Urban electricity access with renewable energy sources

PicoPV - Small and fast solutions for growing cities in Africa?

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Challenge No. 1

Region[1]	Electricity access in 2009 - Regional aggregates Population without electricity millions	Access to electricity rate %	Urban electrification rate %	Rural electrification rate %
Africa	**587**	**41,9**	**68,9**	**25,0**
North Africa	*2*	*99,0*	*99,6*	*98,4*
Sub-Saharan Africa	*585*	*30,5*	*59,9*	*14,3*
Developing Asia	**799**	**78,1**	**93,9**	**68,8**
China & East Asia	*186*	*90,8*	*96,4*	*86,5*
South Asia	*612*		*89,1*	*51,2*
Latin America		4	98,8	74,0
Middle East		5	98,6	72,2
Developing countries	**1 438**	**73,0**	**90,7**	**60,2**
Transition economies & OECD	**3**	**99,8**	**100,0**	**99,5**
World	**1 441**	**78,9**	**93,6**	**65,1**

180 Mio. people without reliable access to electricity in SS African cities

Source: *IEA 2011: World Energy Outlook*

WB estimates that SSA households have 91 days/a with blackouts.

Challenge No. 2

TABLE 1.1.1: **URBANIZATION LEVEL PER REGION AND TIPPING POINT (URBAN VS. RURAL POPULATION)**

Region	Tipping point before 2010 (year)	2010 urban (%)	Tipping point after 2010 (year)	2050 urban (%)
World		50.6		70
Africa		40	2030	61.8
Sub-Saharan Africa		37.3	2032	60.5
Eastern Africa		23.7		47.6
North Africa	2005	52		72
Southern Africa	1993	58.8		77.6
Western Africa		44.6	2020	68

Source: *UNDESA 2011: World Urbanization Prospect*

	Mid–2008 Population (millions)	Percent of Population <Age 5	Ages 5–14	Age 65+	Percent Living in Urban Areas (% of total population)	Slums (% of urban population)	Natural Increase in Population (annual, %)	Increase in Urban Population (annual, %)	Total Fertility Rate
WORLD	6,705	10	19	7	49	—	1.2	2.1	2.6
AFRICA	967	16	26	3	38	58	2.4	3.4	4.9
SUB-SAHARAN AFRICA	809	17	27	3	37	65	2.5	3.8	5.4

Source: PRB 2008: Africa Population Data Sheet

TABLE 1.3.1: **URBAN POPULATION LIVING IN SLUMS, 1990-2010**

Challenge No. 2

Major region or area	URBAN SLUM POPULATION (THOUSANDS) 1990	1995	2000			
Developing Regions	656,739	718,114	766,762	795,739	806,910	827,690
North Africa	19,731	18,417	14,729	10,708	11,142	11,836
Sub-Saharan Africa	102,588	123,210	144,683	169,515	181,030	199,540
Latin America and the Caribbean	105,740	111,246	115,192	110,105	110,554	110,763

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Major region or area	PROPORTION OF URBAN POPULATION LIVING IN SLUMS (%) 1990	1995	2000	2005	2007	2010
Developing Regions	46.1	42.8	39.3	35.7	34.3	32.7
North Africa	34.4	28.3	20.3	13.4	13.4	13.3
Sub-Saharan Africa	70	67.6	65	63	62.4	61.7
Latin America and the Caribbean	33.7	31.5	29.2	25.5	24.7	23.5
Eastern Asia	43.7	40.6	37.4	33	31.1	28.2
Southern Asia	57.2	51.6	45.8	40	38	35
South-Eastern Asia						1
Western Asia						6
Oceania						1

Rate of new electricity connections will be outpaced by population growth → in SSA absolute number without access to electricity will increase by 2030, effecting especially slums and peri-urban areas.

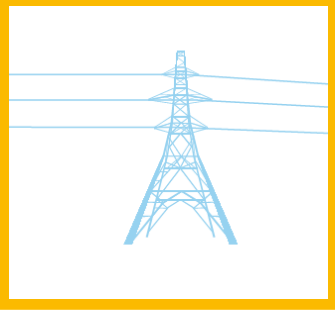
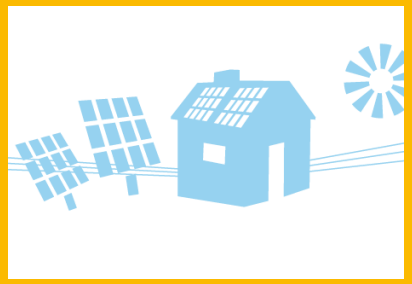
Source: UN-HABITAT estimates (based on United Nations Population Division, World Urbanization Prospects: The 2007 Revision).

