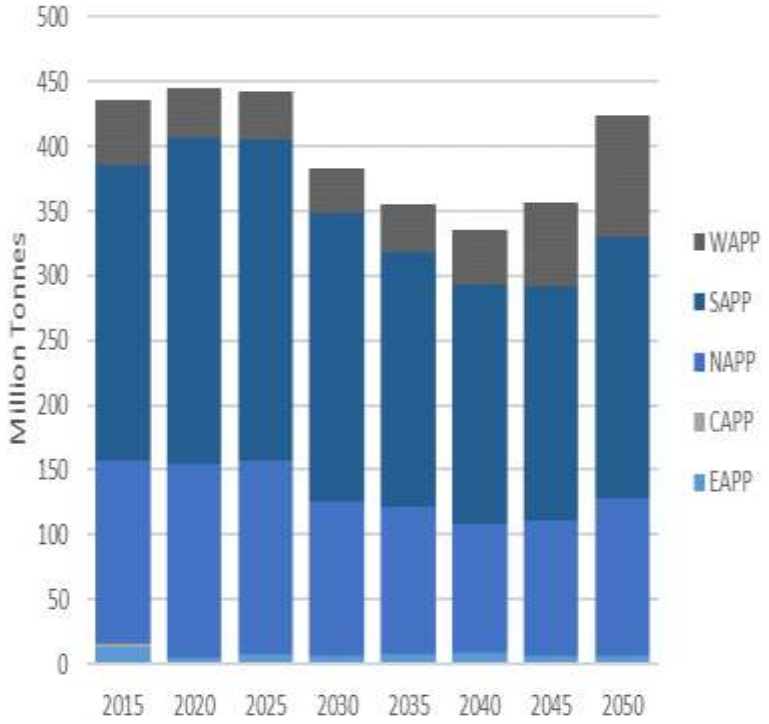
Investments

Optimal Current Trade

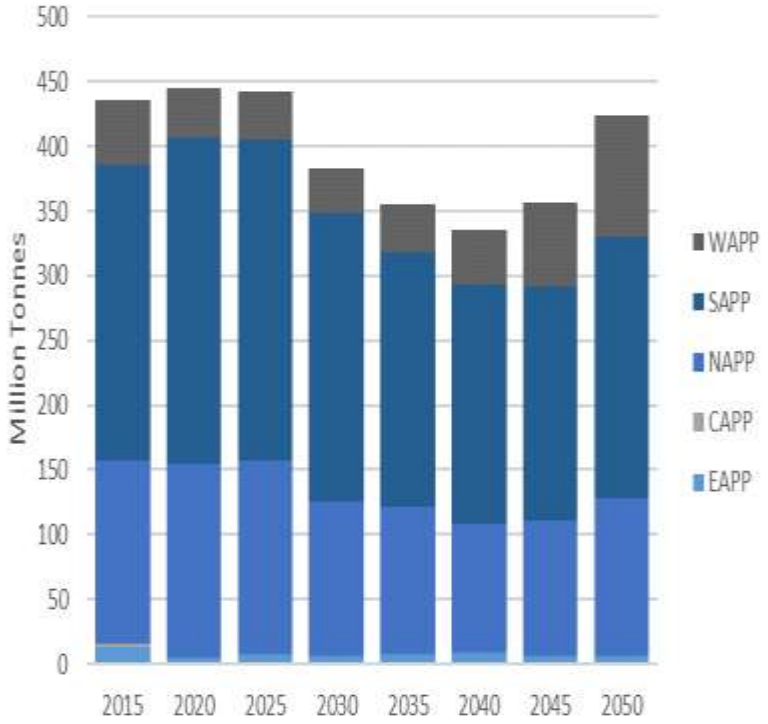


Emissions

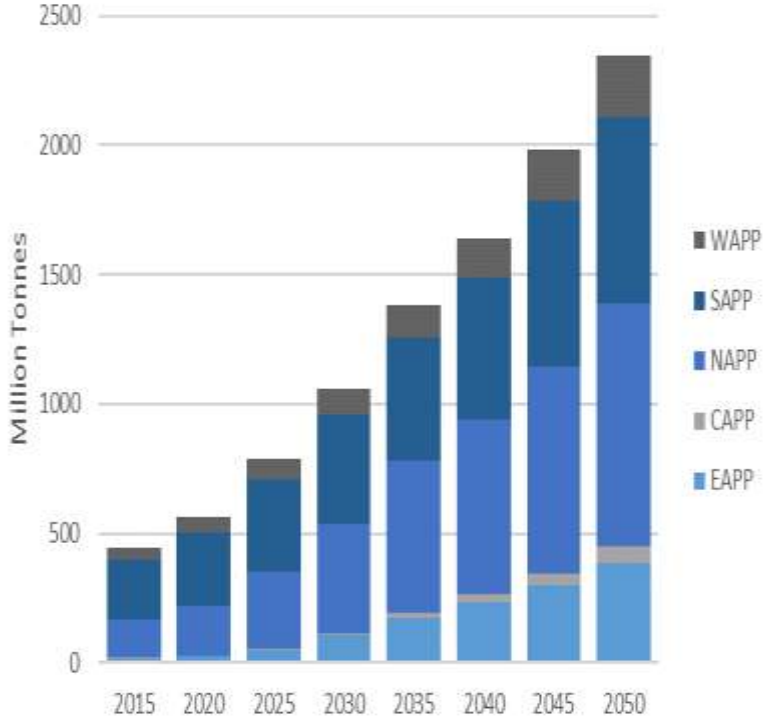
Optimal Current Trade



Optimal Cooperative Trade



Fossil Future

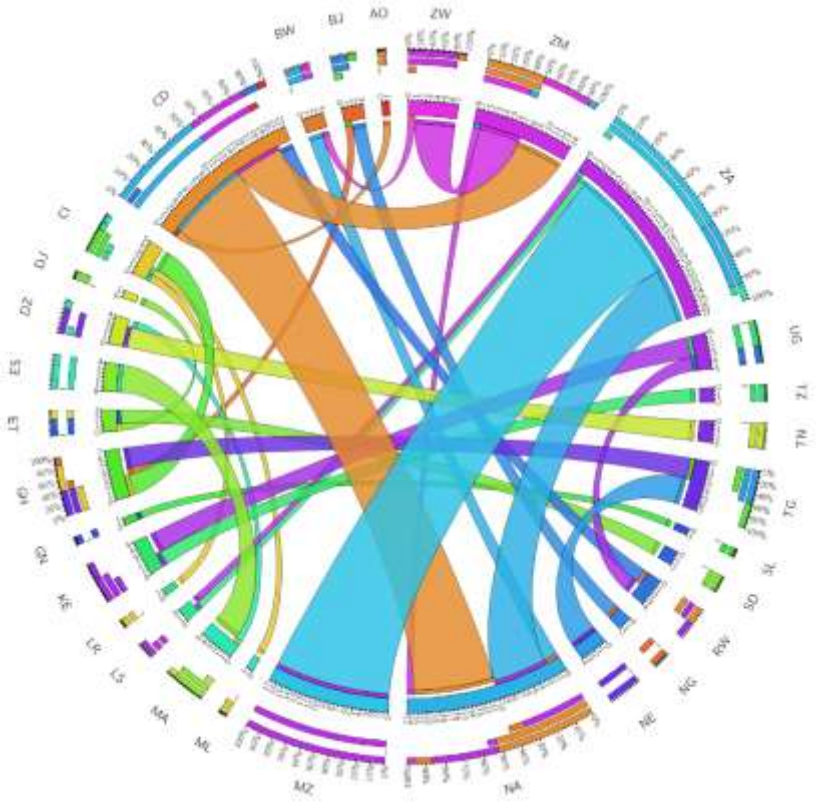


Cross-border electricity trade

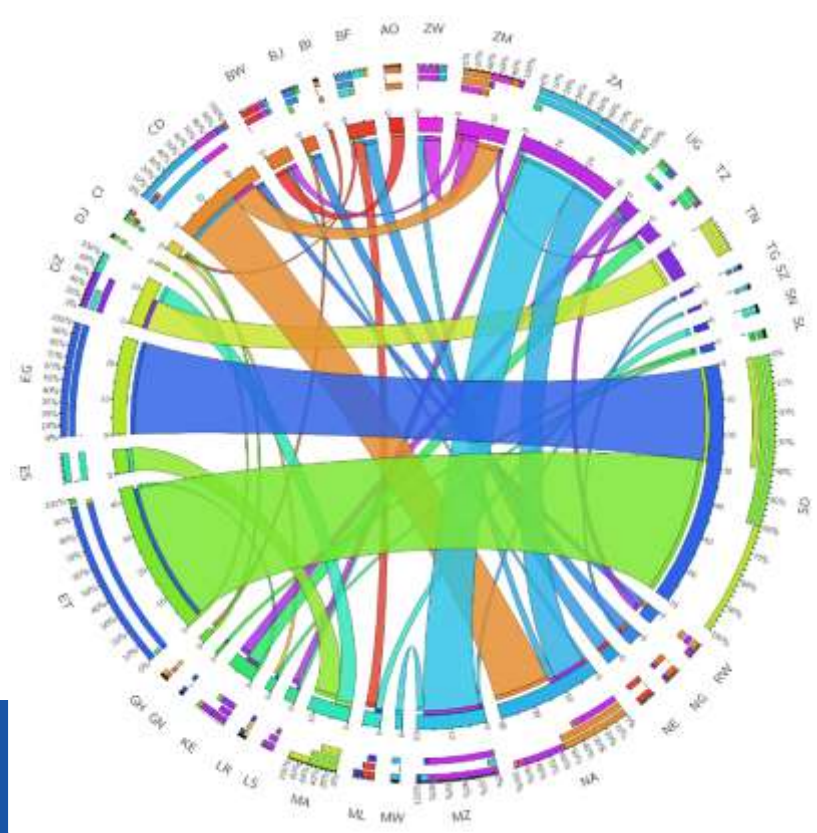
- 42 of the 47 modelled countries are involved in exchanges of electricity by 2040 (EXP).
- DRC is largest net exporter of electricity on the continent in 2040 (total export volume of 115 TWh)
- Primarily due to the assumed development of the Grand Inga project (total addition of 29 GW)
- South Africa is largest importer (net imports of 129 TWh in 2040); about 23% of its final electricity demand.

