

Evaluation of **renewable energy resources** in Africa

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Goals of ANSOLE

Fosters technical and vocational education and training(TVET) in renewable energies at various skill levels (*capacity building*)

Fosters research activities in renewable energy among African scientists and non African scientists who are directly involved in the education of African students and experts (*capacity building*)

Promotes and encourages the use of renewable energy in Africa (*sustainable development, environmental protection, business mediation, etc*)



Stand 22 January 2016

ANSOLE has more than 850 members based in:

42 African Countries: Algeria, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Chad, Central African Republic, Congo-Brazzaville, Democratic Republic of Congo, Cote d'Ivoire, Djibouti, Egypt, Ethiopia, Gambia, Ghana, Guinée Conakry, Kenya, Liberia, Lesotho, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, **Somalia**, South Africa, Sudan, South Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.

26 non African Countries: Albania, Austria, Belgium, Britain, Canada, China, Denmark, Estonia, France, Germany, India, Ireland, Italy, Jordan, Luxembourg, Malaysia, Holland, Palestine, Portugal, Russian Federation, Scotland, Sweden, Switzerland, Taiwan, Turkey and USA

Logos of Institutional Members



SOLAR ENERGY CONSULTING AND CONSTRUCTION COMPANY (SECCCO)

Activities

1) Organisation of RE conferences, symposia, workshops & summer schools

→ *Cameroon 2011& 2012, Morocco 2013, Tunisia 2013, Kenya 2013, South Africa 2013, Ghana 2014, Algeria 2015, Tanzania 2015*

→ *Upcoming: Egypt 2016, Burkina Faso 2016, Kenya 2016, Tanzania 2016*

2) Assisting in organization of non-ANSOLE RE related events worldwide

→ *Hamburg 2011, Giessen 2012, Brussels 2012, Istanbul 2013, Berlin 2014, Dresden 2014, etc*

3) Training, Education & Research

- „*Sur-Place*“ scholarships to selected 3rd year Bachelor students
- „*Sur-Place*“ scholarships to selected Masters and PhD students
- Mobility scholarships to Masters & PhD students (Intra-African Exchange, **INEX**, Africa-North Exchange, **ANEX**, & Africa-Latin America Exchange, **ALAMEX**)
- Mediation of students & researchers from Africa, Europe, USA with own funding to African & non-African RE laboratories
- Implementation of vocational training and education programs in RE at existing training institutions (First initiative planned 2016 in Cameroon)
- *E-learning (looking for partners!)*

4) RE public education & awareness raising in Africa:

- radio & TV, print media, open-air events, popular theater („No Bill with the Sun“)
ANSOLE website, ANSOLE News (ANSOLE e-Magazine)

5) Business mediation

6) ANSOLE websites (www.ansole.org/www.ansole.com)

- information about RE events, job, training, funding opportunities, *e-learning*

7) ANSOLE e-Magazine (ANSOLE News)

- country specific detailed RE information; ANSOLE reports, RE events reports, Events calendar, life stories, etc

8) ANSOLE mailing list

- Rapid information dissemination to members, who forward the information thru own mailing lists

9) Bridging Africa, Latin America and Europe on Water and Renewable Energies Applications (BALEWARE)-www.baleware.org

→ *will be launched in december 2016 in Arusha Tanzania*



Energy Situation in Africa

- Extremely low levels of modern energy supply and access

Electricity

- Low Generation Capacity
 - Total capacity about 140 GW , South Africa accounts for 36%, North Africa (39%), other Sub-Saharan Africa (25%)
- Low Access to Electricity
 - Only about 31% of the Sub-Saharan African population has access to electricity, Contrast with N. Africa – 99% access
 - Electrification rates as low as 9 – 20% in many Sub-Saharan African countries
- Inefficient Transmission and Distribution System
 - Distribution losses as high as 20% in Ghana and Senegal to 55% in Botswana
- Highly unstable and unreliable electricity supply from the grid



Energy Situation Africa

➤ High Generation costs

- Over 80% of electricity generation in Africa is from fossil fuels
Highly vulnerable to price shocks
- Average tariffs are US\$0.14 per kWh compared to US\$0.04 and US\$0.07 per kWh in South and East Asia, respectively

