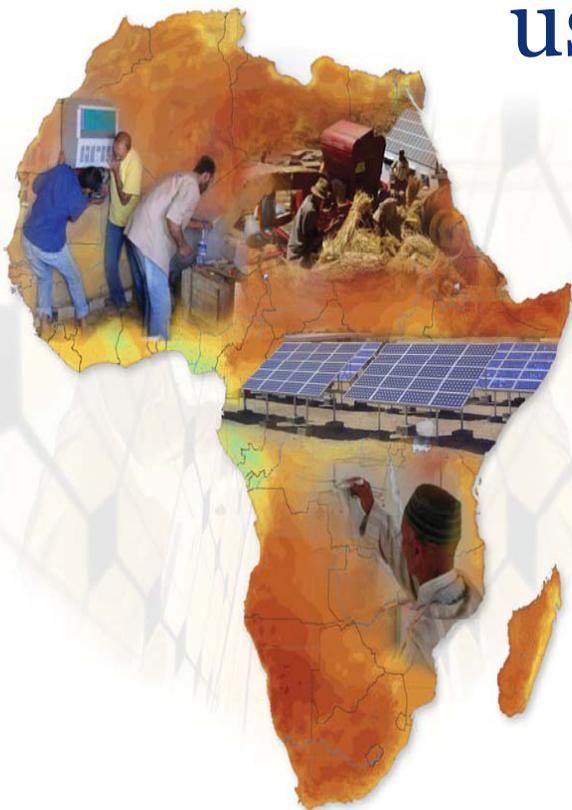




Spatial evaluation of viable RE technologies in rural areas using GIScience



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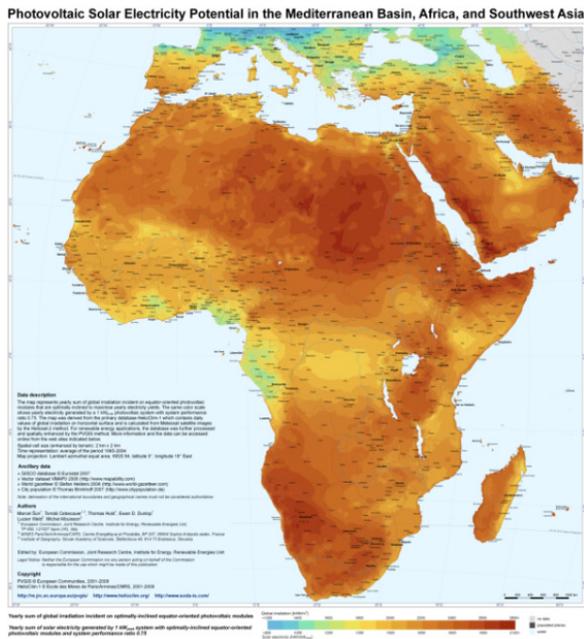
The context of the presentation

- The findings of the presentation is based on an ongoing EU project AFRETEP.
- Cooperation with regional research centres in Africa (9 African research partners, 70+ members)
- Collection of more accurate information to increase reliability of the commonly developed analysis (ECREE, Makerere University, 2iE Burkina Faso)
- What are the most efficient ways to support the more reliable technologies to enter the African off-grid market of? How can applied research speed up this process? Can innovative GIS techniques assist site selection process?

Task Activity

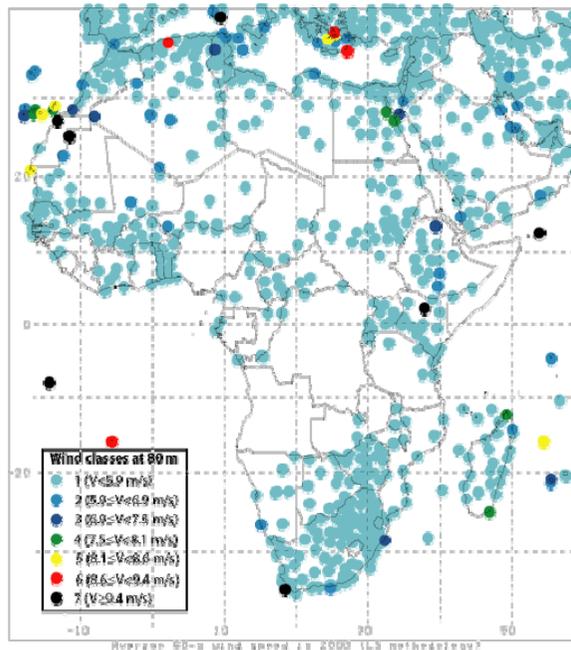
Support sustainable energy planning for rural electrification.

Gather **high quality renewable energy resource geographical information in Africa** (solar, wind, hydro, biomass, geothermal) and make it **accessible** via AFRETEP website.



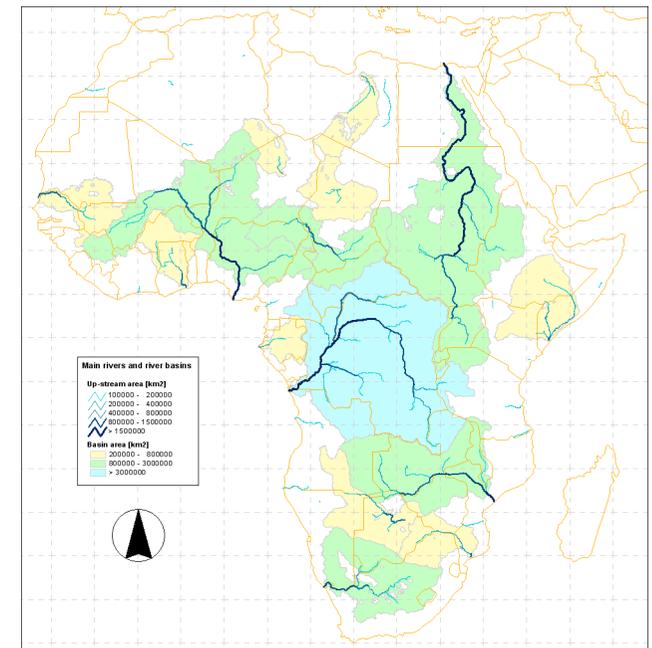
SOLAR RESOURCE

Source: Huld, T. et al. (2005)
 Source: PVGIS, JRC IE REU
<http://re.jrc.ec.europa.eu/pvgis>



