European Commission

Identifying Renewable Energy potential by innovative mapping tools and research platforms

Sándor Szabó – Katalin Bódis

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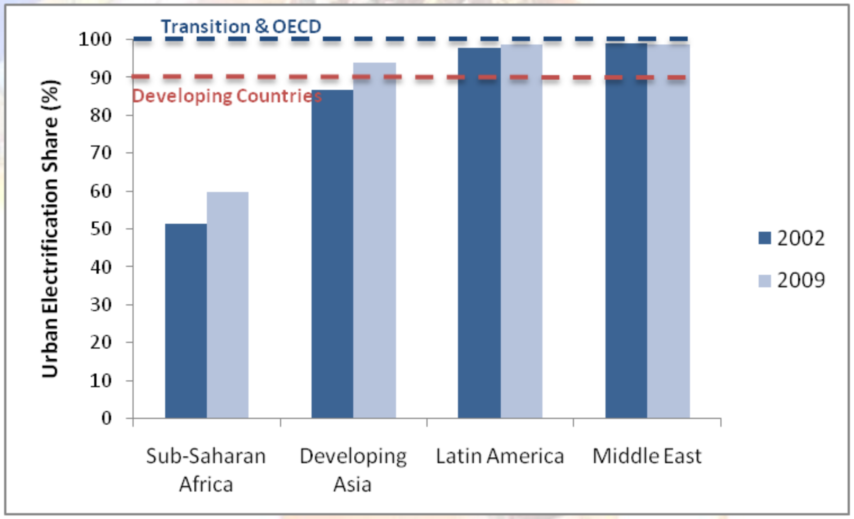
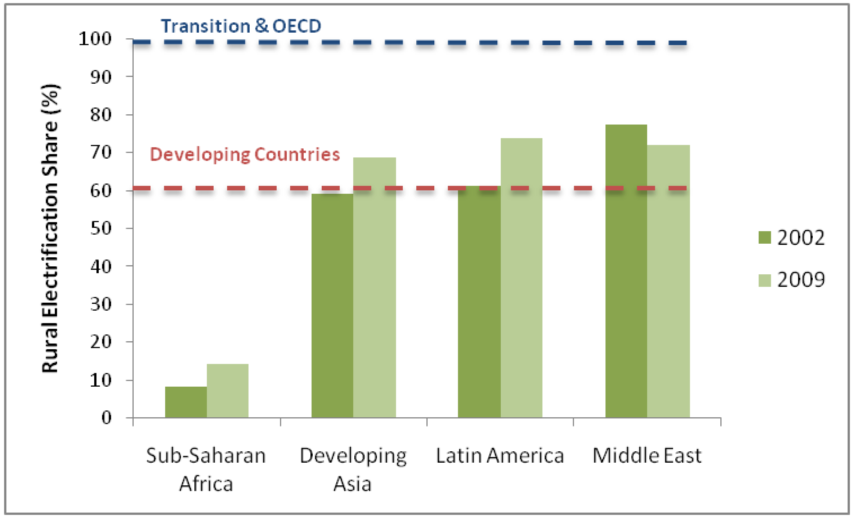
Joint Research Centre

Trends and current status of electrification: reach out of grid extension

Evolution of electrification share for (a) urban and (b) rural areas (2002-2009)