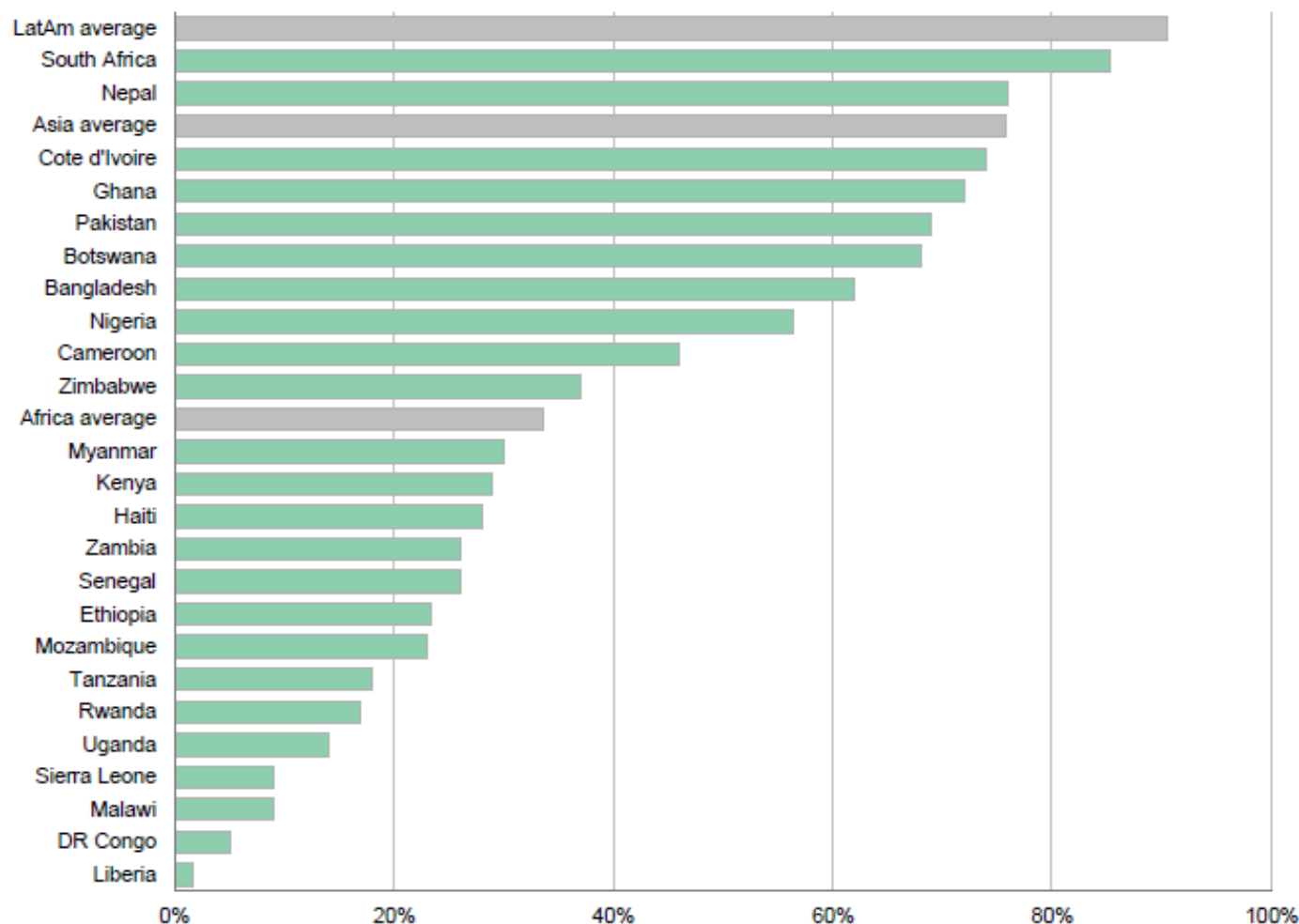
➤ Low Electricity Consumption

- Per capita electricity consumption of 571 kWh in Africa is 5 times less than world average

Other forms of energy

- About 80% of SSA population depends on biomass for cooking with very low efficiency in heat conversion of traditional stoves (10 – 15% efficiency)
 - Serious impacts on health and mortality (mostly affecting women and children)
- Huge dependence on animal and human labor for productive activities especially in rural areas

ELECTRIFICATION RATE 2013 (%)





The Opportunity: Energy Resources Potential of Africa

Energy Type	Reserves	Regional Distribution
Non-renewable		
Crude oil	132.1 billion barrels	Northern Africa: 53.2% Western Africa: 28.2% Central Africa: 16.9% Other Africa: 1.7%
Natural gas	14.7 trillion m ³	Northern Africa: 55.8% Western Africa: 36.1% Other Africa: 8.2%
Coal	31.696 billion tonnes	Southern Africa: 95.2% Other Africa: 4.8%
Nuclear	Reasonably assured resources: 663,400 tonnes Inferred resources: 286,300 tonnes	Northern Africa: 2.9% Western Africa: 36.7% Central Africa: 2.7% Eastern Africa: 4.2% Southern Africa: 53.5%
Renewable		
Hydro	1,834 TWh/yr	Central Africa: 57% Eastern Africa: 32% Other Africa: 11%
Biomass	Woody biomass: 70 billion tonnes	All regions
Solar	¹ Solar insolation: 1800 - 2850 kWh/m ² .a	Most of Africa
Wind	¹ Wind speeds: Southern Africa (6 - 8 m/s) ² Northern Africa (5 - 8.5 m/s)	Most attractive sites in the Northern and Southern coasts
Geothermal	15,000 MW	Eastern Africa

Energy context in Africa

Africa : the lowest electrification rate of the world

SOURCE: IEA, World Energy Outlook 2012

Electricity access in 2010 - Regional aggregates

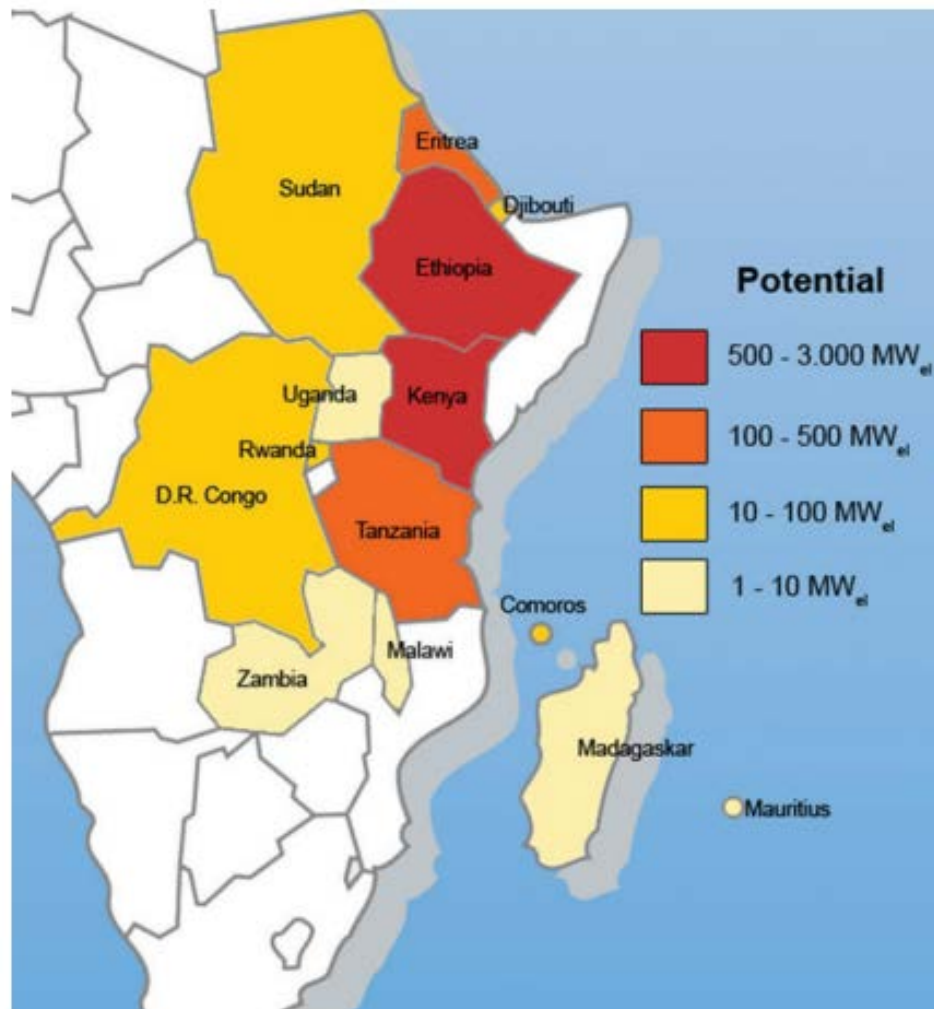
Region	Population without electricity millions	Electrification rate %	Urban electrification rate %	Rural electrification rate %
Developing countries	1 265	76.1	92.1	63.7
Africa	590	43	72	24
North Africa	1	99	100	99
Sub-Saharan Africa	589	32	64	13
Developing Asia	628	83	96	74
China & East Asia	157	92	98	88
South Asia	471	70	92	61
Latin America	29	94	98	76
Middle East	18	91	99	75
Transition economies & OECD	2	99.8	100.0	99.5
World	1 267	81.5	94.7	68.0