WIND RESOURCE

Source: Archer, C. L. and Jacobson, M. Z. (2005)
http://www.stanford.edu/group/efmh/winds/global_winds.html



HYDRO RESOURCE

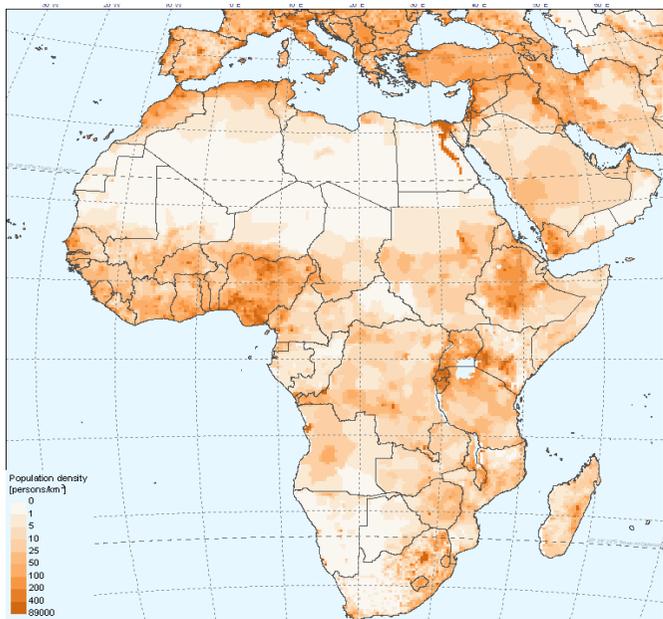
Source: Bódis, K. (2009)
 Derived data based on SRTM V4
<http://srtm.csi.cgiar.org/>

Task Activity

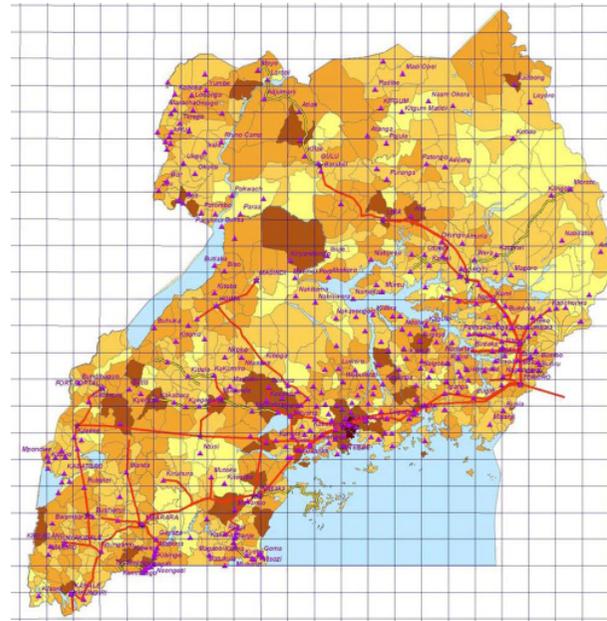
Support sustainable energy planning for rural electrification.

Develop a consolidated **technical and socio-economic base** for assessing rural electrification projects

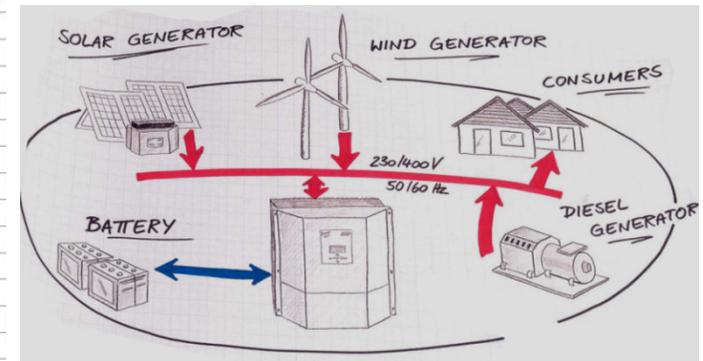
- Criteria to be used in the evaluation of grid extension vs. off-grid solutions.
- Harmonization of existing tools and/or development of missing methodologies.



