

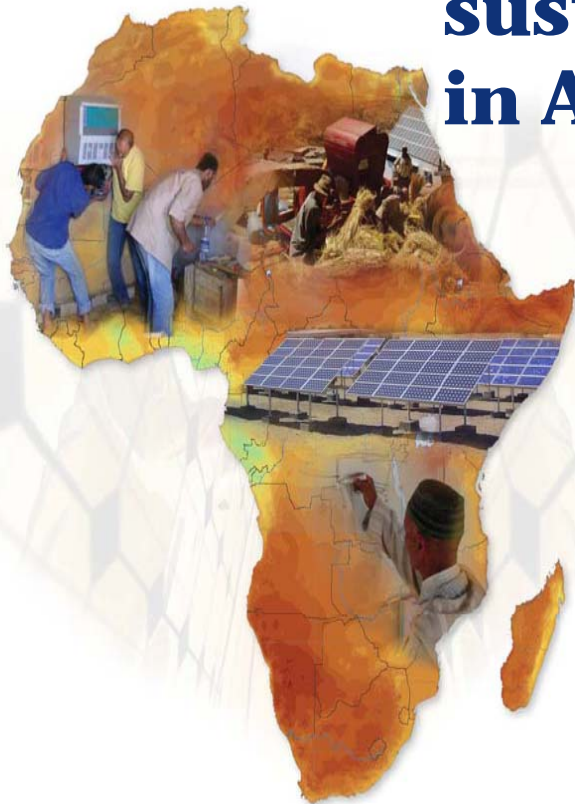


25<sup>th</sup> European Photovoltaic Solar Energy Conference and Exhibition  
5<sup>th</sup> world conference on Photovoltaic Energy Conversion

Valencia, 8<sup>th</sup> September 2010

# AFRETEP

**Integrating support tools for a  
sustainable energy development  
in Africa.**



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- Project:* Scientific and Technical Support to Sustainable Energy Development in Africa: Rural Electrification, Renewable Energy and Communication.
- Funded by:* European Commission, EuropeAid Co-operation Office.
- Implementing body:* European Commission - Joint Research Centre  
Institute for Energy, Renewable Energy Unit (REU)
- Starting date:* August 2009
- Duration:* 3 years
- Overall objective:* to contribute to understand the potential for renewable energy options in Africa for increased access to electrification in rural areas.
- Specific objective:* to develop a common African scientific approach towards evaluating rural electrification methodologies.
- Tasks:* Increase Scientific and technological knowledge sharing  
Establish a network of African Research Institutions  
Promote cooperation and coordination  
Provide scientific information, geographical data and appropriate tools.

## The 1<sup>st</sup> AFRETEP meeting

École Nationale Supérieure Polytechnique (ENSP), University of Yaounde I

***Cameroon***

Centre d'Études et de Recherches sur les Energies Renouvelables (CERER)

***Senegal***

Center for Research in Energy and Energy Conservation (CREEC), Makerere University

***Uganda***

Research and Development Directorate, Ministry of Mines and Energy

***Ethiopia***

Fondation 2iE - Groupe EIER - ETSHER International Institute for Water and Environmental Engineering

***Burkina Faso***

ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)

***Cape Verde***

Kwame Nkrumah University of Science & Technology (KNUST), Technology Consultancy Centre

***Ghana***

Faculty of Mechanical Engineering, College of Engineering and Technology, University of Dar es Salaam