Energy resources in Africa

Energy potentials : renewable energy resources (geothermal)

**Geothermal
energy**

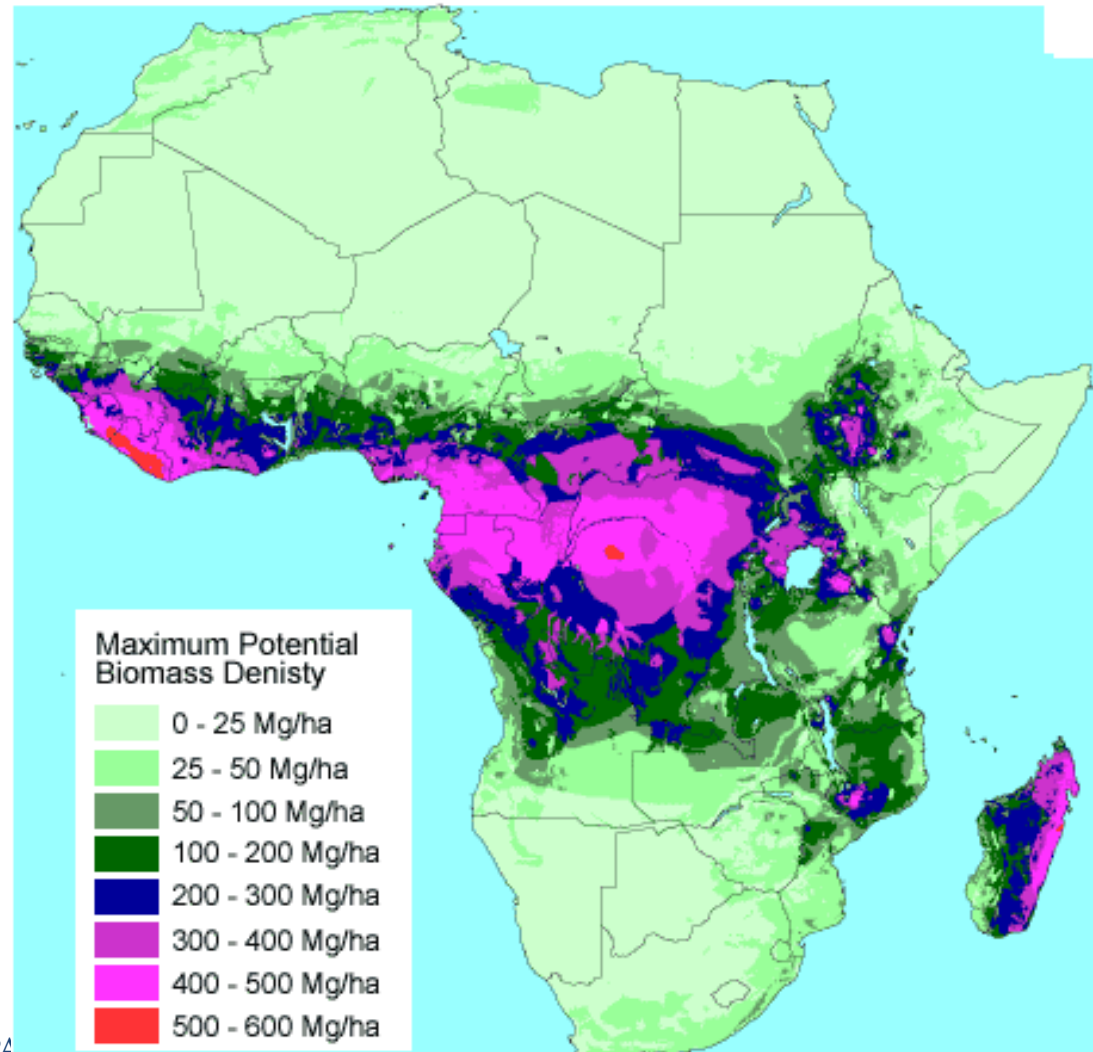
**More concentrated
in Eastern Africa**



Energy resources in Africa

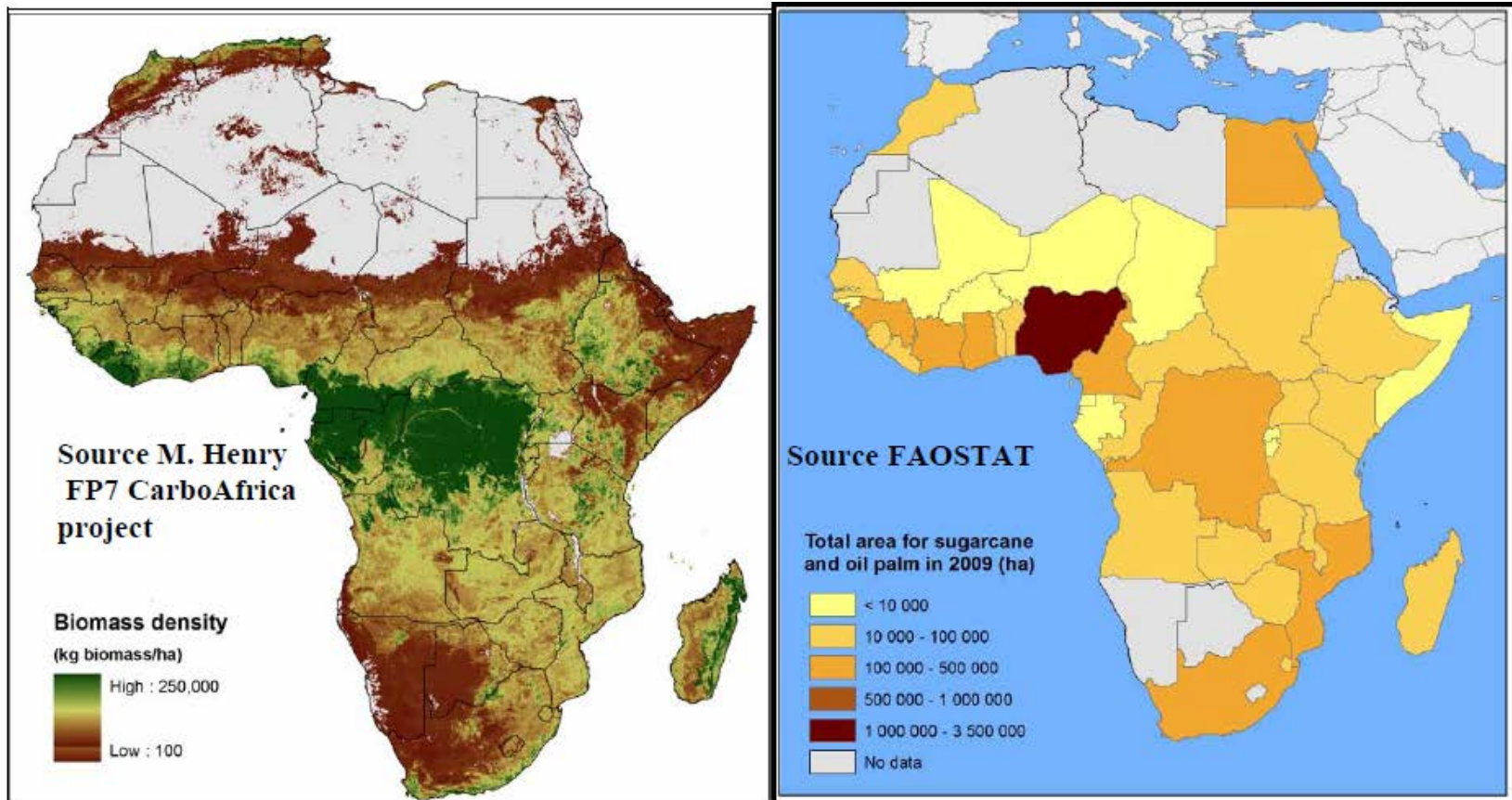
Energy potentials : renewable energy resources (biomass energy)

Biomass energy
 25% of the
 global biomass
 reserves



Energy resources in Africa

Energy potentials : renewable energy resources (biomass energy)



Biomass density in the Africa continent (left) and total area used to produce sugarcane and oil palm in Africa in 2009

20. Internationale Solarkochertagung, Altötting, 20-21. April 2013



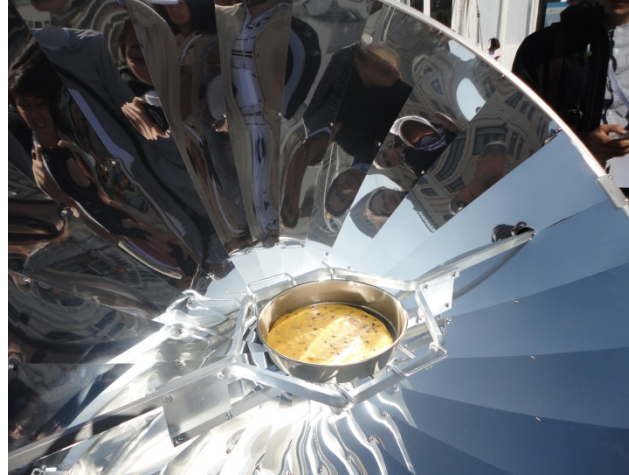
21. Internationale Solarkochertagung in Altötting (25-26. April 2015)