Population density (inhab./km²)



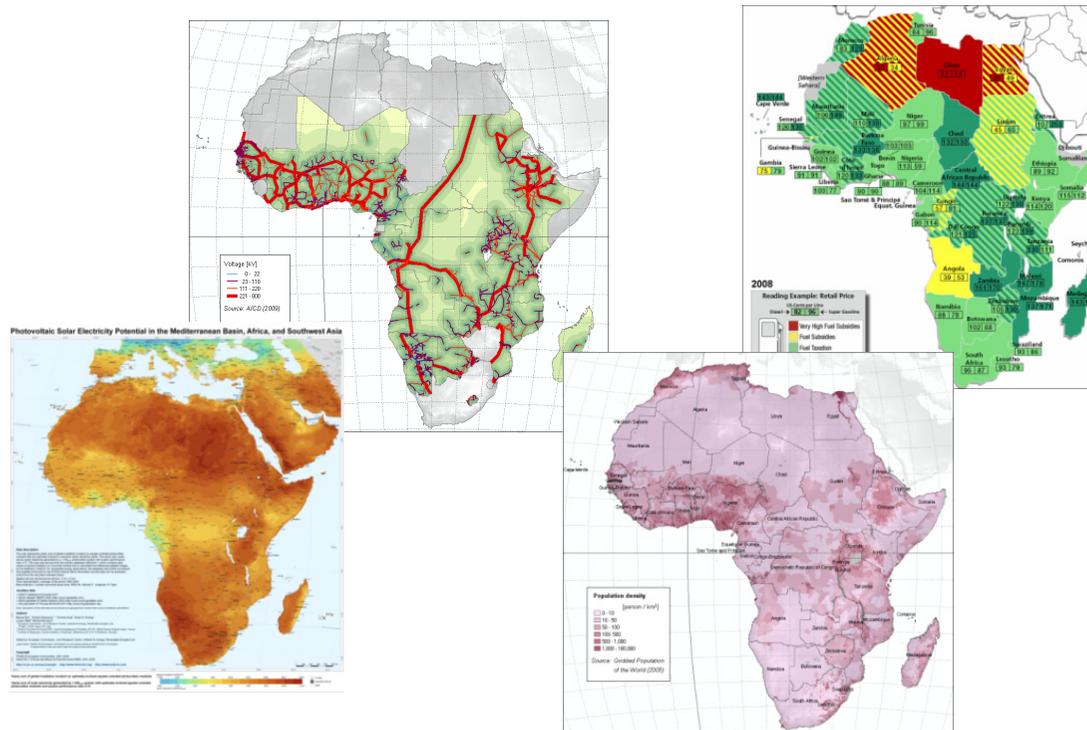
Population density along the electricity grid in Uganda (Kajjuka, 2006)



Example of hybrid system in isolated areas

Identify locations where PV is the most economic option for electricity

Data compilation:



Preliminary analysis:

- PV minigrid, diesel minigrid and grid extension.
- continental scale.
- simple cash flow model.
- how much the electricity would cost?

Resource maps
 (solar, wind, biomass, electricity transmission network...)

Social/Demographic data (demand distribution, consumption pattern, level of service, willingness to pay, etc.)

Technical data
 (configuration, sizing, performance, etc.)

Economic data
 (discount rate, costs, O&M, etc.)

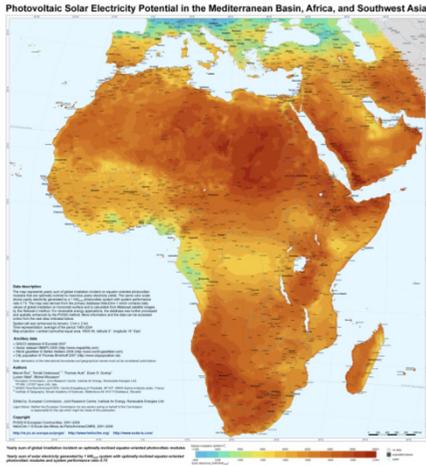

Decision support system tool


 Existing energy planning tools

New methodologies

PV mini-grid electricity cost

Sources:



PVGIS solar radiation database (daily data 2002-2004).

Analysis:

System must not run out of energy more than 5% of the day
Daily energy consumption pattern: 1/3 daytime and 2/3 evening and night.

PV array size 15kWp; battery depends on location.

Total system losses: 30%.