***Tanzania***

Centre of Study in Renewable and Sustainable Energy, University of Botswana

***Botswana***

Renewable Energy Unit, Institute for energy, Joint Research Centre

***EU***

*Task*    *Activity*

*Scientific and technological  
knowledge sharing.  
Increase cooperation.*

**Capacity building** of African researchers/students.  
Training workshops.



European Solar Test Installation Laboratory

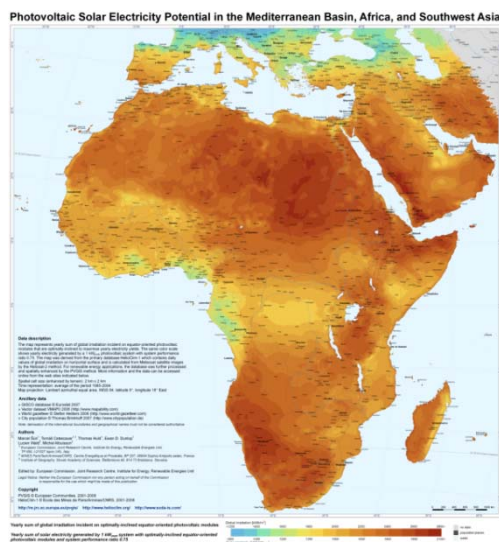
*Establishing a network of  
African Research  
Institutions.*

**Launch a public accessible web-based African Renewable  
Energy Technology Platform (AFRETEP).**  
This platform consists of a network of African renewable energy  
research centers.

## Task Activity

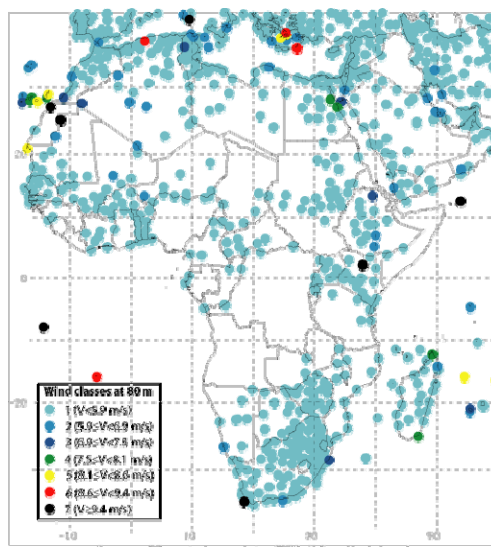
*Support sustainable energy planning for rural electrification.*

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



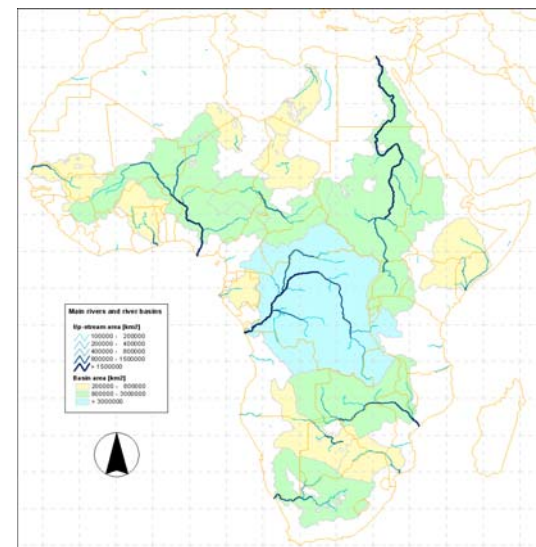
### SOLAR RESOURCE

Source: PVGIS, JRC IE REU  
<http://re.jrc.ec.europa.eu/pvgis>



### WIND RESOURCE

Source: Archer C. L. - Jacobson M. Z.  
[http://www.stanford.edu/group/efmh/winds/global\\_winds.html](http://www.stanford.edu/group/efmh/winds/global_winds.html)