21.Int. Solarkochertagung: Ms Regula Ochsner, CEO of the swiss organisation ADES (Association pour le Développement de L'Energie Solaire) presenting the successful implementation of solar cookers in Madagascar. www.adesolaire.org







TriesteNext, Trieste, Italy 26-28 September 2014

Public Educational Mission of ANSOLE

UNESCO World Science Day, 10 Nov. 2014, UCLAN, Westlakes, Britain



Technical and Vocational Education and Training as from 2016



CARPENTRY
AUTO MECHANICS
BRICKLAYING
ELECTRICITY
PLUMBING
TILING

New training programs: Solar cookers, solar photovoltaics, solar lamps, wood saving stoves, and solar heaters

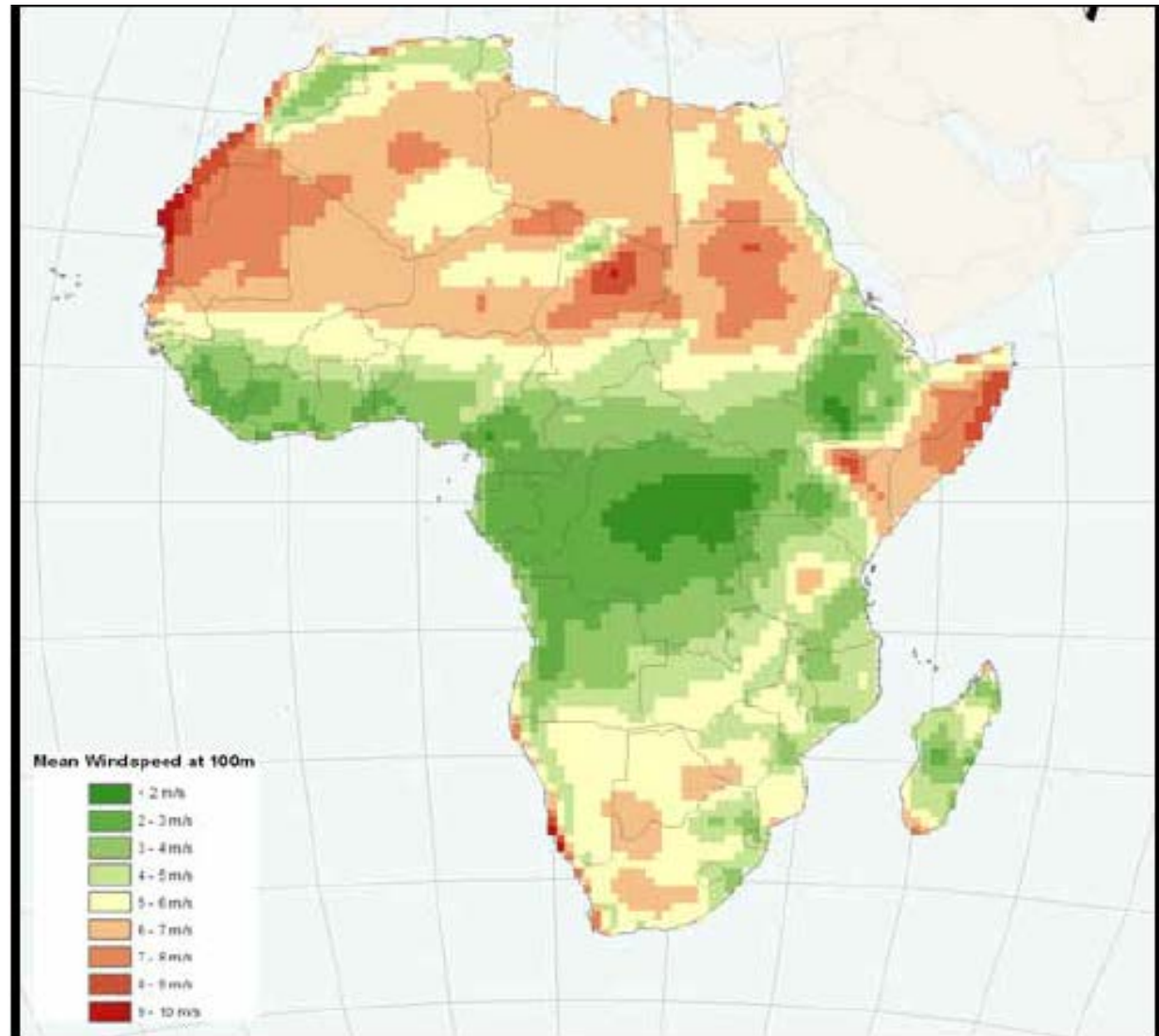
Partners: ANSOLE, Full Gospel Mission in Cameroon, Liebe in Aktion e.V., EG Solar e.V. Performing Arts and Cinematography Section at the Faculty of Arts and Letters of the University of Yaounde I and Prof Tahar ACHOUR