Source: Data compiled from IEA, World Energy Outlook 2010

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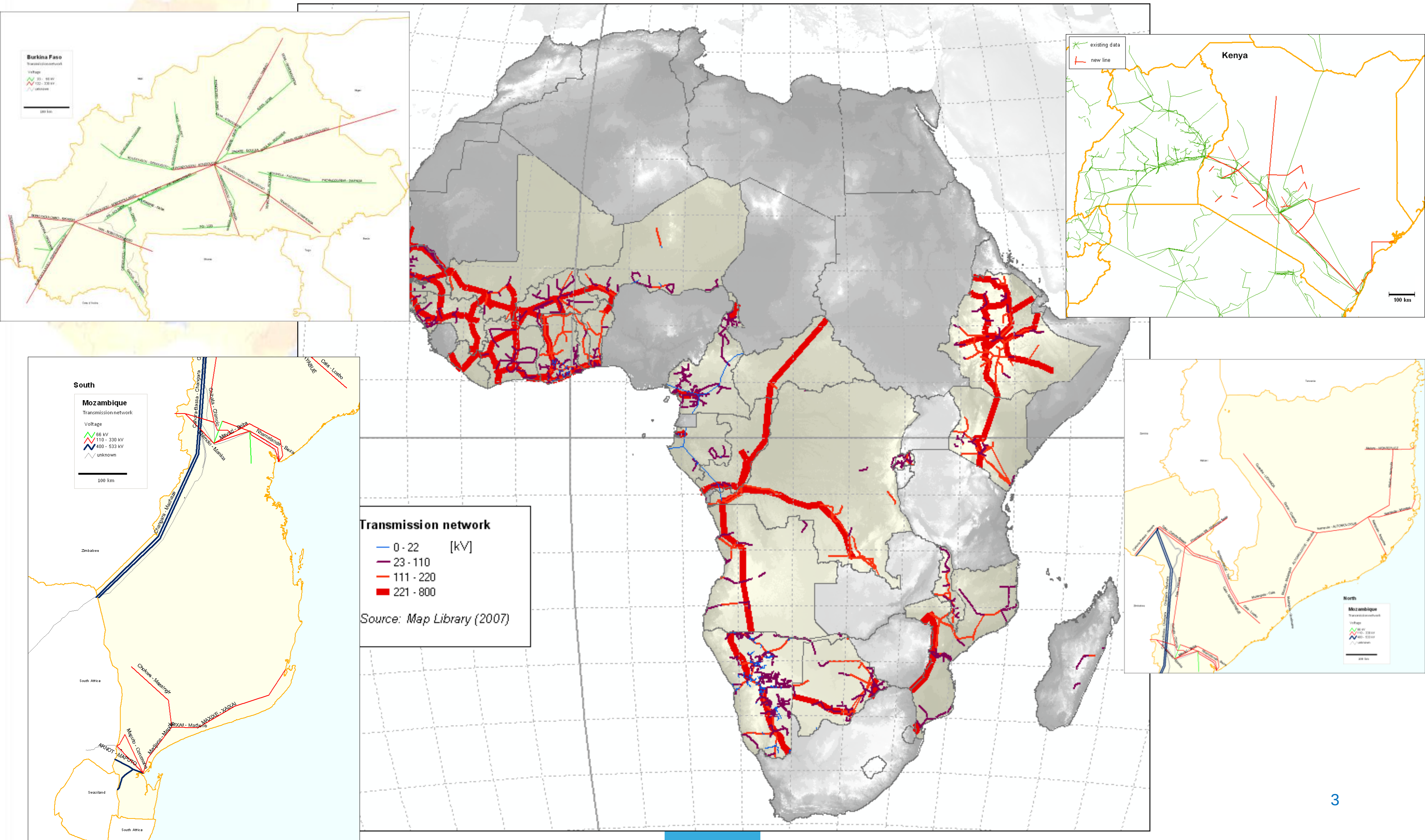
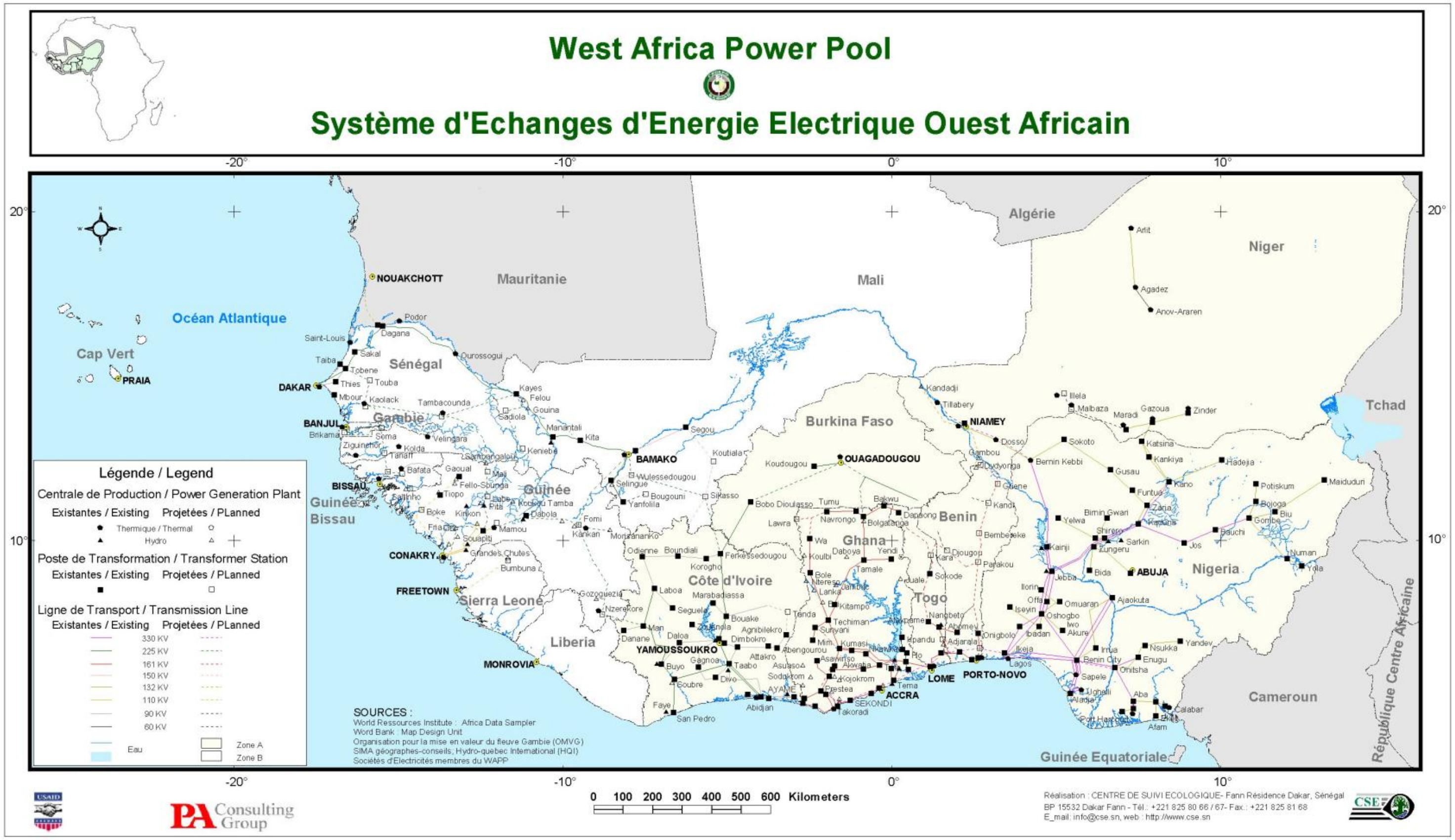