### HYDRO RESOURCE

Source: Derived data based on SRTM V4  
<http://srtm.csi.cgiar.org/>

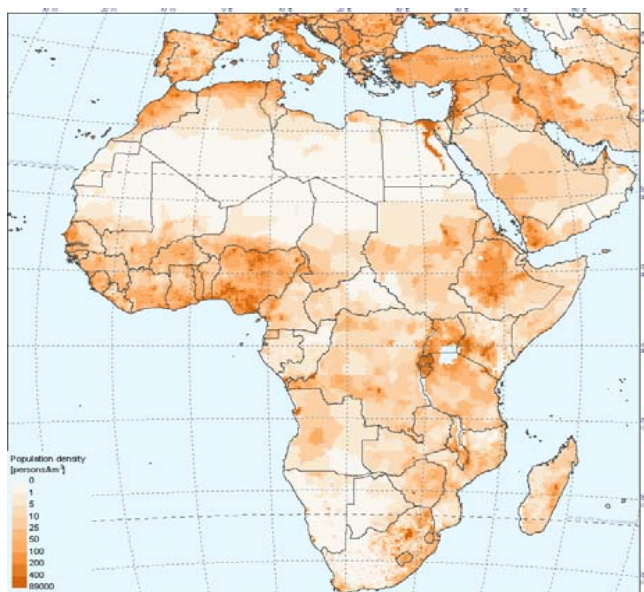


## Task Activity

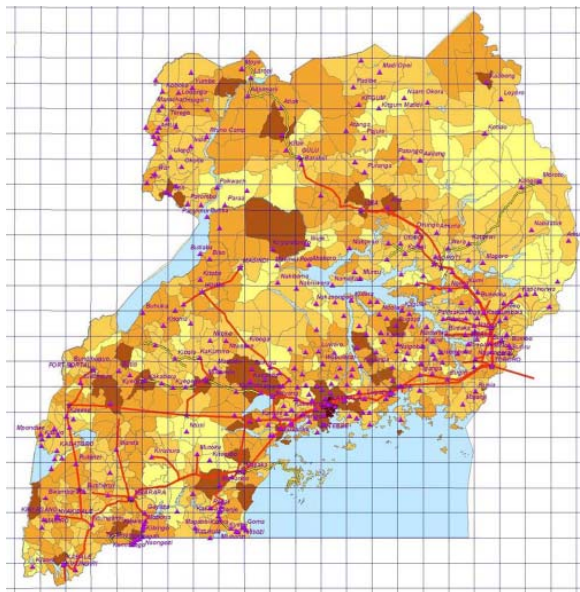
*Support sustainable energy planning for rural electrification.*

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

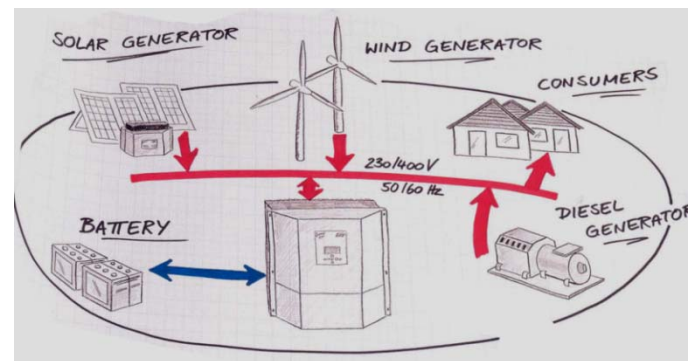
- Criteria to be used in the evaluation of grid extension vs. off-grid solutions.
- Harmonization of existing tools and/or development of missing methodologies.



Population density (inhab./km<sup>2</sup>)