Energy resources in Africa

Energy potentials : renewable energy resources (wind energy)

Wind energy
20% of global
energy

**More
concentrated in
northern and
southern parts
of the continent**



Energy resources in Africa

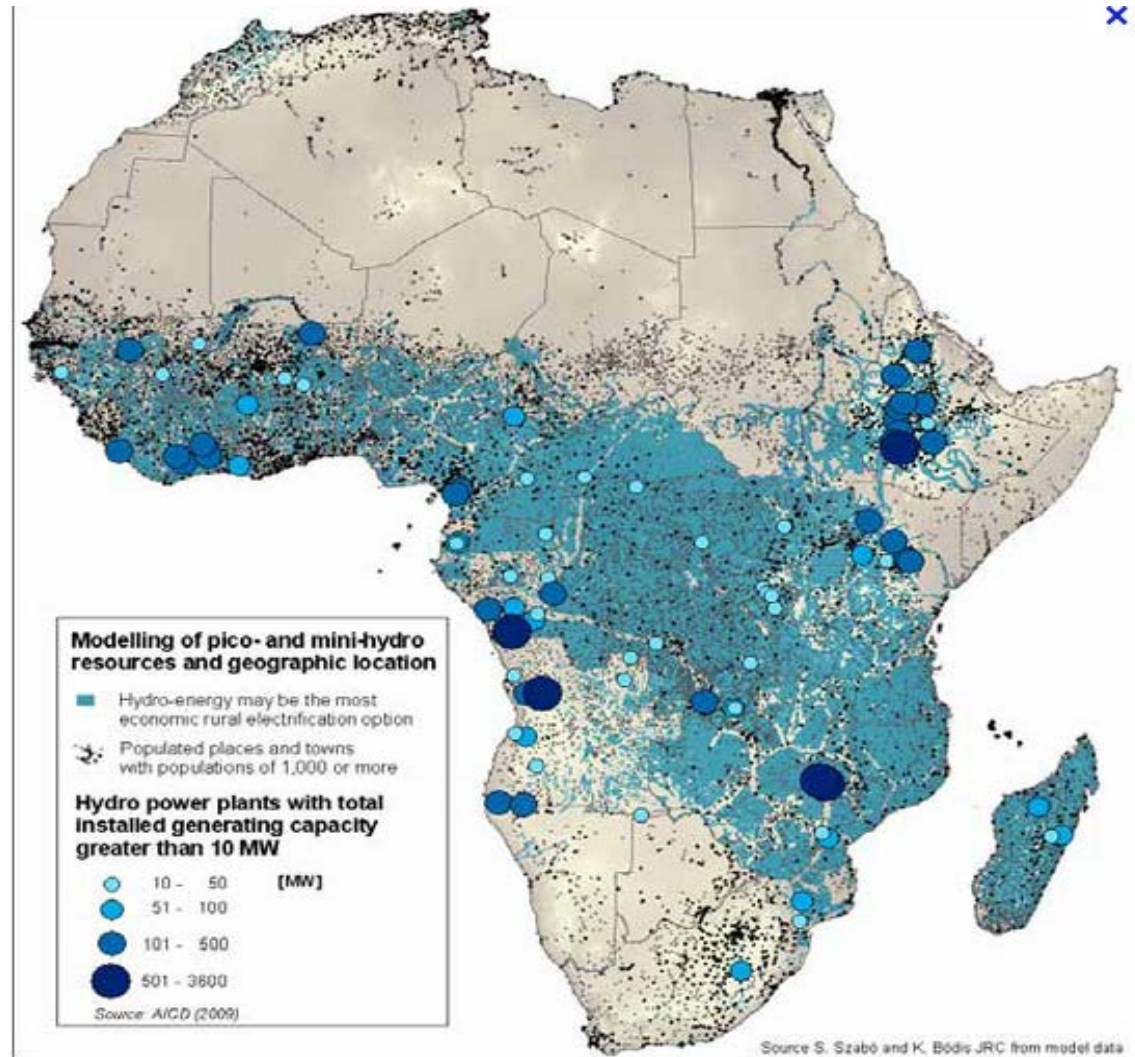
Energy potentials : renewable energy resources (wind energy)

Country	Potential (m/s)	Number of Wind Pumps
Botswana	2-3	200
Burundi	>6	1
Djibouti	4	7
Eritrea	3-8	<10
Kenya	3	272
Morocco	>10	-
Mozambique	0.7-2.6	50
Namibia	-	30,000
Rwanda	-	-
Seychelles	3.62-6.34	-
South Africa	7.29-9.7	300,000
Sudan	3	12
Tanzania	3	58
Uganda	4	7
Zambia	2.5	100
Zimbabwe	3-4	650