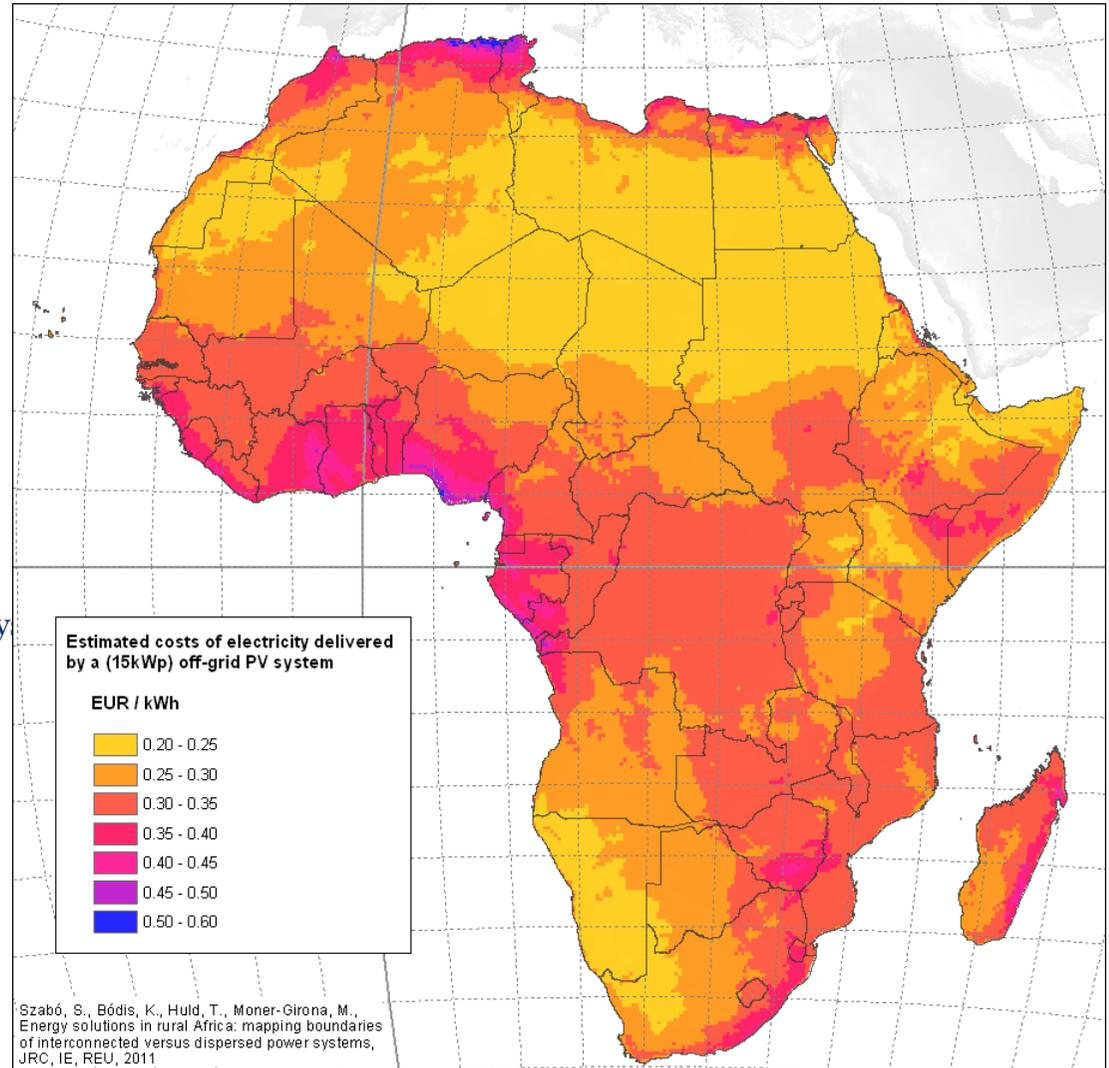
Lifetime: 20 years PV modules and 5 years batteries.

Investment costs: 2.5€/Wp + 40% installation; 1.5 €/Ah.

O&M: 1200 €/year.

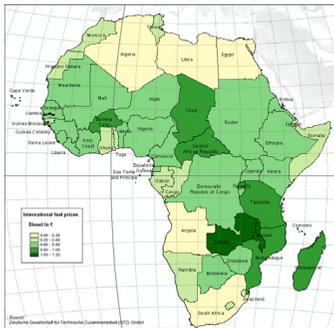
Discount rate: 5%.

Result:

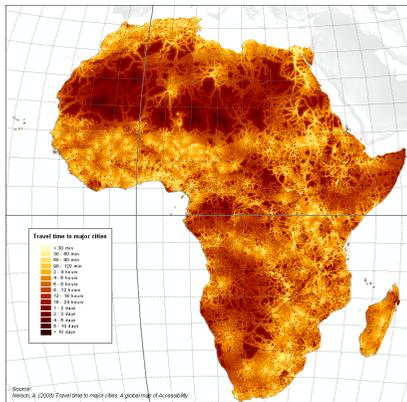


Electricity cost from the diesel gen-set

Sources:



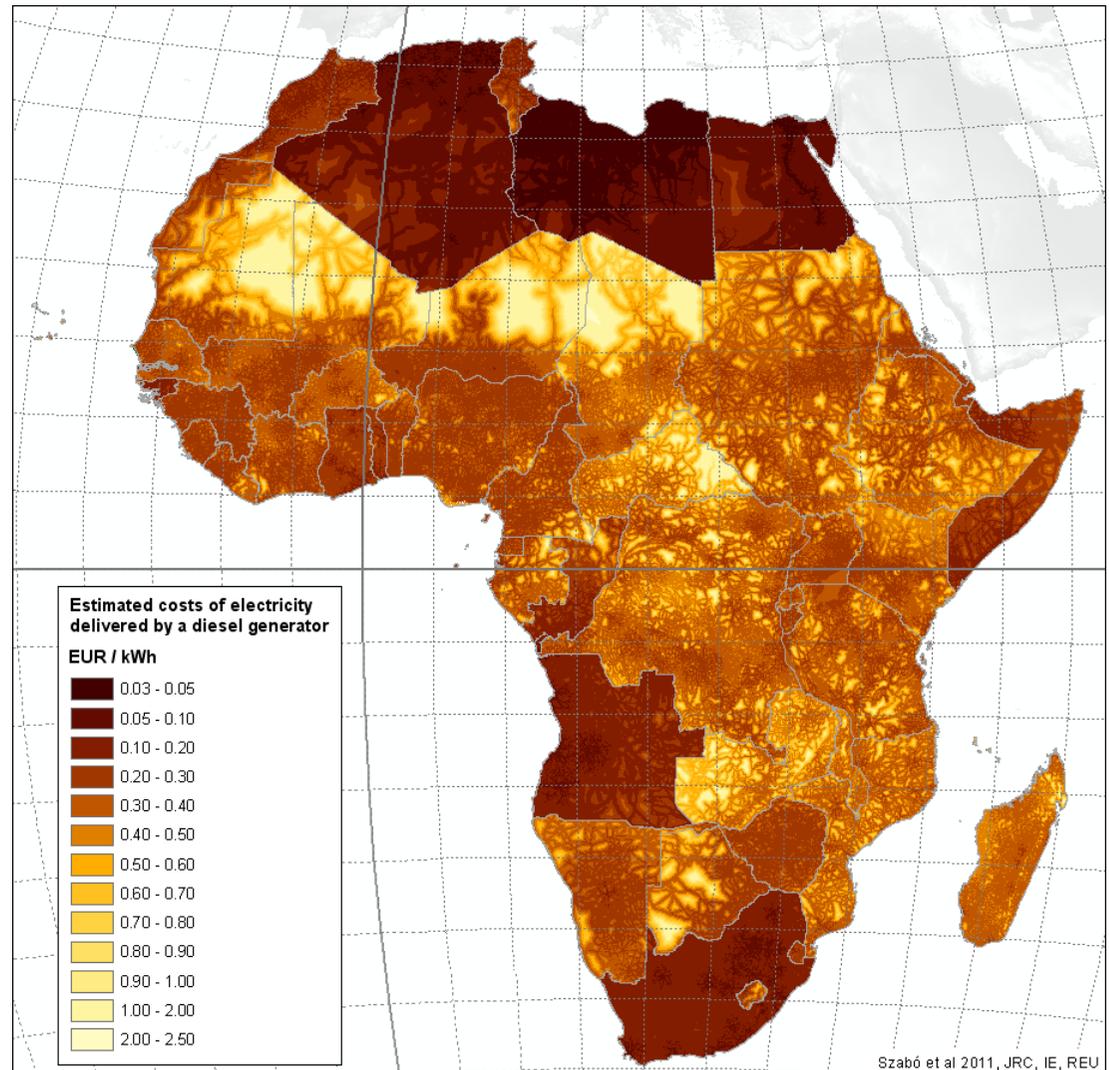
2008 diesel prices database.
Accessibility map.