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

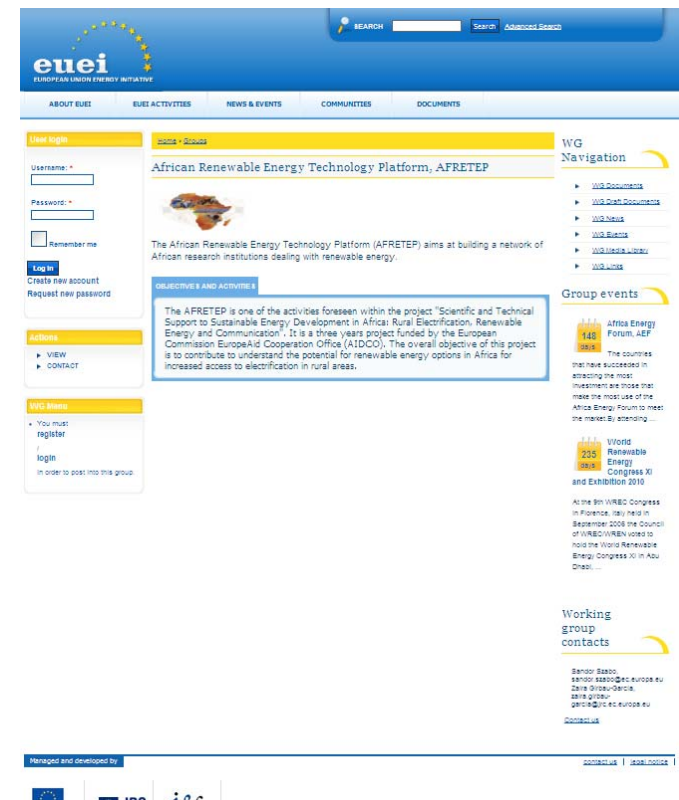


Example of hybrid system in isolated areas

## Task Activity

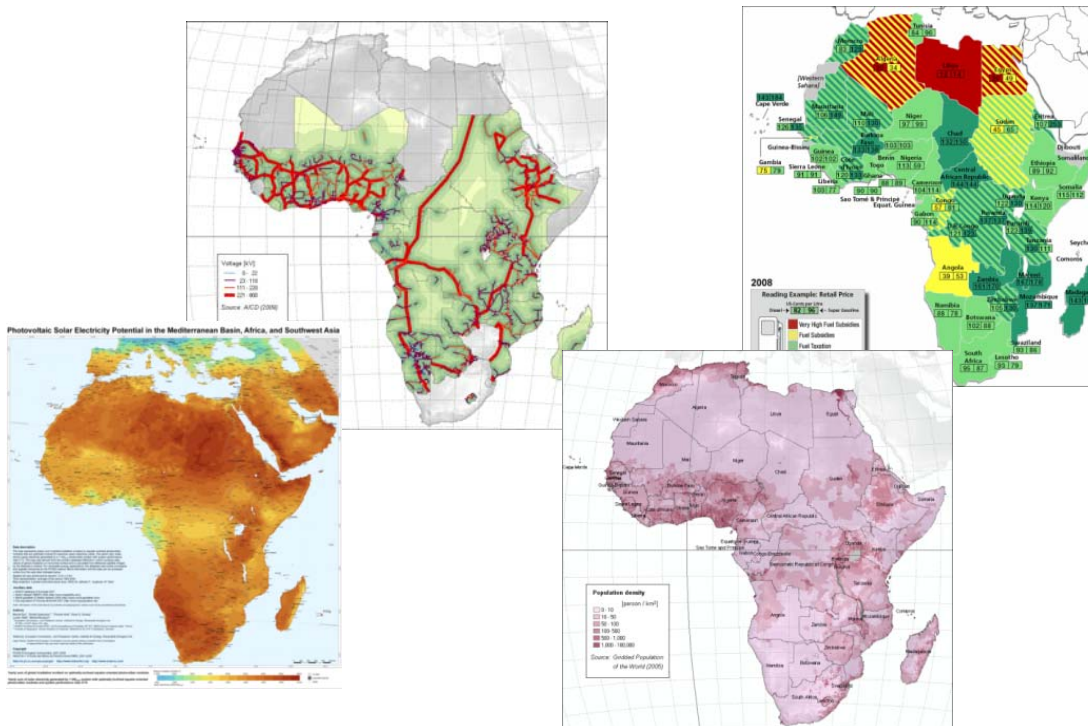
*Scientific and technological knowledge sharing.  
Increase cooperation.*