Energy resources in Africa

Energy potentials : renewable energy resources (hydro energy)

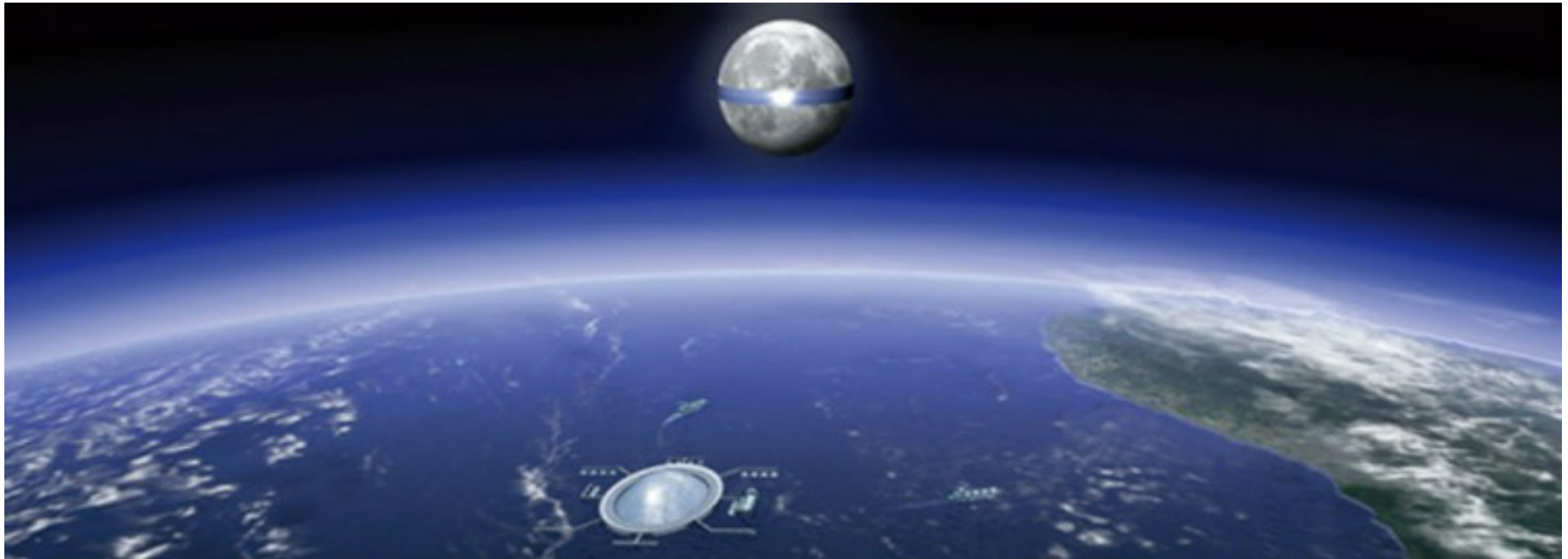
**Hydro
production
potential of
1440
TWh/year**