Analysis:

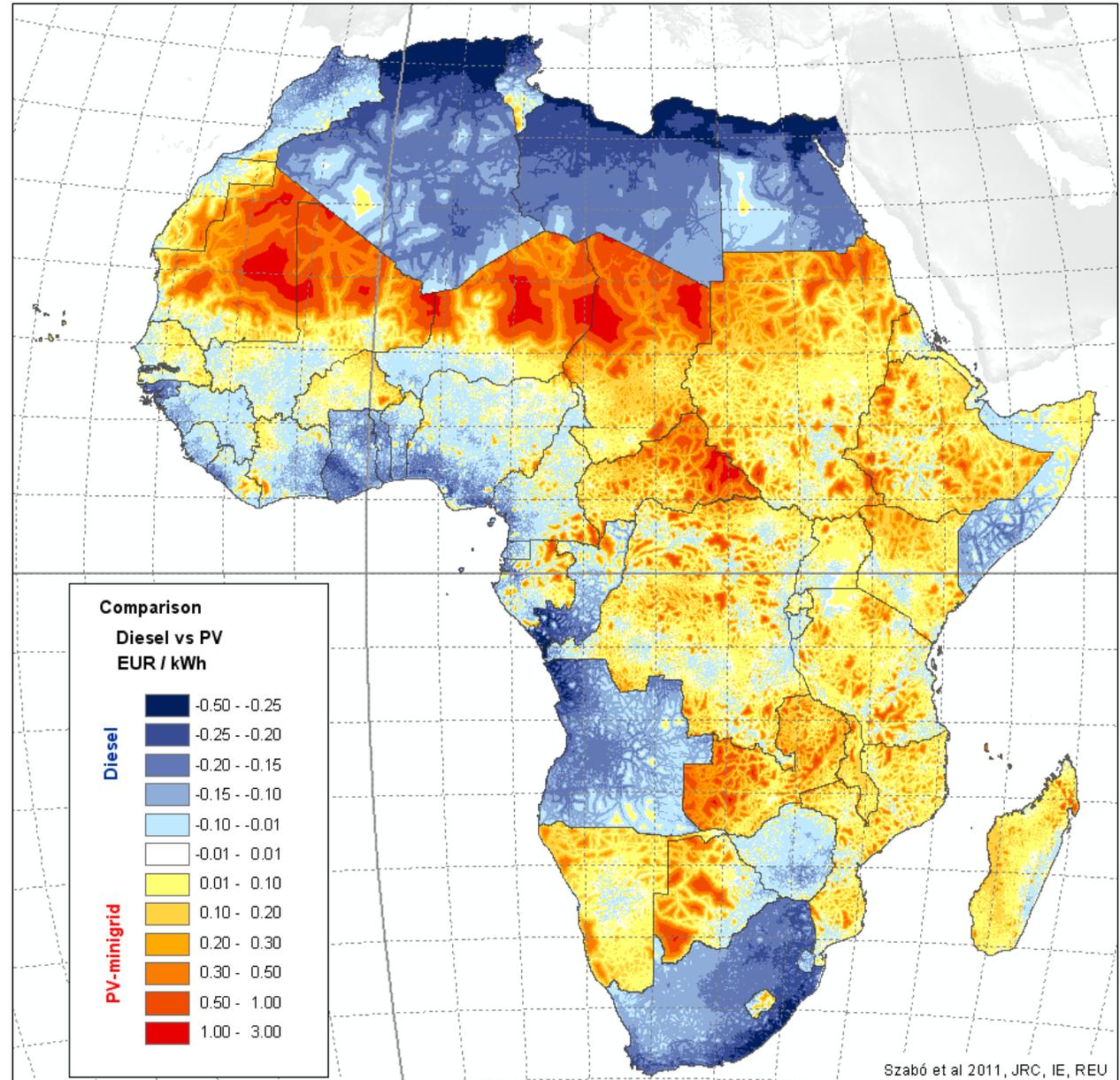
Transport cost per liter
Transport cost per kWh
Generation and transport cost per kWh, including labour,
capital cost, maintenance and amortization.