Challenges No. 3 / 4

Barriers to urban electrification identified by ESMAP in conusltation with SSA practitioners:

1. Complex Governance Issues (especially regarding slums / peri-urban areas) → slow implementation of electrification plans
2. Mutual Distrust: a complex consumer / community / supplier / government interface
3. Lack of affordability: a) the initial costs are too high for the urban poor b) costs for daily consumption are a burden for consumers with no regular income

Little data available regarding the **actual energy needs** in urban areas as basis for **energy planning**. GNESD (studies in Slums / Peri-Urban areas in Dakar, Nairobi, Cape Town): electrification levels vary, **electricity mainly used for lighting**, high number of illegal connections

Broad range of solutions:	Grid extension / densification	Decentralised RE structures	HH based solar systems (SHS / Pico PV Systems)
			
Time frame /scale	Long-term	medium/long-term	short-term
Energy services covered	Full (productive purposes, advanced ITC, cooking)	Medium (ITC, household lighting)	Low (basic lighting, radio, battery charging)
Involvement of stakeholders	High governmental (state, regional and local), utility, private sector (high coordination efforts)	medium: private sector, government, utility,	Medium/low: mainly (local) private sector
Advantages	Full-fledged electricity access, least cost in most cases, no fragmentation	Full-fledged electricity access, supply and demand (generating capacity)	Short term effects, via market development (economic effects), solutions for BoP
Disadvantages	Even more load on the electricity grid, subsidies needed, complex coordination	Complex legal environment – net-metering needed, availability of technology	Fragmented solution, no easy upgrade possible

PicoPV systems are small independent appliances providing light and/or additional small electrical services, such as radios, mobile phone charging, mp3 player, etc. These systems allows the substitution of traditional light sources like inefficient and relatively dark kerosene lamps.




Mini reading lamps → *lanterns* → *micro solar home systems*

Example: Pico PV end user prices

- Solux e.V.: Solux-LED-100
  - **US$ 70**
  - 2.5 W PV module, LED bulb

- Noble Energy Solar Cosmos Ignite Innovations: Mightylight
  - **Price: US$ 60**
  - 2.5 W PV module, LED bulb

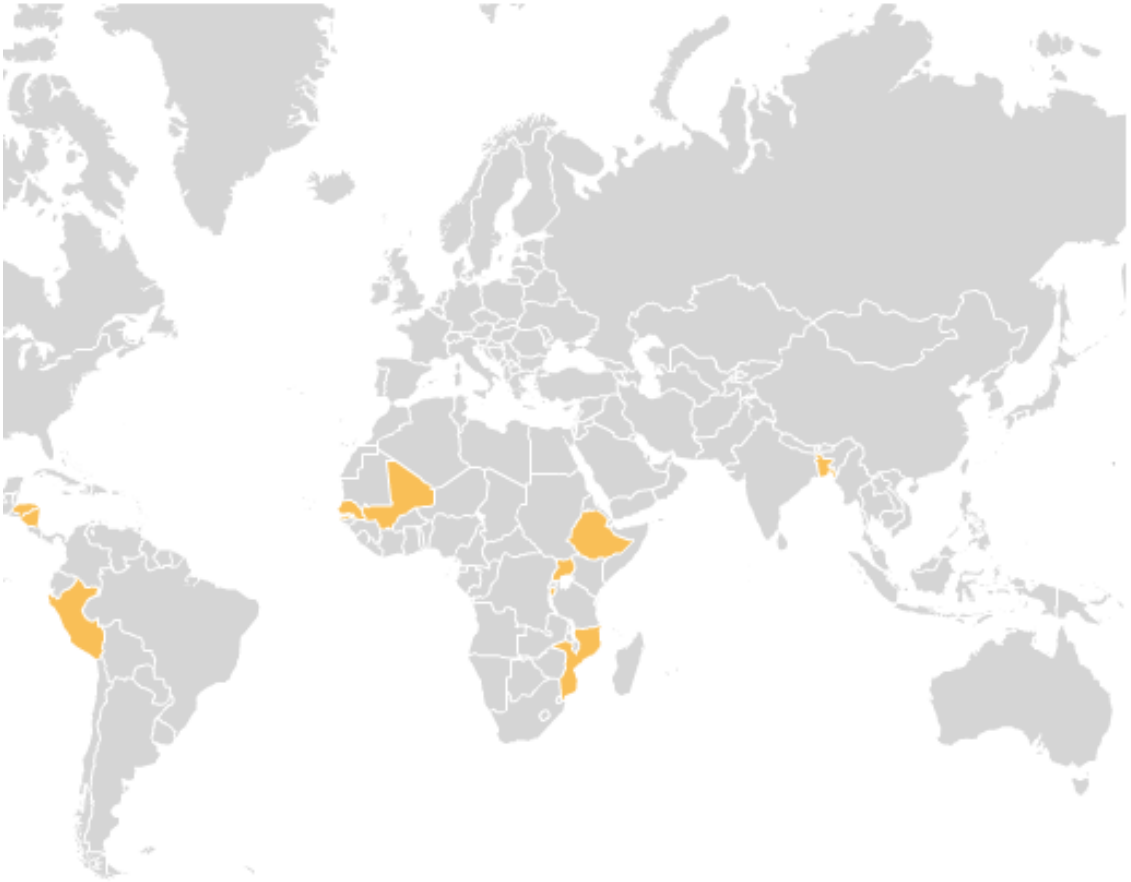
Barriers for wide dissemination of Pico PV Systems:

- Market development is difficult (local dealers often need support)
- Bad quality → bad reputation
- Low Purchasing Power of the targeted customers

<u>Possible role of public sector and development partners</u>

- **Support market development**: through dealer associations, producer networks, awareness campaigning etc
- **Create small incentives for local dealers / distribution networks** (free training, loan schemes for bulk purchase of equipment)
- **Keep subsidies out of the sector** (sector is already quite mature – prices are dropping, subsidies would destroy the market)
- **Facilitate access to (pre/micro)financing** (for dealers and customers)
- **Protect customers from low quality products** (standards, labels, etc)

Energising Development - EnDev - is an impact-oriented initiative between the Netherlands, Germany and since 2011 Norway. EnDev promotes the supply of modern energy technologies to households and small-scale businesses. The Partnership cooperates with 18 countries in Africa, Latin America and Asia – www.endev.info



Countries - Solar

Bangladesh	Ethiopia	Mali	Rwanda
Benin	Ghana	Mozambique	Senegal
Bolivia	Honduras	Nepal	Uganda
Burkina Faso	Indonesia	Nicaragua	
Burundi	Kenya	Peru	

Technologies

To see in which countries we apply the different technologies please click on the symbols below.

Solar	**The radiation energy of the sun can be utilised** ... *About*
Hydro	Water moving down a mountain contains ... ▪ *About*
Biogas	Biogas originates from bacteria in the bio- ... ▪ *About*
Grid	Connecting end-users to a grid is more than ... ▪ *About*
Improved Cooking	Cooking energy accounts for about 90% of all ... ▪ *About*

Fields of activities

Market Review

overview of >100 lamp models

Lab Test

of 12 promising lamp models

Field Test

Uganda, Mozambique, Senegal, Bolivia, Nicaragua, Bangladesh

PicoPV_Database

? Baseline data about energy consumption, lamp models preferred, where and how do people charge their lanterns, technical performance of tested lanterns in the field ?

Start of project activities in Kenya, Ethiopia, Bangladesh

How much do HH actually save?:

Uganda – HH continue to use kerosene lamps

Baseline running costs:	2,50 US$/week
Savings on kerosene &dc batteries:	0,80 US$/week
Remaining expenses:	1,70 US$/week

PicoPV Database

This is the Energypedia database of PicoPV systems.

PicoPV systems include the full spectrum of mini solar appliances such as mini reading lamps, torches, mulitfunctional devices as well as micro-solar home systems. Just like other sections of this wiki, the PicoPV database is driven by the users, so the content of the database is jointly edited by the energypedia users.

- Add new PicoPV systems which are still missing in our database (or correct the existing data by clicking the "Edit with form" link on the product page)
- See the Latest Activities within the PicoPV Database
- Search the list

https://energypedia.info/index.php/PicoPV_Database

Add PicoPV System

You can add new entries to the PicoPV Database by entering the name of the system into

Create or edit

Full List

Edit

Product Name	Is produced by	Bulk price	Type of bulb	Luminous flux	System voltage	Type of battery	Tested
AH-Lantern	Ambros Huber		Light-emitting diode	200		Lithium-ion battery	✗
AJ-Y01	Quanzhou Anjie Solar Energy Co., Ltd	40			9	Lead-acid battery	✗
AJ-Y02	Quanzhou Anjie Solar Energy Co., Ltd	19			9	Lead-acid battery	✗
AJ-Y03	Quanzhou Anjie Solar Energy Co., Ltd	23.34			9	Lead-acid battery	✗
AJ-Y05	Quanzhou Anjie Solar Energy Co., Ltd	23			9	Lead-acid battery	✗
AS016	Astsolar	20			6	Lead-acid battery	✗
AS021	Astsolar	16.5			6	Lead-acid battery	✗

Stakeholders

TOTAL

Gas stations as distribution hubs, training of young entrepreneurs, active in Kenya, Cameroon, Indonesia

LIGHTING AFRICA
Catalyzing Markets for Modern Lighting
AN INNOVATION OF IFC International Finance Corporation
THE WORLD BANK

IFC and World Bank program that works towards improving access to better lighting in areas not yet connected to the electricity grid

GOGLA

Global Off-grid lighting association: neutral, independent, not-for-profit organization and formed through a public-private initiative

Fraunhofer ISE

Testing facilities, research

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Pico PV Systems for Growing Cities in Afrcia?

- Cannot substitute long-term energy planning in urban areas
- Can relief energy poverty especially in Slums and fast growing city areas
- Can be supported on short/medium term basis.
- Can be implemented using existing distribution channels in cities (easier than rural areas)
- Cannot be done without proper background analysis on market development and customers‘ needs.

Thank you very much for your attention

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