2020

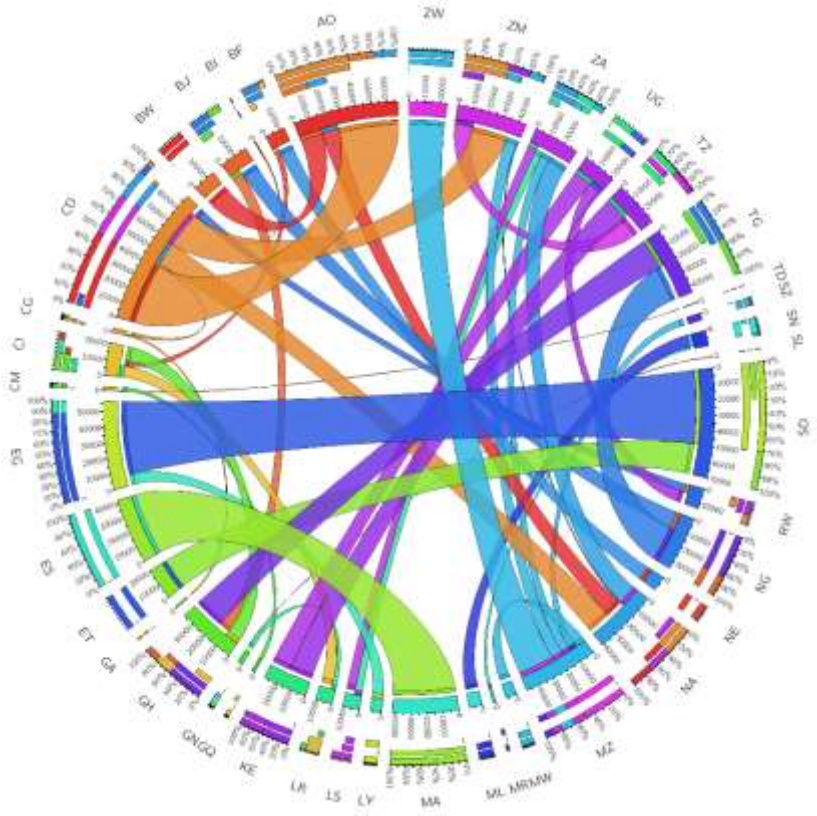
Optimal Current Trade



Optimal Cooperative Trade

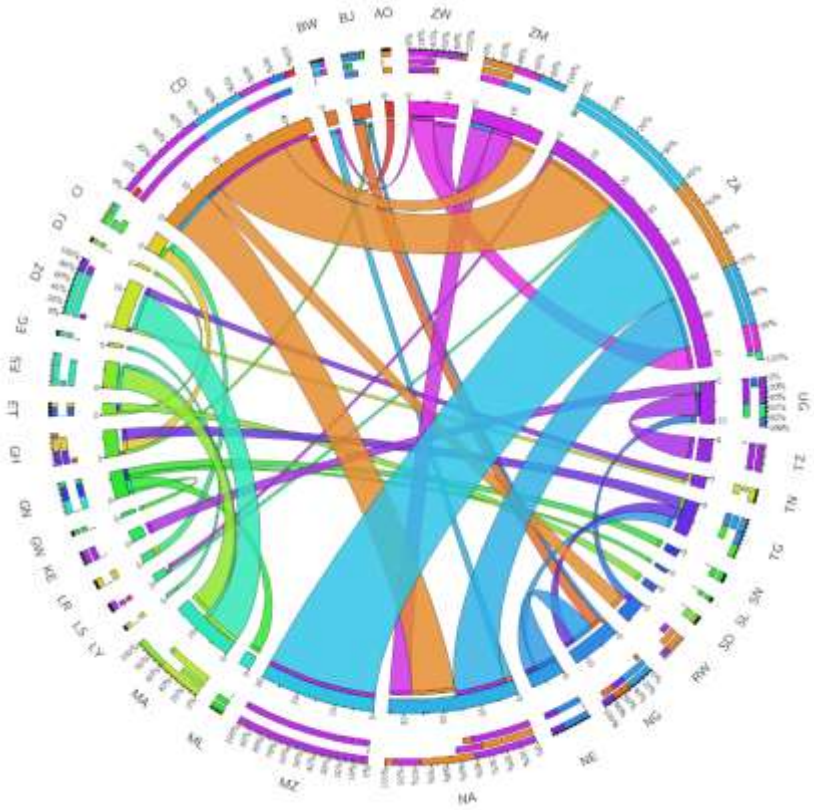


Fossil Future

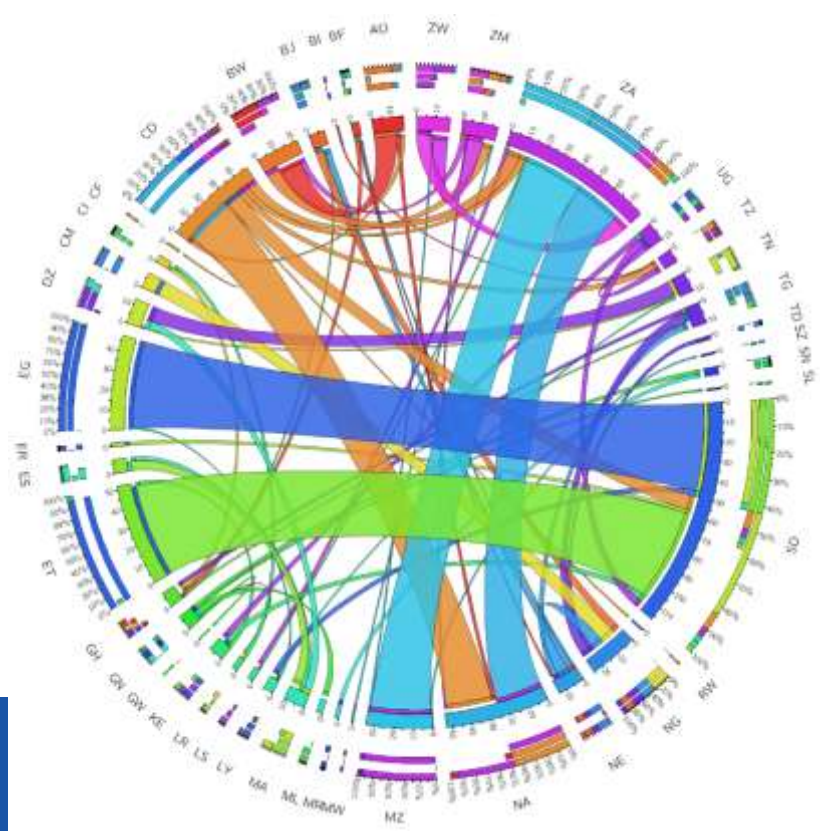


2030

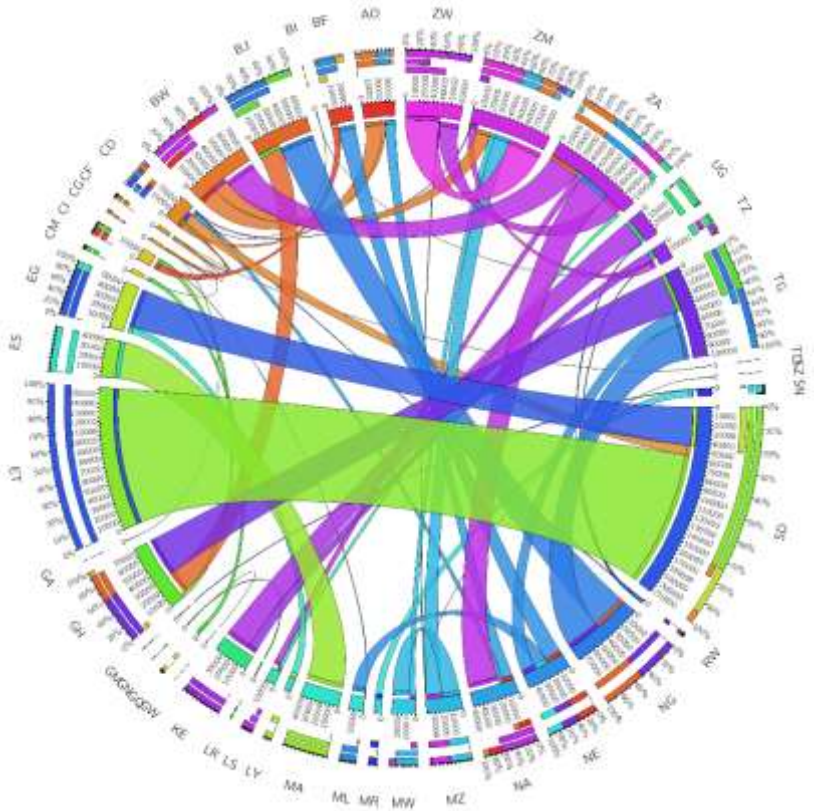
Optimal Current Trade



Optimal Cooperative Trade

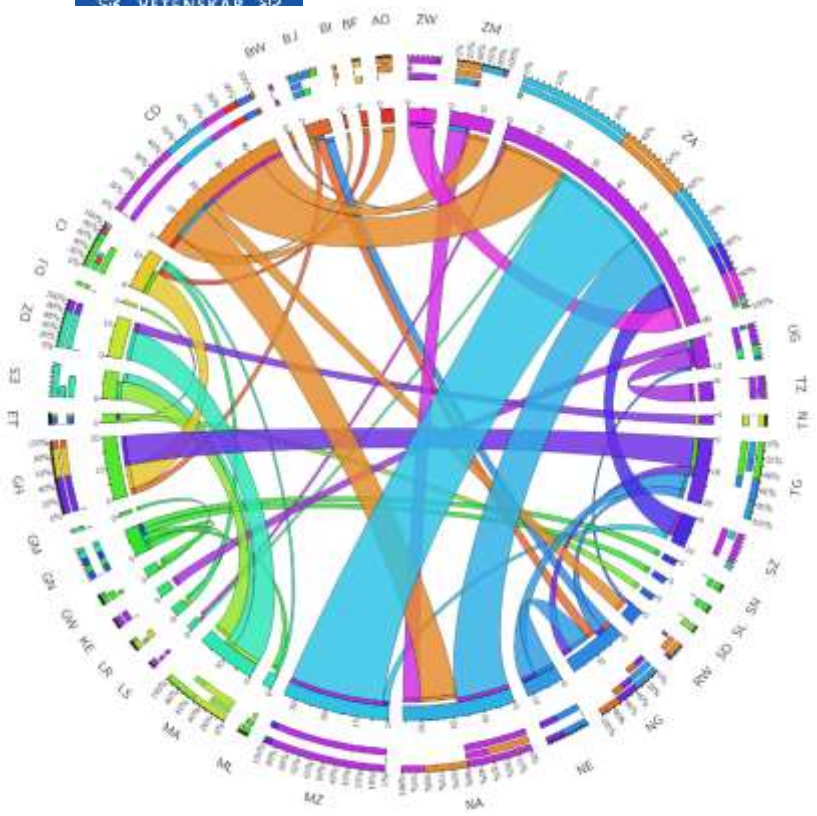


Fossil Future