Provide a **communication channel** for decision, policy makers and stakeholders.  
AFRETEP website, **http://www.afretep.net**, is hosted by the European Union Energy Initiative (EUEI) site:  
**http://www.euei.net**



# How much energy could be economically supplied by using renewables?

## 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**

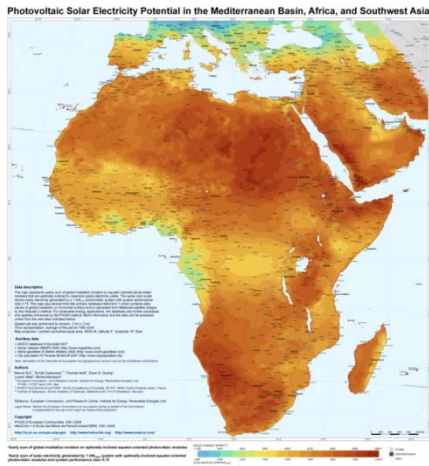
Existing energy planning tools

New methodologies



# PV mini-grid electricity cost

## Sources:

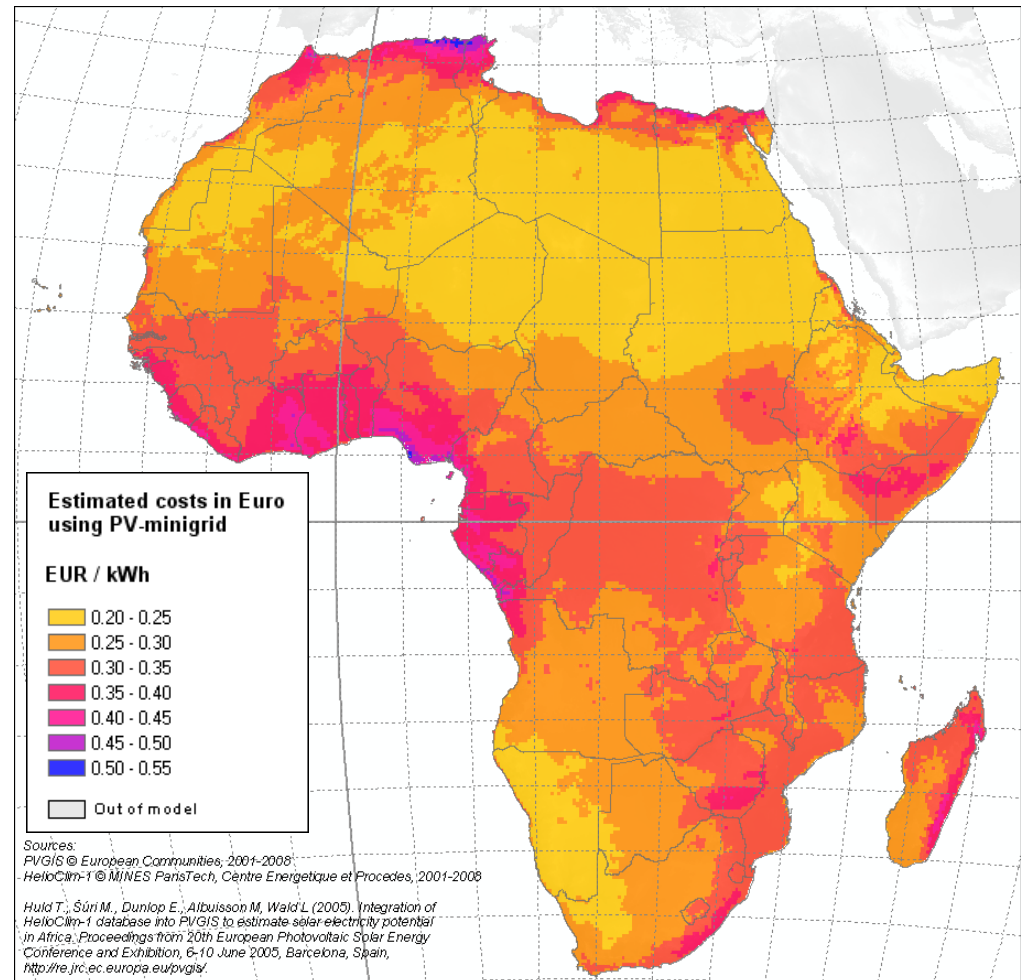


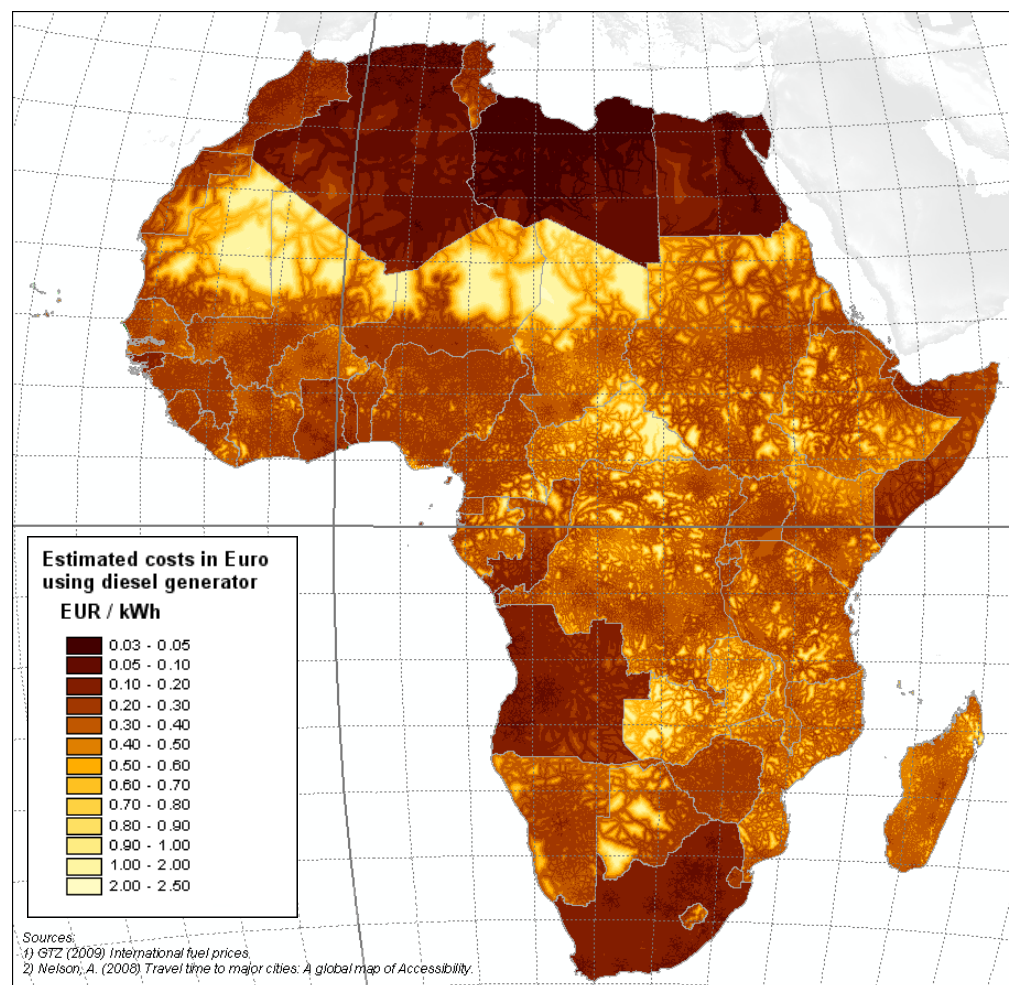
PVGIS solar radiation database (daily data 2002-2004).