Result:

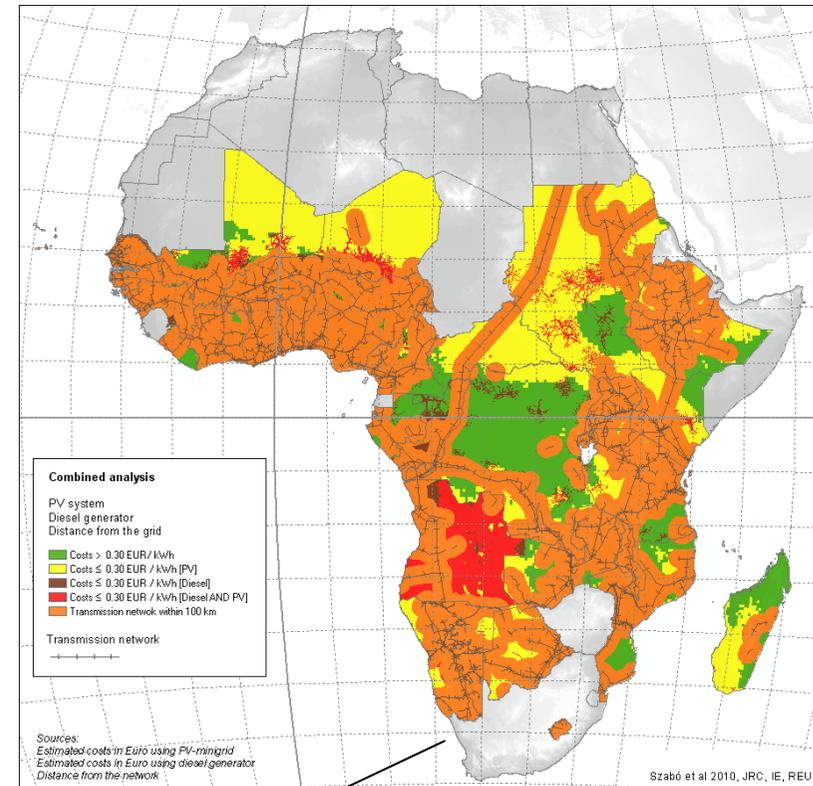
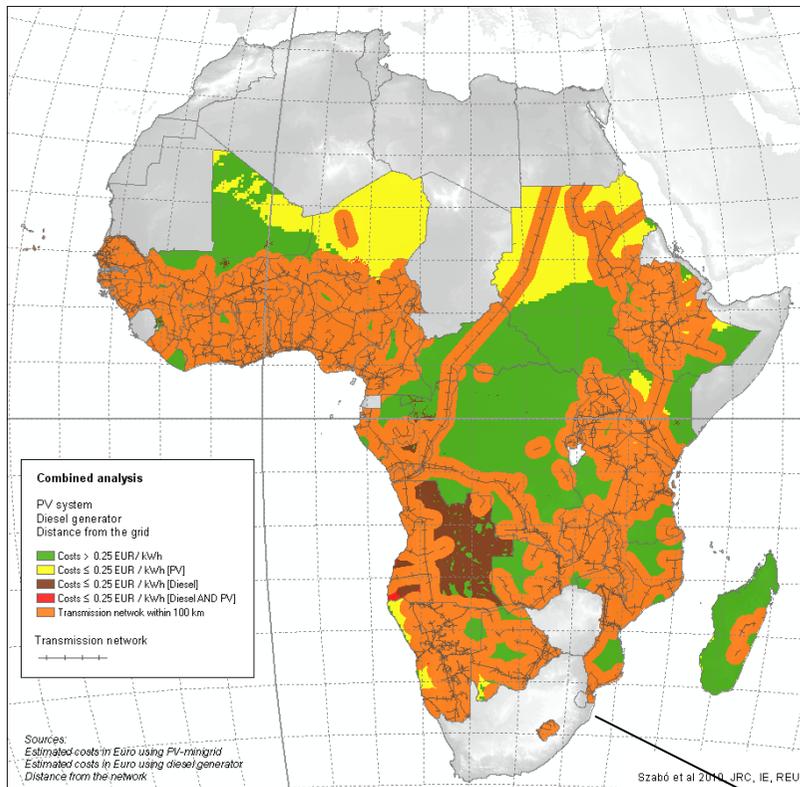


PV vs. Diesel

Importance of the role played by fuel
taxation policies in PV
competitiveness in each country.



Ability/willingness to pay (change from 25 to 30 Cent/kWh)



Cheapest technology

Population of the area [millions.]