Collecting available grid maps …



…but in digital form

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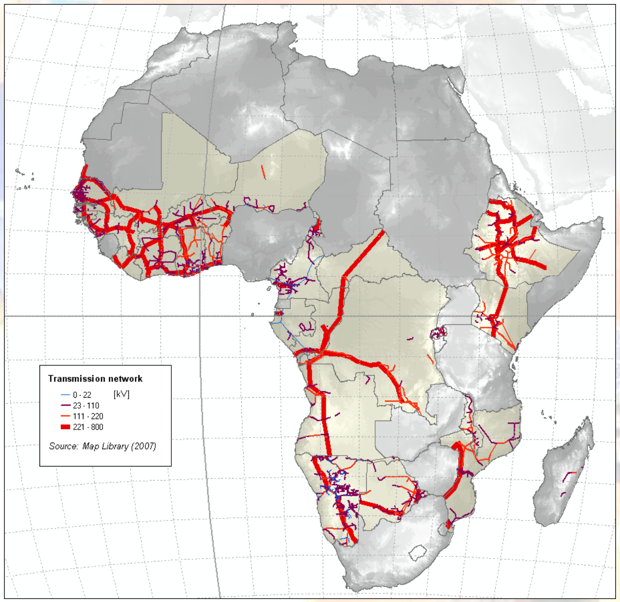
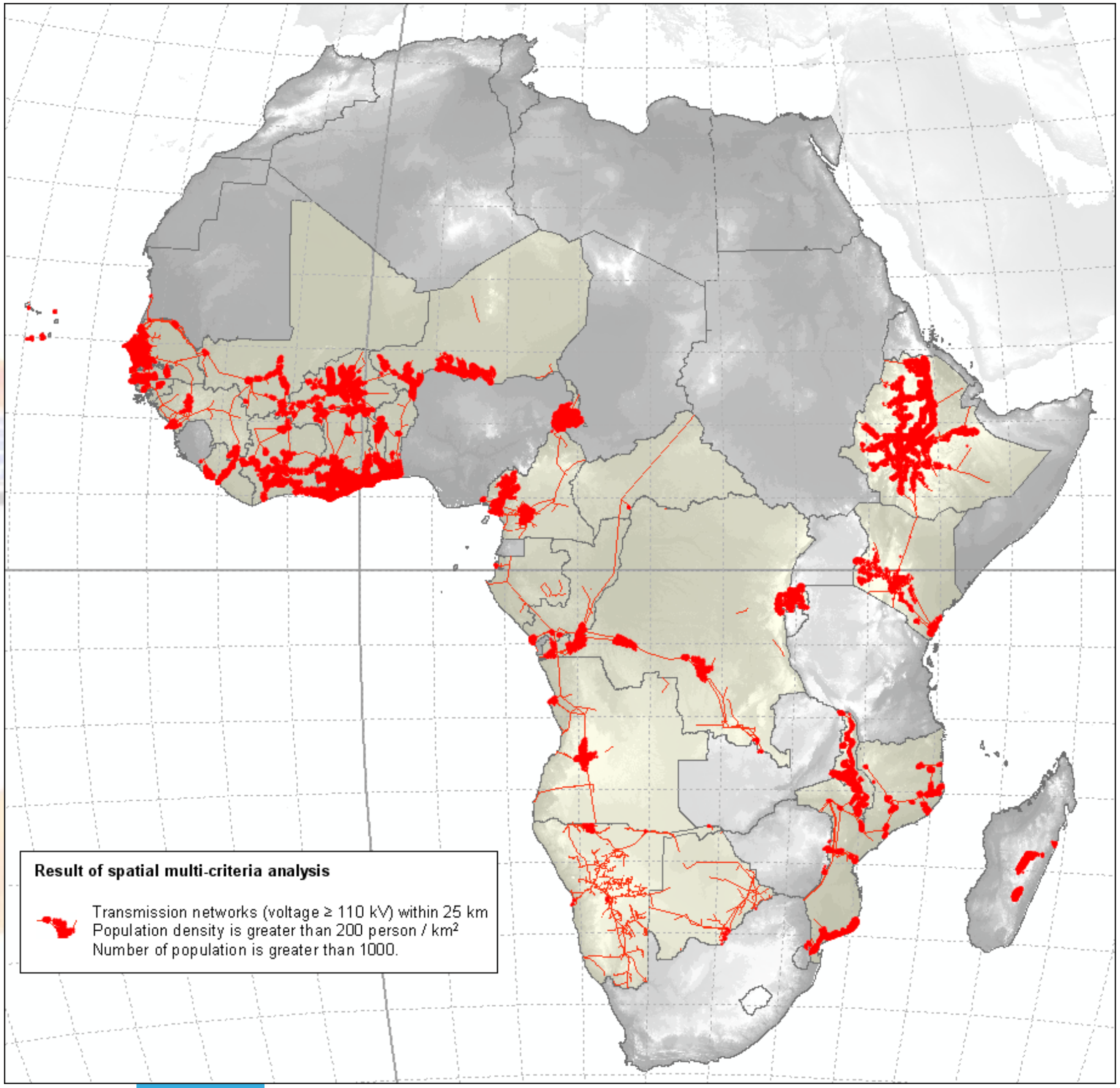
The grid is extended to the places with the high density population



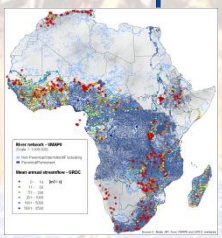


Modeling electrification technologies

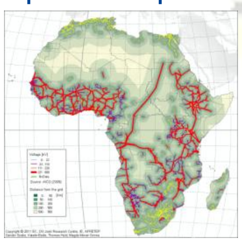
Resource & socioeconomic maps ✚ Technical & Economic data ➡ Cost of kWh per technology:

diesel, minihydro, grid extension, PV offgrid*

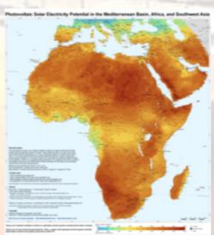
Populated places



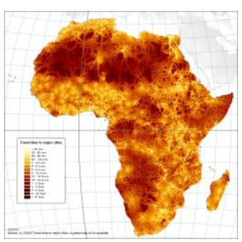
Rivers



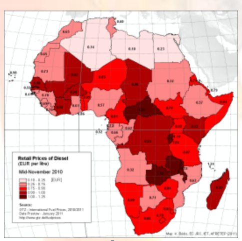
Grid network



Solar irradiation

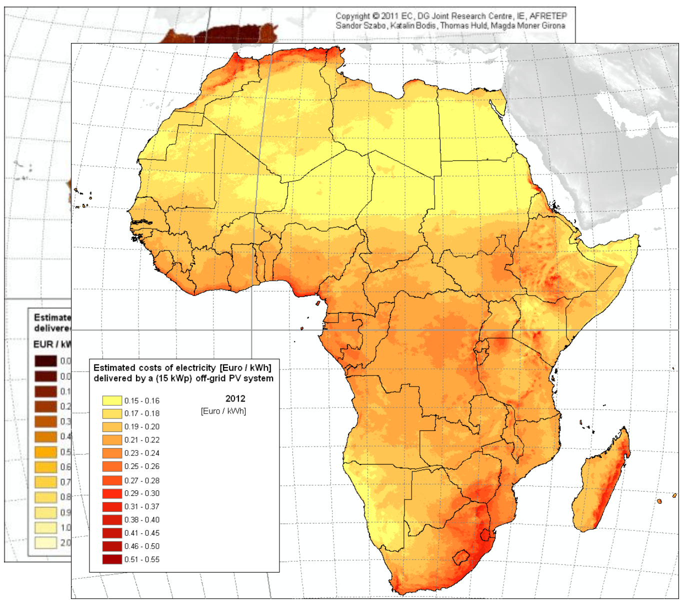


Travel time distance



Diesel prices

System must not run out of energy more than 5% of the days.
Daily energy consumption pattern: 1/3 daytime and 2/3 evening and night.
PV array size 15kWp; battery depends on location.
Total system looses: 30%.
Lifetime: 20 years PV modules and 5 years batteries.
Investment costs:
PV Modules 1.1€/Wp
Rest system 0.8€/Wp
Batteries 1.5 €/Ah.
O&M: 2.5%/year of PV array.
Discount rate: 5%.



More information:
T.Huld, 27th EUPVSEC, 5BV.1 PV
Szabo et al. (2011) Env.Res.Lett. 6

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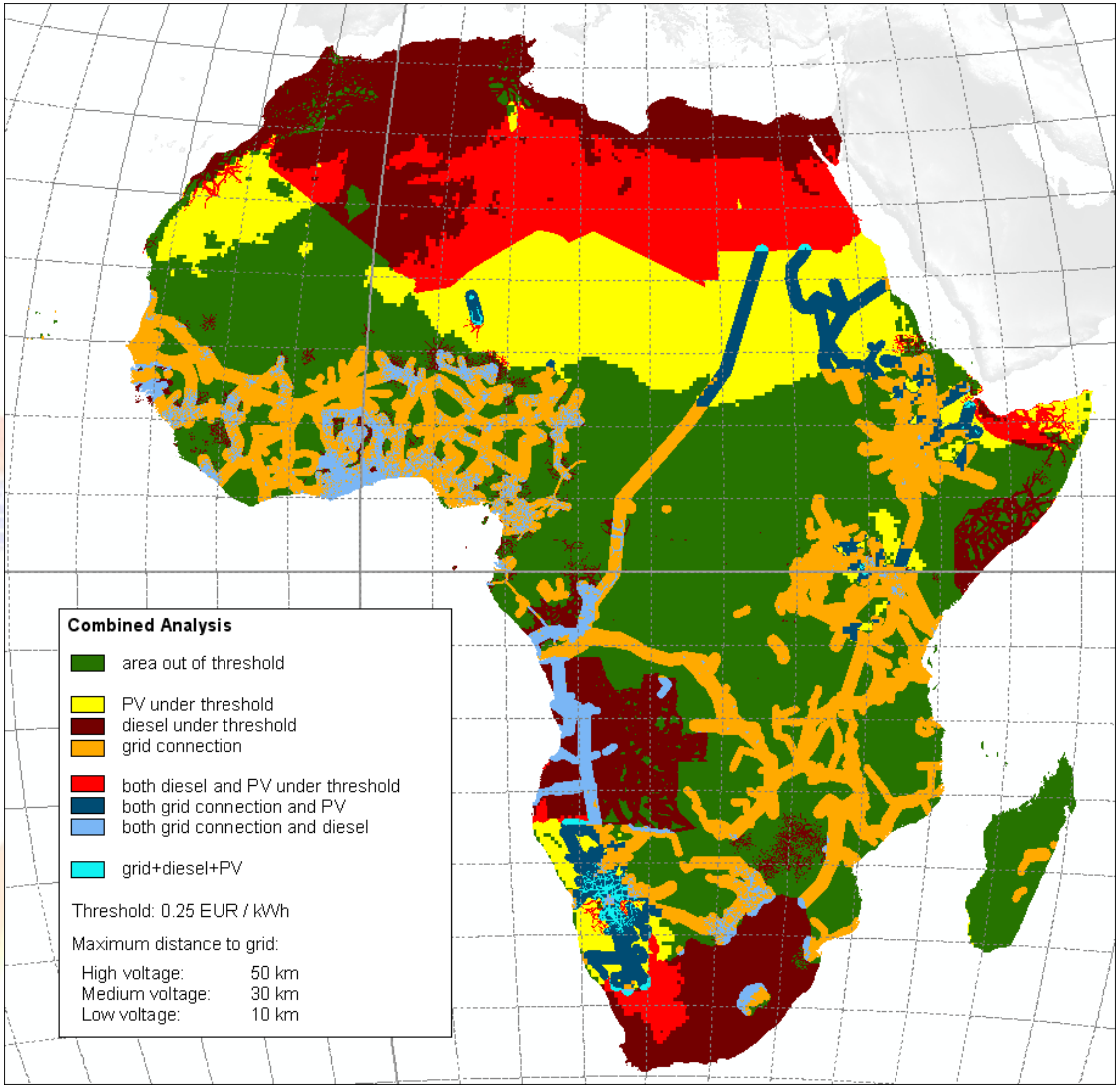
Comparison

The 2011 analysis shoved that huge regions could not be served under the 25 €cent/kWh threshold by any of the technologies examined



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Changes introduced

•New important rural electrification technology (mini hydro)