## Analysis:

System must not run out of energy more than 5% of the days.  
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%.

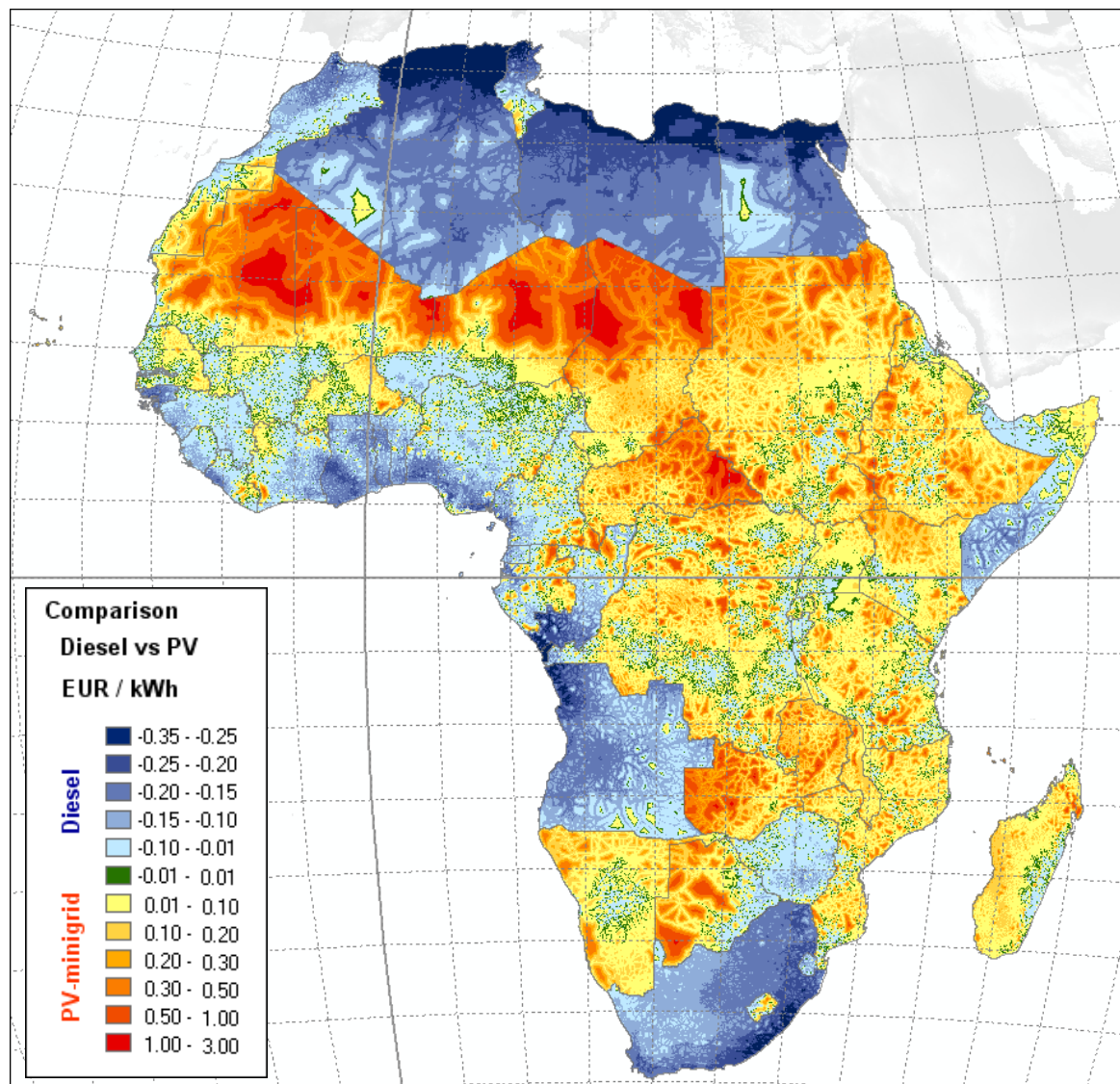
## Result:





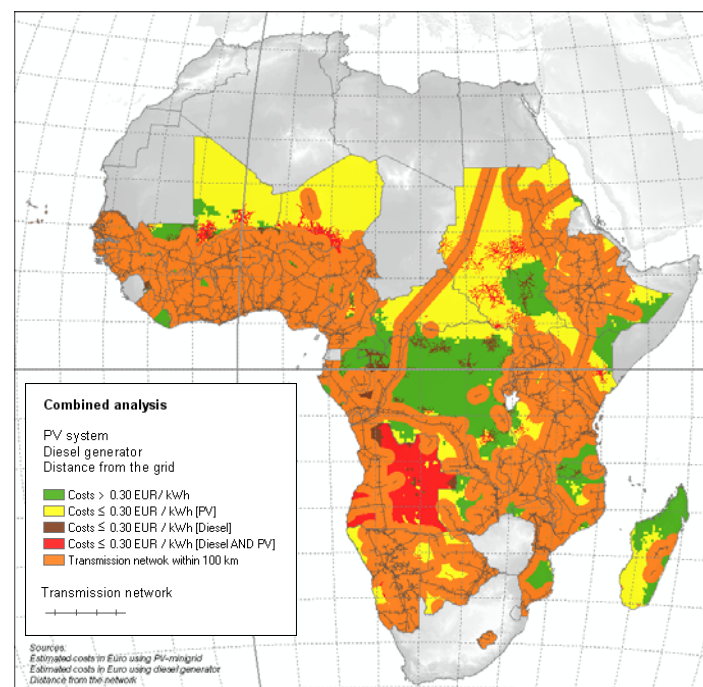
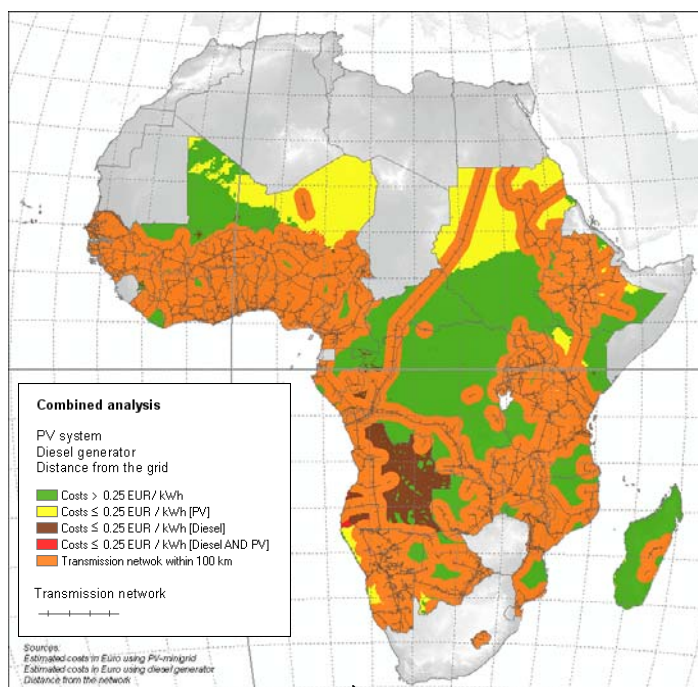
## PV vs. Diesel

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





## Ability/willingness to pay



Cheapest technology → Population of the area [millions.]

	<0.25€	<0.30€
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.**



## Conclusions

- At huge regions in Africa, PV is already a cost effective option for rural electrification.
- Electricity costs are highly influenced by social, economic, technical and geographic characteristics. GIS is an appropriate tool to help in the decision making process for rural electrification plans in Africa.
- AFRETEP platform has already been set up; 10 centres; website; capacity building.

# Thanks for your attention

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