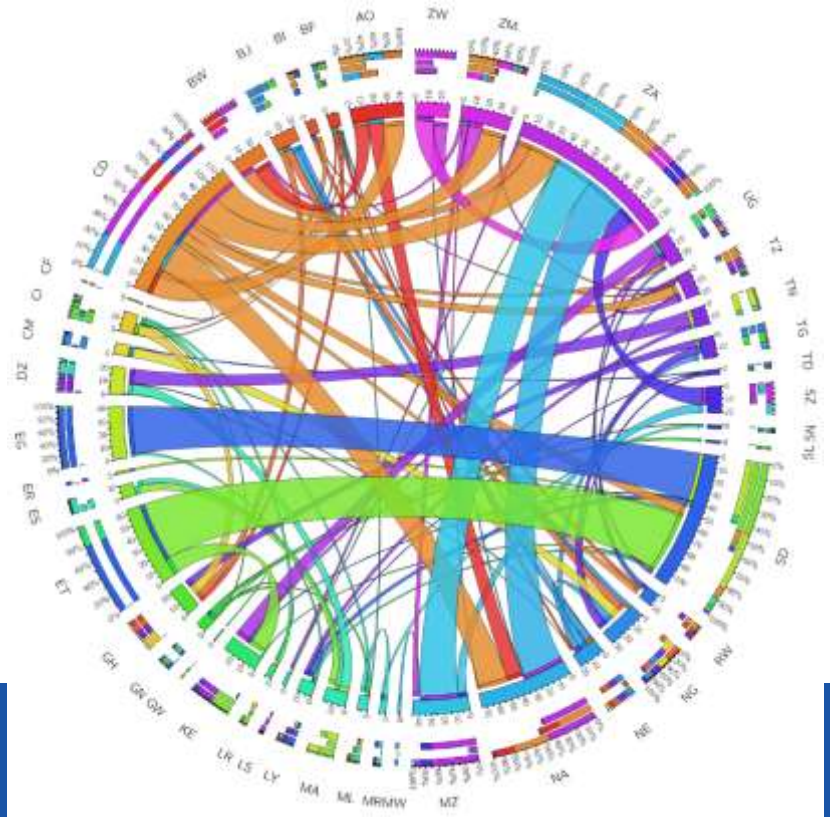


2040

Optimal Current Trade



Optimal Cooperative Trade



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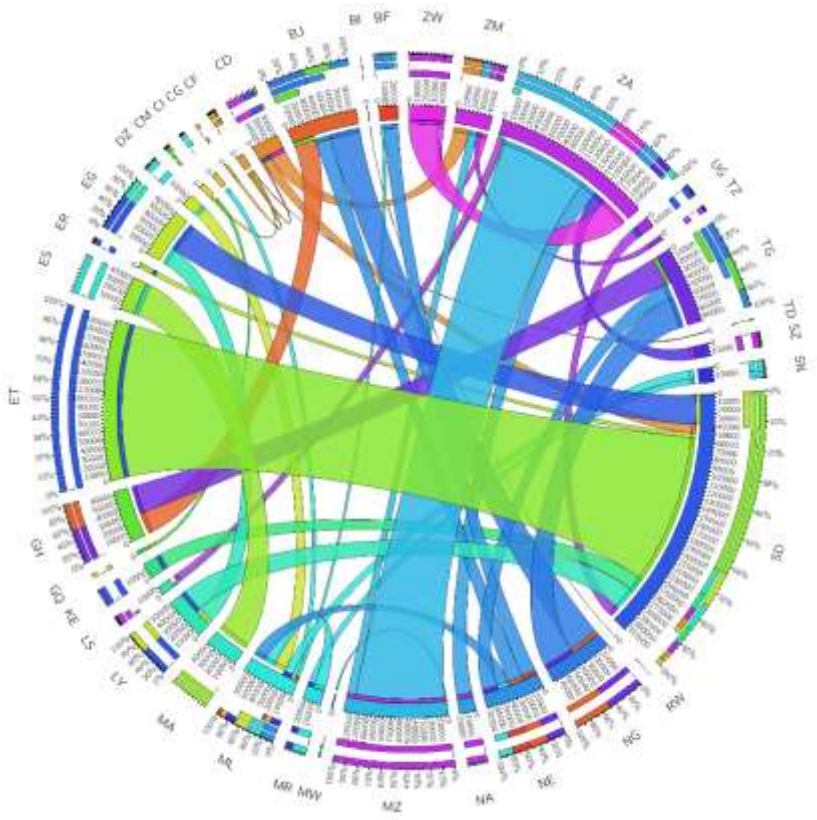
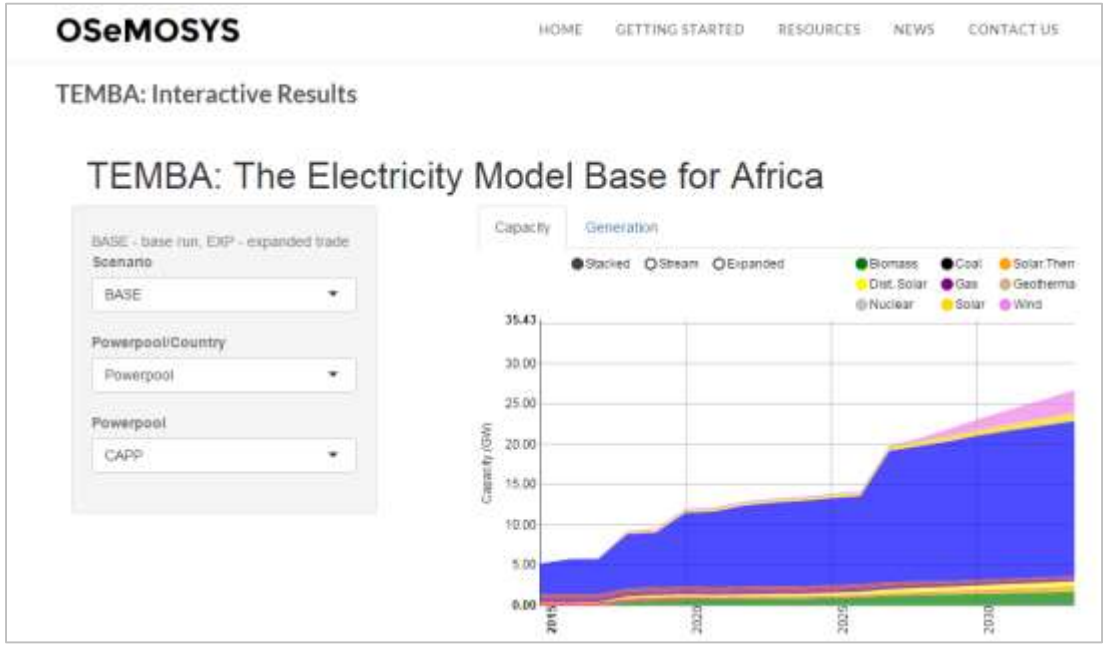


Transit countries

- In 2040, 49 TWh are imported by Sudan from Ethiopia, of which 40 TWh are further exported to Egypt (corresponding to about 5% of Egyptian final electricity demand).
- Similarly with electricity from DRC to South Africa; Angola, Botswana, Namibia, Zambia and Zimbabwe act as transit countries (further justifying proposed power corridor projects).

www.osemosys.org

- OSeMOSYS is a fully fledged energy systems linear optimisation model, with no associated upfront financial requirements.
- It is (comparatively) easy to adjust the model to anyone's particular needs!
- It is a collaborative effort -> join in!
- For further information and downloads, visit www.osemosys.org



Take away messages

- Helps analysts identify **Tn's of USD** worth of investment:
  - By country
  - By technology type
  - By location
- Enormous economic and financing opportunity
- All information is open and can be downloaded
- Can be used to inform decision making (science-policy, financing etc.)
- National strategies for any country in the world can be developed
  - Can be tailored to national circumstances
    - E.g. Changing oil prices
    - E.g. Differentiated electrification targets
  - For capacity building
  - Can be adapted autonomously or in partnership with UNDESA