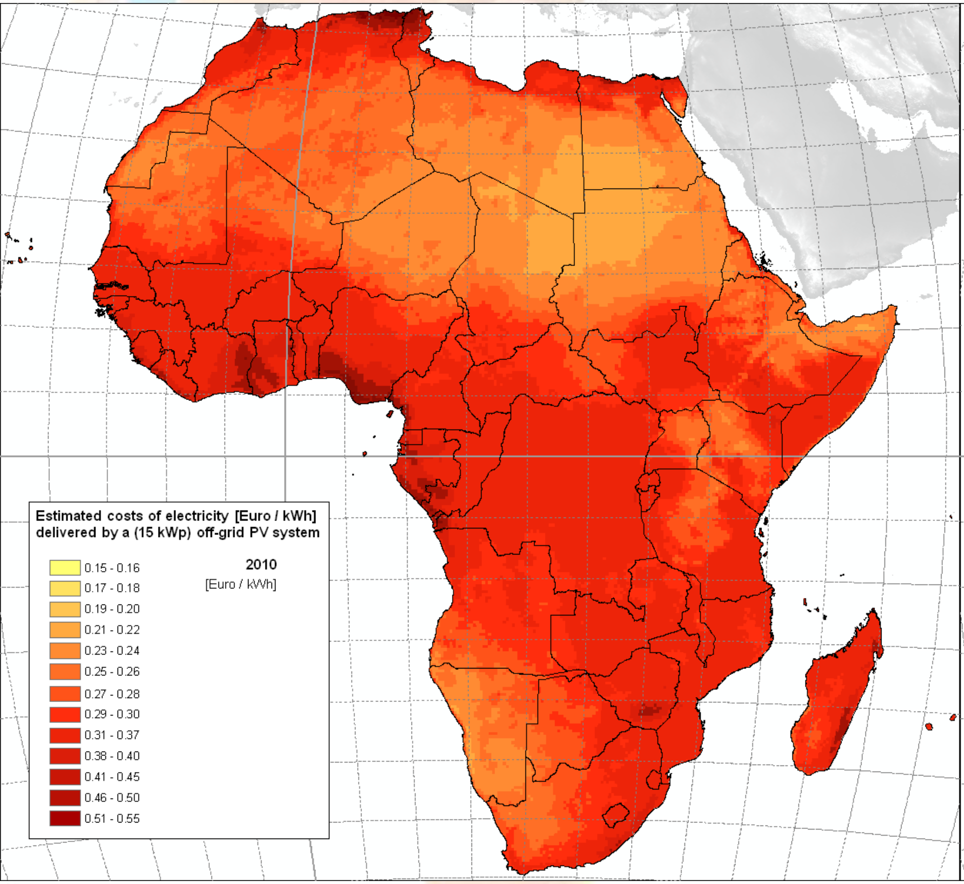
- Mostly competitive in areas where the other analysed technologies are not affordable

•New diesel cost data from GIZ

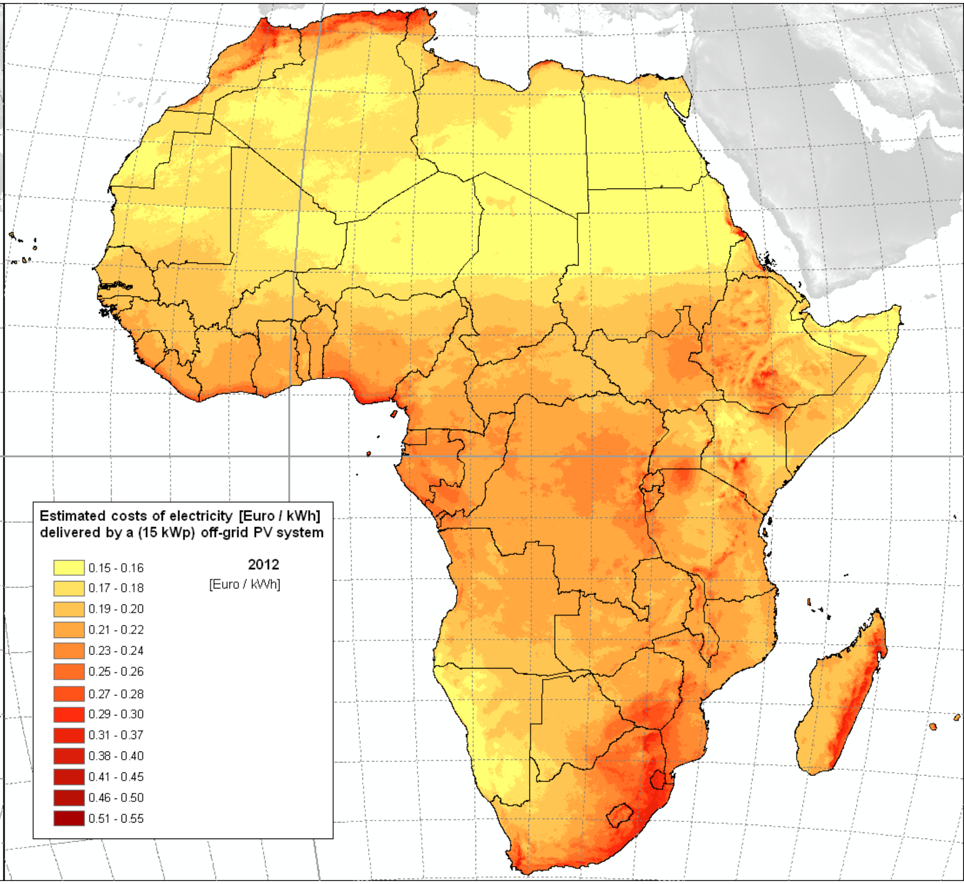
•New network lines close to realisation (mainly in case study countries)
Assumptions on the 15kWp PV system
1/3 energy consumption during day and **2/3** during night.
Operation maintenance costs **2.5 %/year** of the PV array.
PV lifetime: **20 years**
Battery lifetime: **5 years** (required battery size changes with PV output)
Discount rate: **5 %**

	PV module cost	Rest of the system	Battery price	O & M costs
Analysis based on 2010 data	2500€/kWp	1000€/kWp	1.5€/Ah	2.5 %/year of PV array
Analysis based on 2012 data	1100€/kWp	800€/kWp	1.5€/Ah	2.5 %/year of PV array