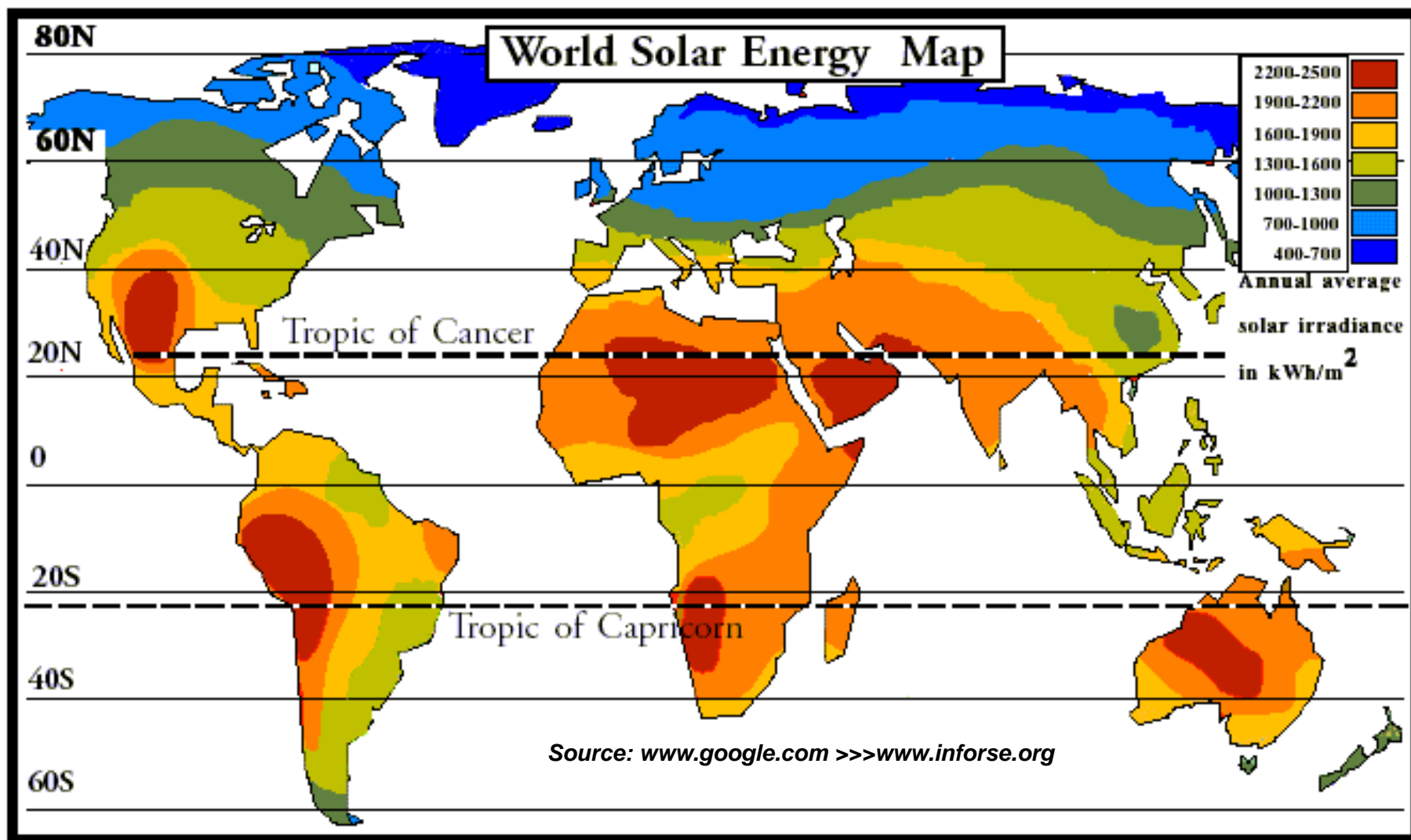
Solar Panels to ring the Moon

How the moon could provide for our energy

News and Trends, January 8, 2014



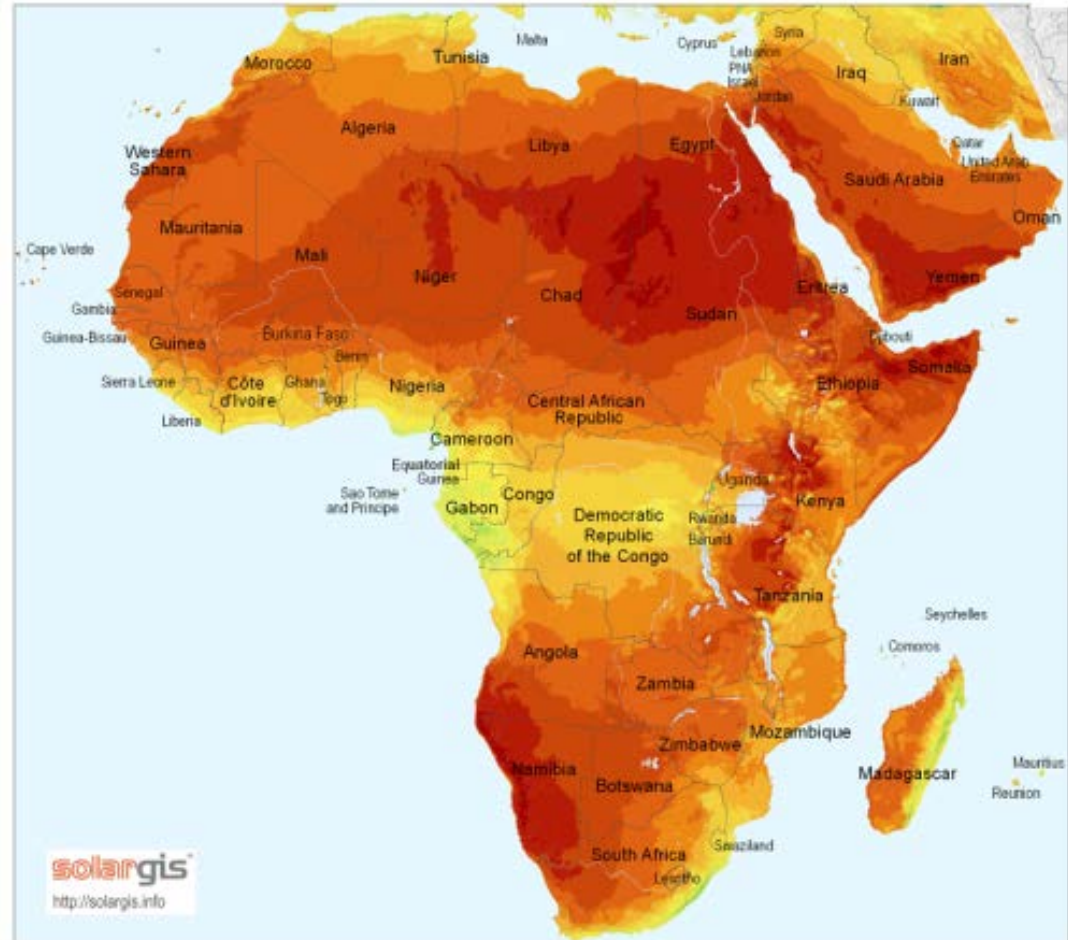
11000 Km solar panels around the moon equator and transmission of energy to Earth via microwave (Japanese project 2035)



Energy resources in Africa

Energy potentials : renewable energy resources (solar energy)

Global horizontal irradiation



**Solar energy:
74% of the
continent
receives more
than 1900
kWh/m²/year**

Average annual sum (4/2004 - 3/2010)

