



Aalto University  
School of Business

# Emerging markets: Energy challenges and opportunities

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# Introduction



**New Global studies how frugal and reverse innovations develop in complex global systems**

# Introduction

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**We help build more  
sustainable societies**

Leapfrog Projects is a network of entrepreneurs, researchers and designers with a shared passion to solve complex sustainability challenges. We help organizations and networks leapfrog to their next level.

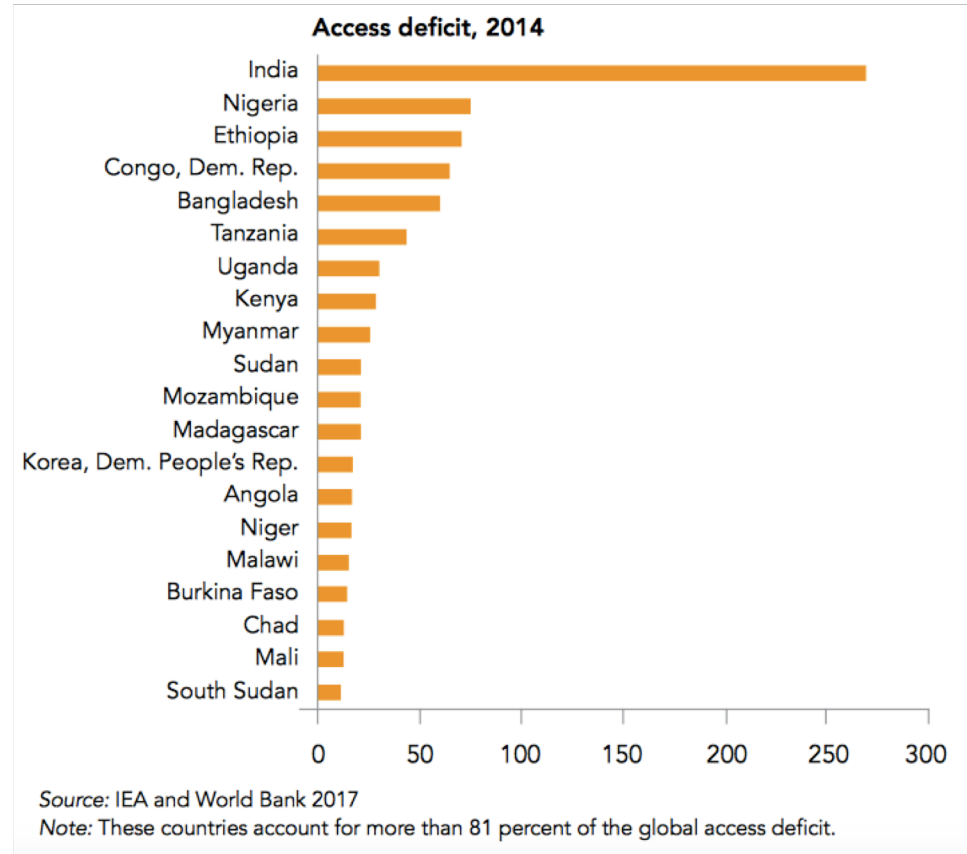
# Lecture outline

## 14.35-15.45 Overview

- **Electrification status in emerging markets**
- **On-grid and off-grid: Challenges and opportunities**
- **Off-grid innovations**

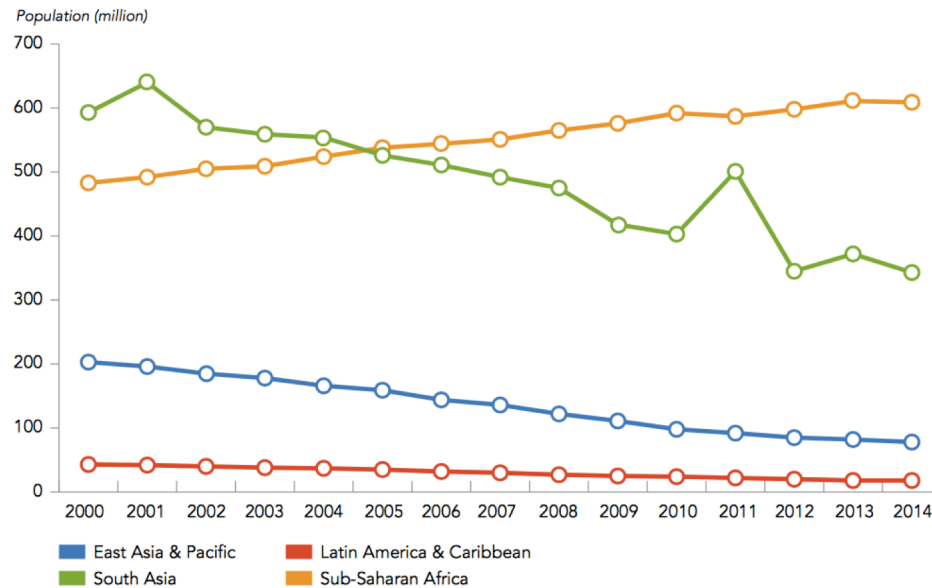
# State of electrification

**1 billion people still lack access to electricity**



# Influence of population growth

**FIGURE O.3 Sub-Saharan Africa is not keeping up with population growth for electricity access**  
(Trends in population lacking access to electricity, 2000–2014)