The kWh electricity cost using the 2010 PV module cost data



The kWh electricity cost using the 2012 PV module cost data



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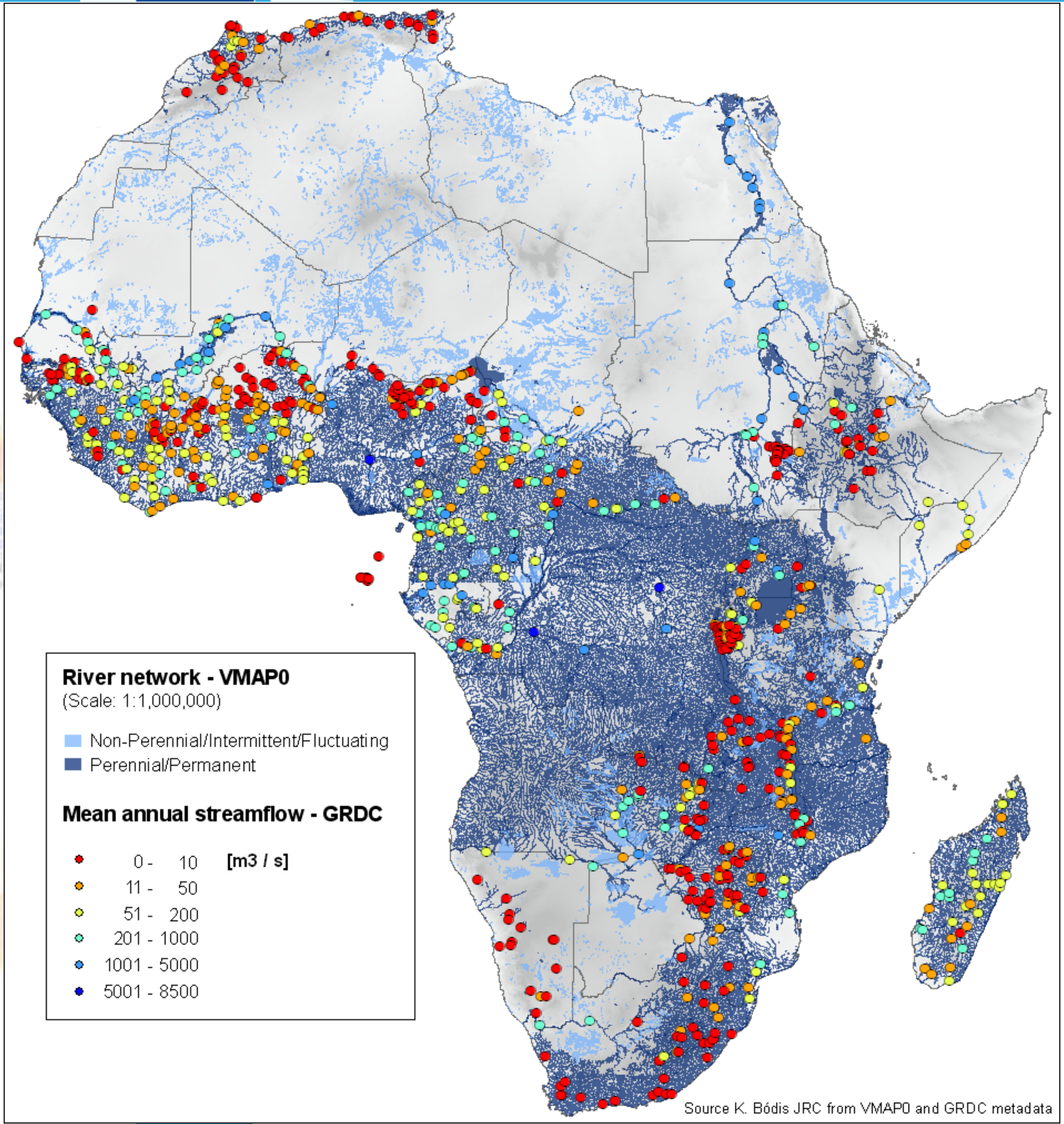
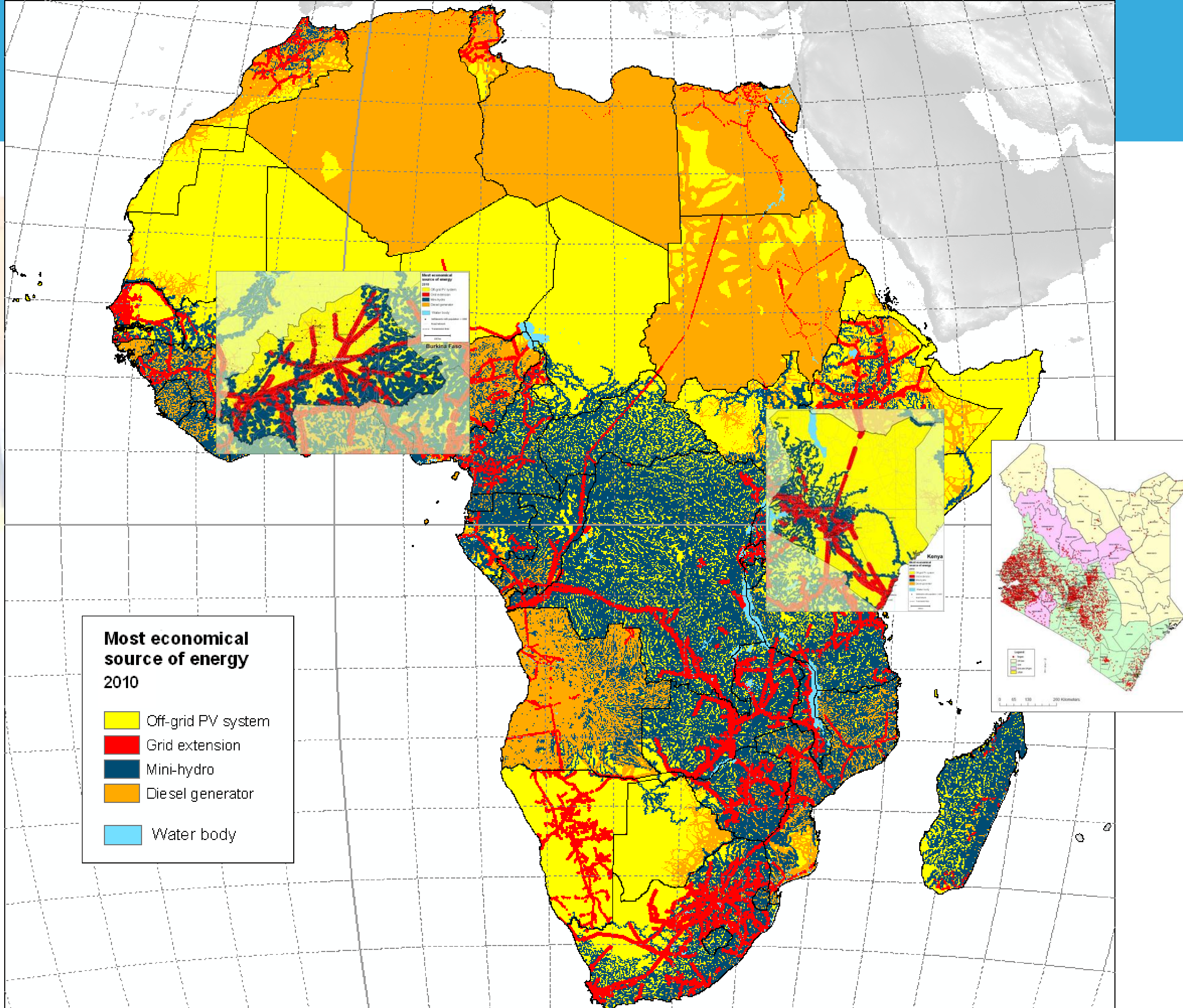
Permanent river network and measurement points with the mean annual river streamflow data