<math>< 0.25\text{€}</math>

<math>< 0.30\text{€}</math>

None

60.6

34.7

PV

9.7

26.3

Diesel

4.9

5.4

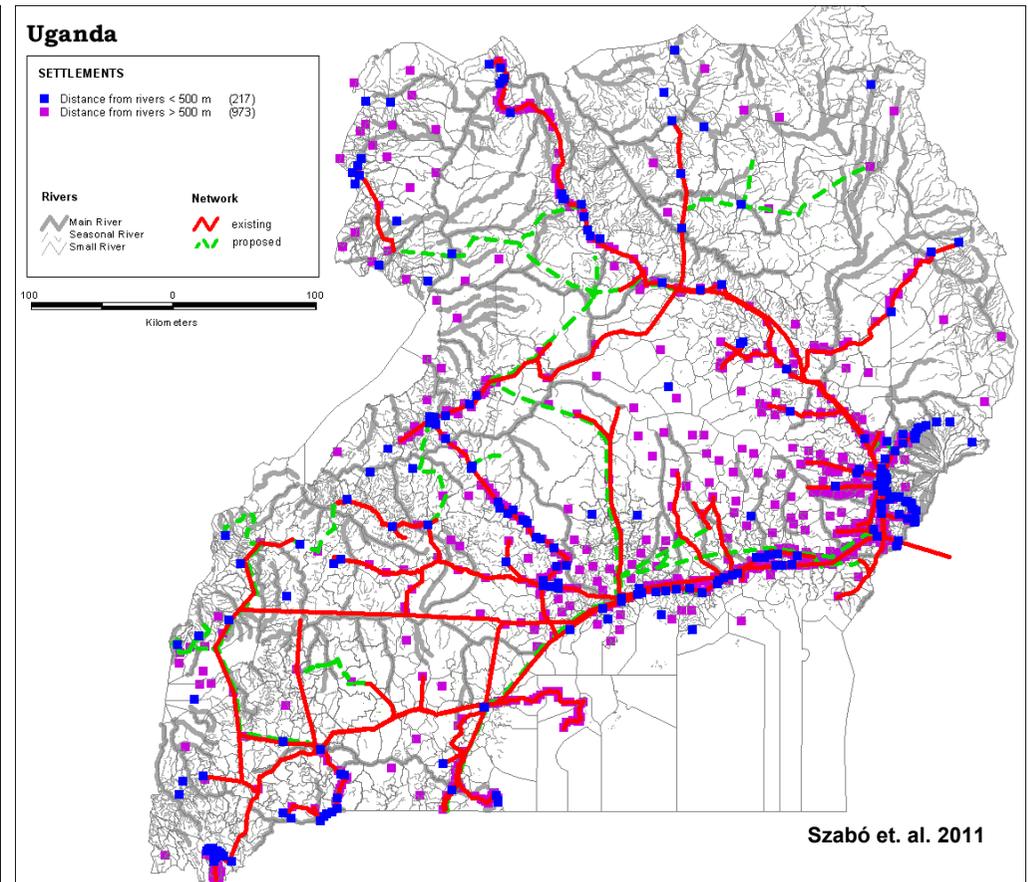
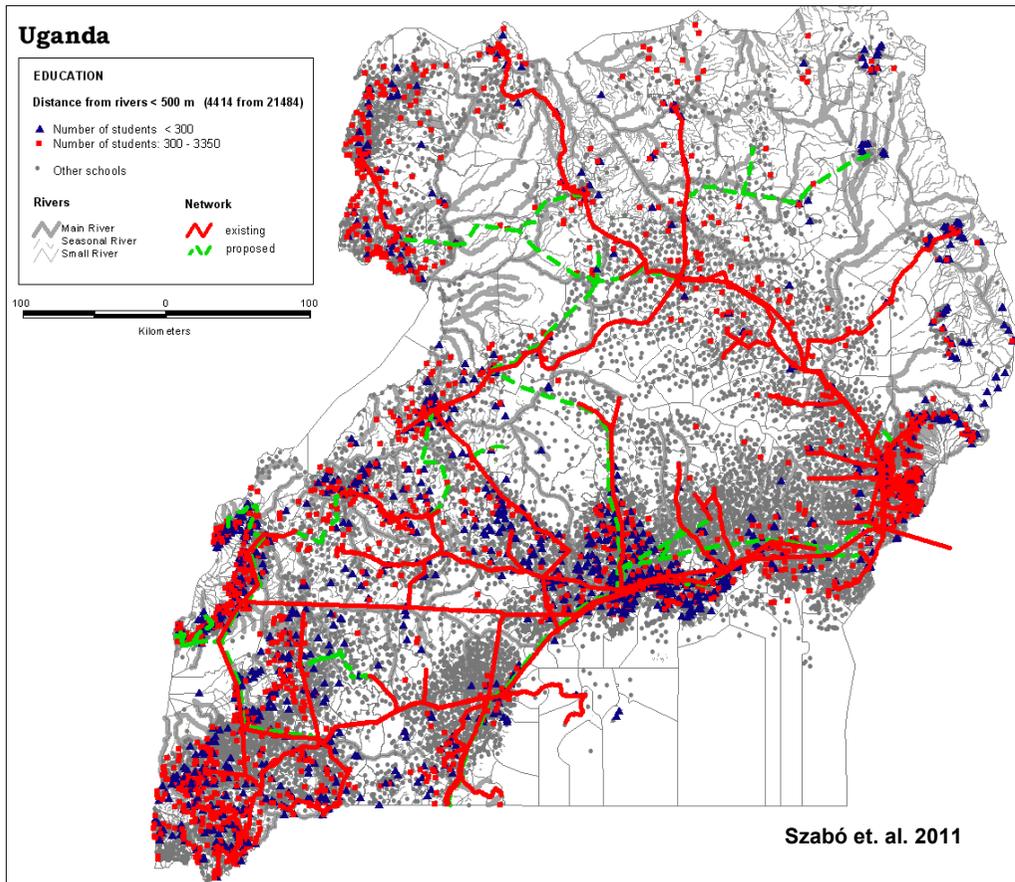
Both