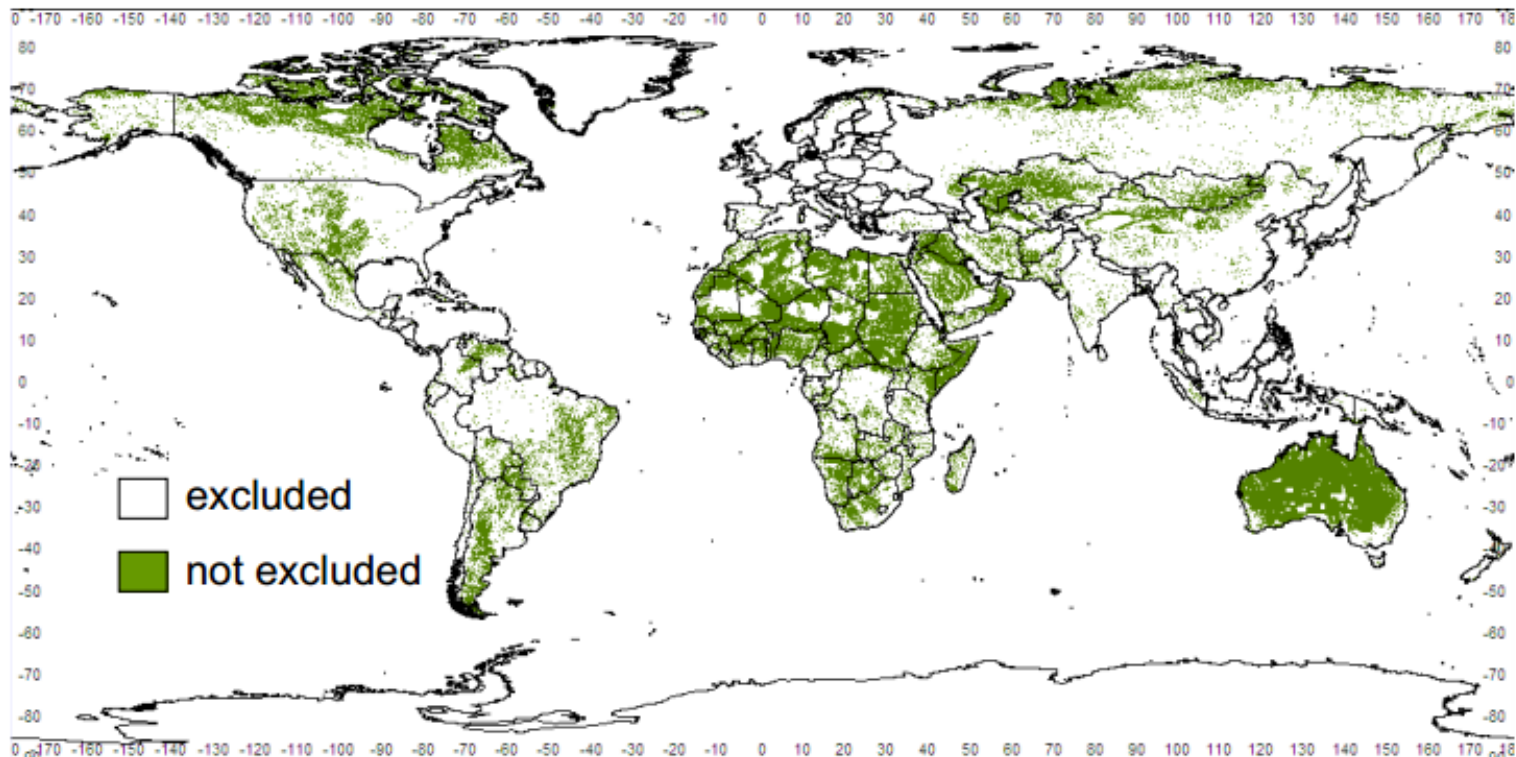
 < 1600 1800 2000 2200 2400 > kWh/m²

© 2011 GeoModel Solar s.r.o.

Energy resources in Africa

Energy potentials : renewable energy resources (solar energy)

Site Exclusion for Concentrating Solar Power Plants (Trough)



Deutsches Zentrum
 für Luft- und Raumfahrt e.V.
 in der Helmholtz-Gemeinschaft

Example of an adaptable and affordable technology



Easy transportation of a rolled up 135 W panel on a motorbike



Solamander 36 W photovoltaic panel mounted on a corrugated roof and held in place with nails

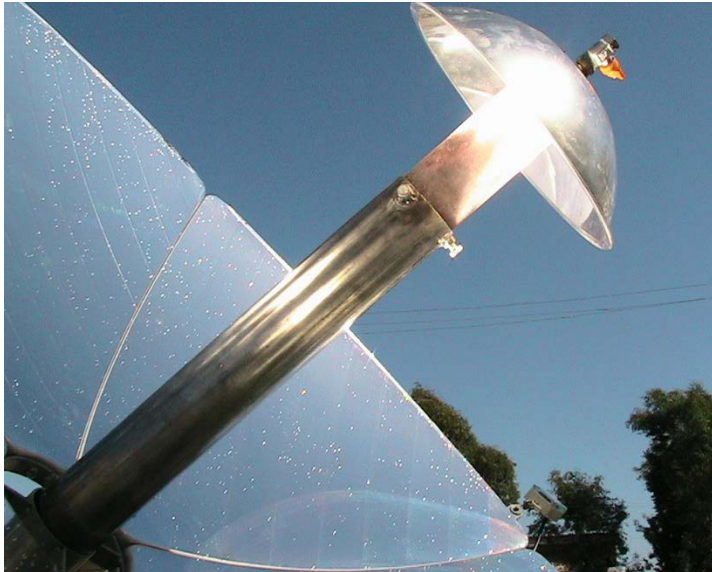


Solamander 135 W photovoltaic panel mounted on a corrugated roof

SOLAR PARABOLA For WATER HEATING

Mirela Alushllari, Alfred Alushllari

Institute of Applied Nuclear Physics, University of Tirana, Albania
(looking for investors)



Founder of the „Solarbier“ concept: **Hubert Brandl**

Freitag, 25. März 2011

— DIE SEITE 3 —

Der Pfaffenhofener | Seite 3



Hallertauer Erfindung reißt den deutschen Bierhimmel auf

Mit Solarbier und exquisitem Weißbierpils lässt Hubert Brandl für Freunde des Gerstensafts die Sonne aufgehen



Solarbier

Gebraut mit der Kraft der Sonne

drink
green

33l

STEN mit 24 Flaschen

SCHAFT „drink green“

Umweltbilanz pro Flasche Bier

Felsenbräu

Normale Produktion

2 g CO₂

73 g CO₂

98 % weniger Umweltbelastung

Felsenbräu: drink green!

Schmeckt gut. Jeder Schluck ein Beitrag
zum Umweltschutz.

Prost!



DIE UMWELTBRAUEREI
FELSEN BRÄU

Frische aus Franken. Das Beste am Tag.

Solar Food Concept



Certification institutions:



Technische Universität München



www.solar-food.com

- Only about 30% of population in sub-Saharan Africa has access to electricity
- The present yearly economic growth of Africa is ~5.5%, despite of lack of sufficient energy and infrastructure.
- However, Africa cannot embark on the same path as Europe, USA and China for its development by relying only or strongly on environmental non-friendly energy sources. This is imperative in order to keep the predicted overall world temperature rise below 2% due to climate change.
- The appropriate use of the abundant solar energy can be regarded as a solution of the African energy problem
- **Appropriate, adaptable, efficient and affordable electrical energy solutions are necessary**

Energy resources in Africa

Energy potentials : Energy Efficiency and energy conservation

Status of Energy Efficiency in Africa

- Compared to renewables, very little done on energy efficiency
- Energy efficiency programmes largely absent
 - No evaluation of the real potential
 - Lack of information on energy efficiency



Energy resources in Africa

Energy potentials : Renewables and Energy Efficiency

Renewables and Energy Efficiency Policies in Africa

- Underdeveloped renewables and energy efficiency is reflection of energy policies
- Focus on conventional energy systems
- Lack of implementation plans for renewables and energy efficiency
- Rationale for promoting renewables and energy efficiency not well argued:
 - Leads to focus on conventional energy systems
 - Does not attract significant budgetary allocations

Energy resources in Africa

Energy potentials : Renewables and Energy Efficiency

Why should Africa promote Renewables?

- Significant energy resource potential exists
- Increasingly unreliable conventional energy supply
- Lowering the risk profile of energy sector
- Enhance competitiveness of agro-industries
- Minimise high oil import bills
- Job creation potential
- •Decentralized energy supply

Why should Africa promote Energy Efficiency?

- Reduction in the cost of energy supply
 - Tunisia: Switch to SWH to reduce electricity cost by 20%
- Job creation potential
- Can attract CDM-related financing
- Industry: Reduction in the cost of production