Most economical source of energy
2010
Off-grid PV system
Grid extension
Mini-hydro
Diesel generator
Water body
Burkina Faso
Kenya

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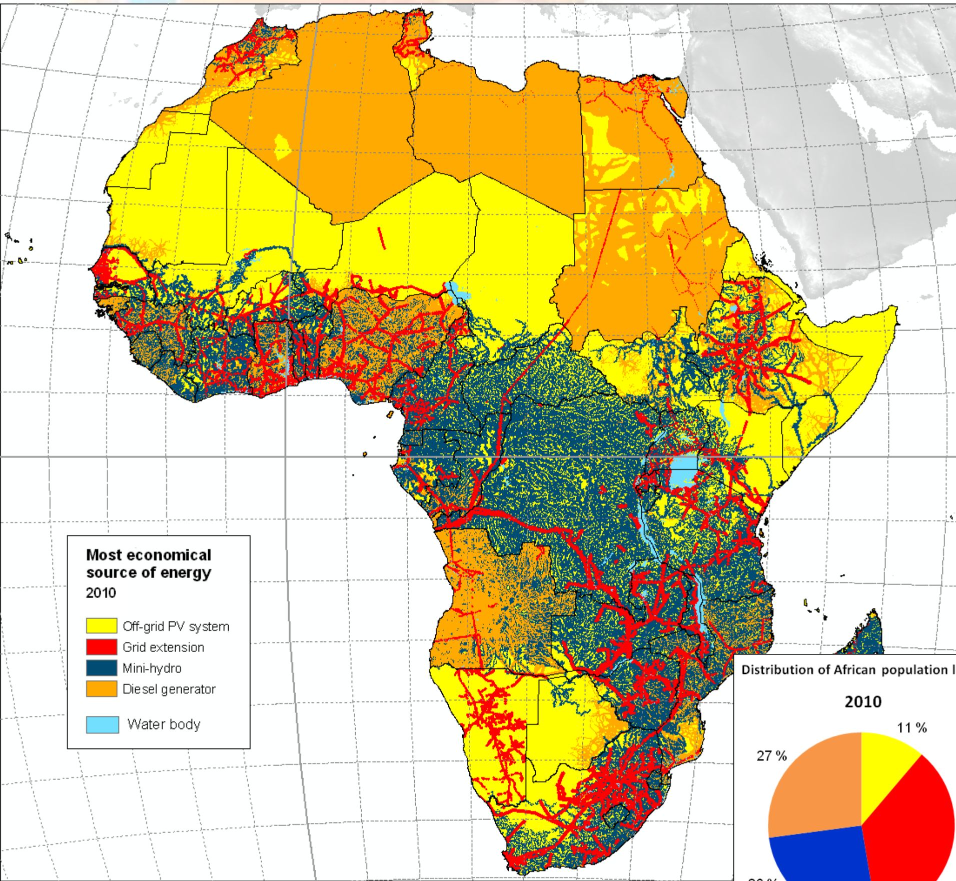