0.2

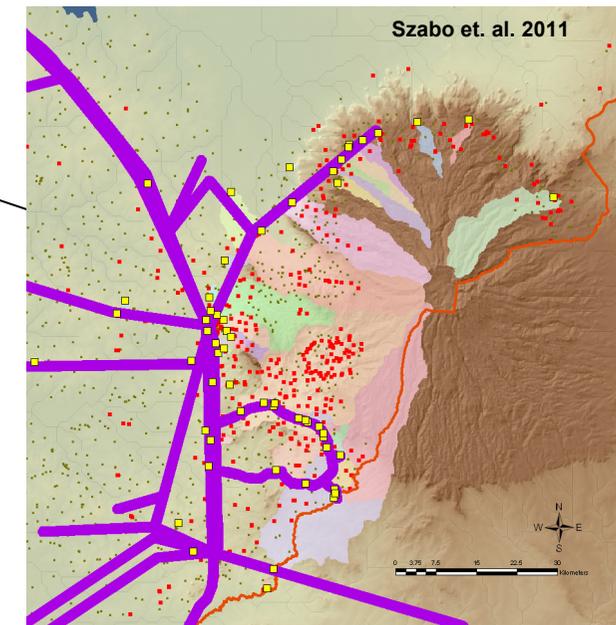
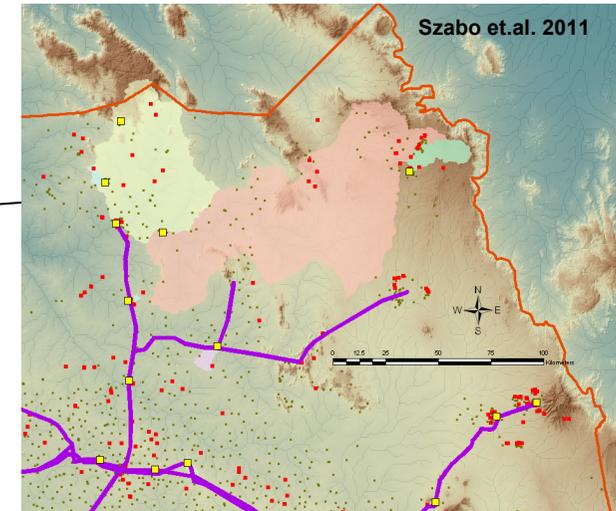
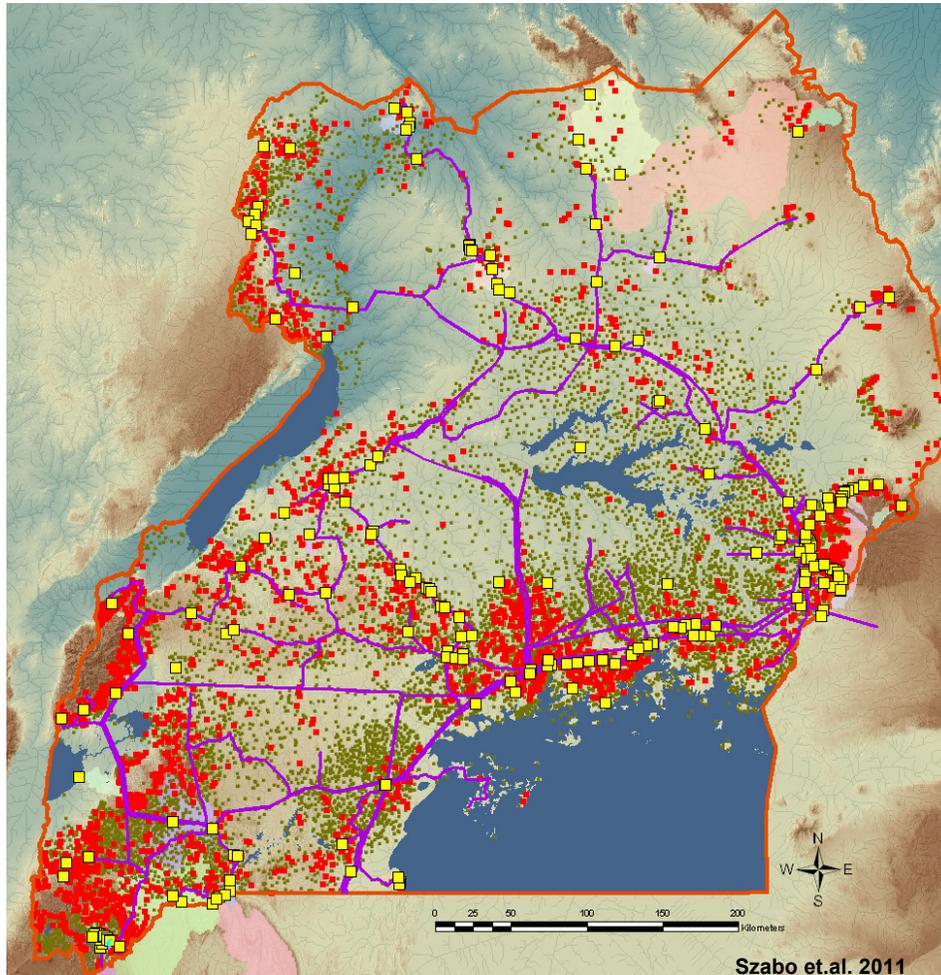
9.1

Importance of financial mechanisms that could reduce the burden of rural population on paying for the improvement in energy services.

Potential mini hydro electrification projects



Identify the most promising settlements for micro hydro calculated size of catchment, distance from river, network



Conclusion

- What are the most efficient ways to support the entrance to the African market of the more reliable technologies? Can applied research (e.g. innovative GIS techniques) speed up this process?
 - Designing a combination of technologies
 - Initial site selection
 - New design of aid/support schemes: emphasis on the output of the system instead of subsidizing the installation. This would disfavour unreliable technologies.
 - Offering certification in EU labs or transferring know-how to newly set up laboratories in Africa

The maps and links to the freely available datasets will be uploaded to the websites:

<http://www.EUEI.net> OR <http://www.AFRETEP.net>

For further information, please contact:

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umberto.tromboni@ec.europa.eu

THANK YOU for YOUR ATTENTION !