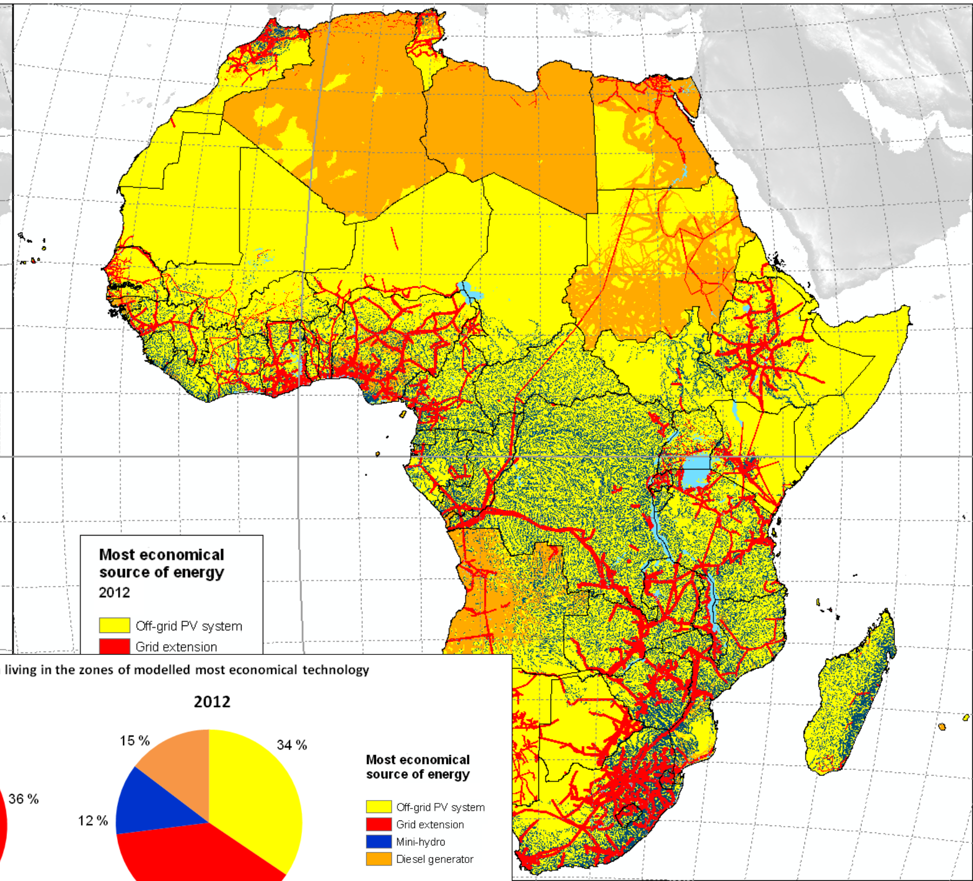

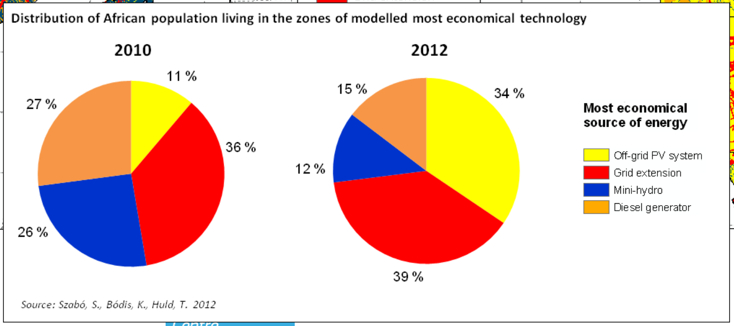

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The maps show clearly how the competitiveness of the different rural electrification options have changed due to the technological learning, diesel price and due to the changing subsidy policies.

Despite the PV became the cheapest rural electrification option in vast territories of Africa, the high up-front costs require that the market find non-traditional commercialisation. As the ability-to-play is very low compared to the rest of the world the system has to be paid during the operation from the generated cash flow or in small yearly instalments.

The Africa-Eu Energy Partnership can instrumental in setting up the right business-public policy framework. www.aeep-forum.org/en/aeep

Adequate partners are needed which require networking: ARE, AREA or AFRETEP could be a good way to start with.

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Dissemination & collaborations

Collaboration with International organisations

European Union EXTERNAL ACTION

ECOWAS Regional Centre for Renewable Energy and Energy Efficiency

IRENA

International Renewable Energy Agency

AREA African Renewable Energy Alliance

sansa SOUTH AFRICAN NATIONAL SPACE AGENCY

OMEGA Investment Research

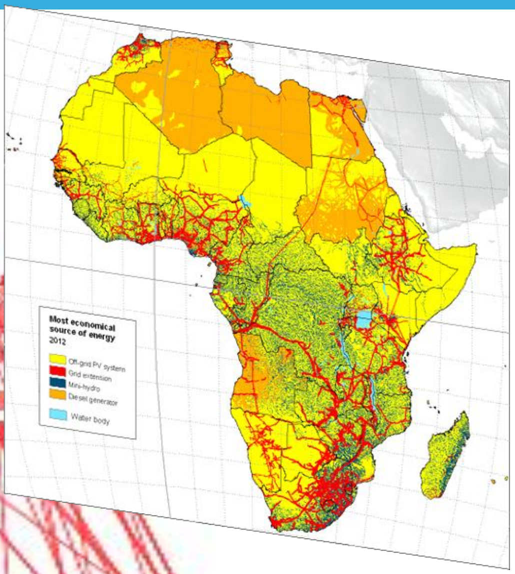
ERRA ENERGY REGULATORS REGIONAL ASSOCIATION

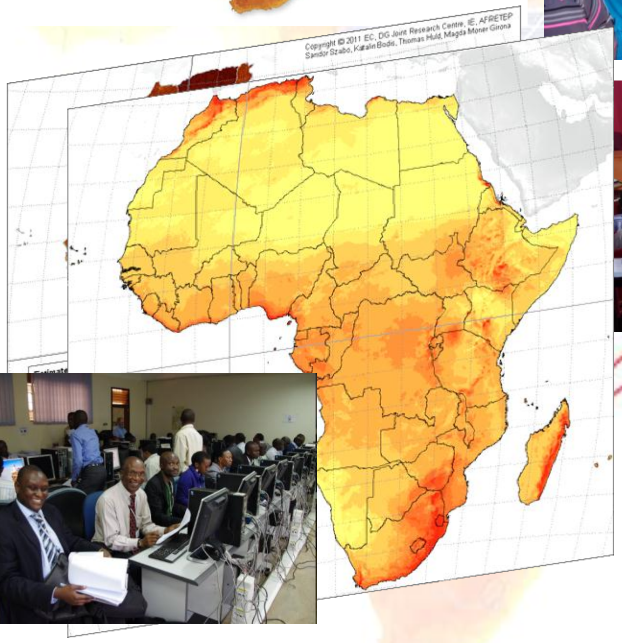
Collaboration within the network

ECREEE-ECOWAS: Involvement in the Developments of a Regional RE Policy of the different African regions: Channelling experience and best practices between EU-Africa and also between the different African regions

IRENA: Working out more adequate methodology for GRID extension, Global Atlas initiative

Case Country Studies
Complementing roles
Applicability and validation of regional results to national electrification Master Planning





- **Thanks for your attention**