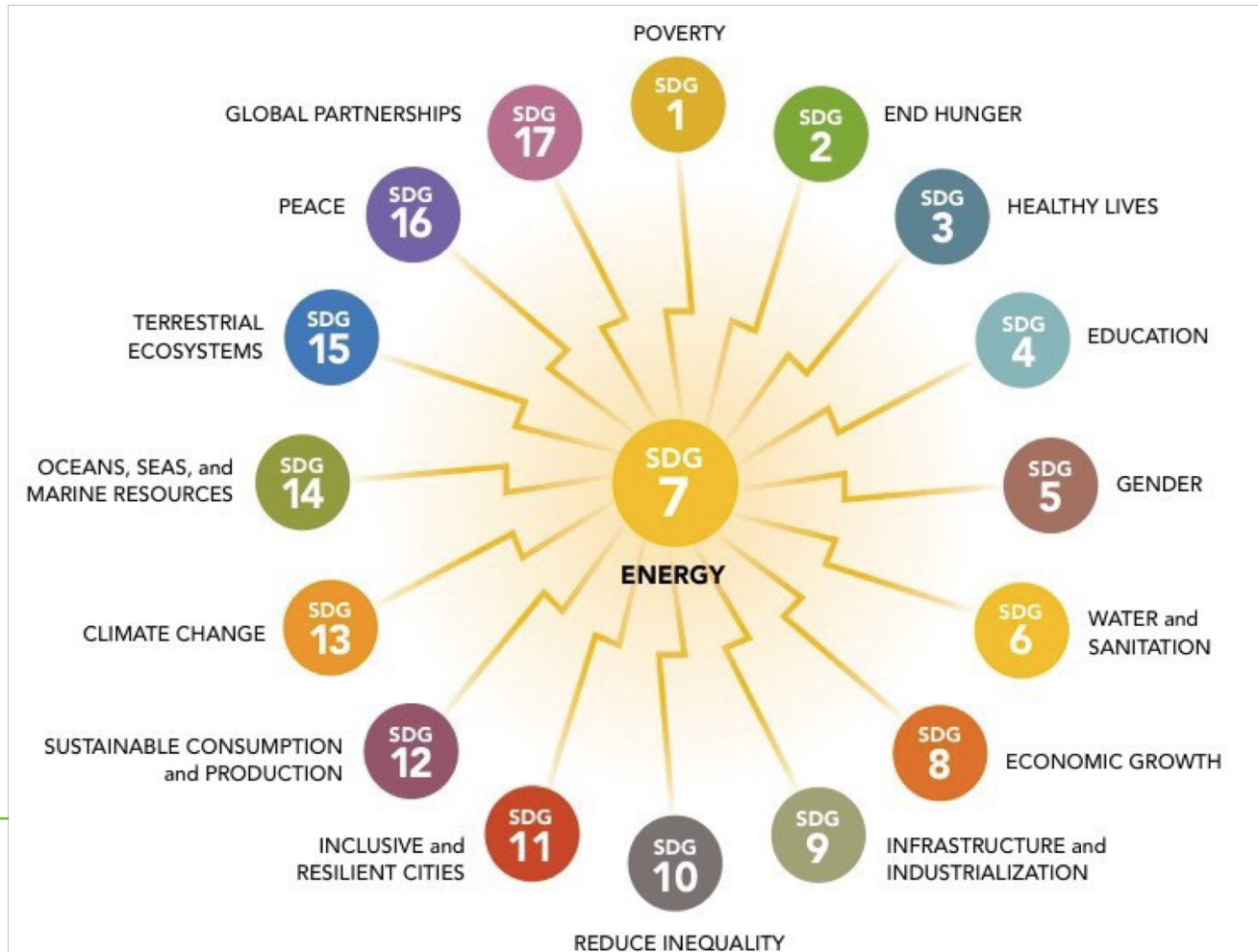


Source: Data from IEA and World Bank 2017

# Energy sources before electrification



# Role of energy for development





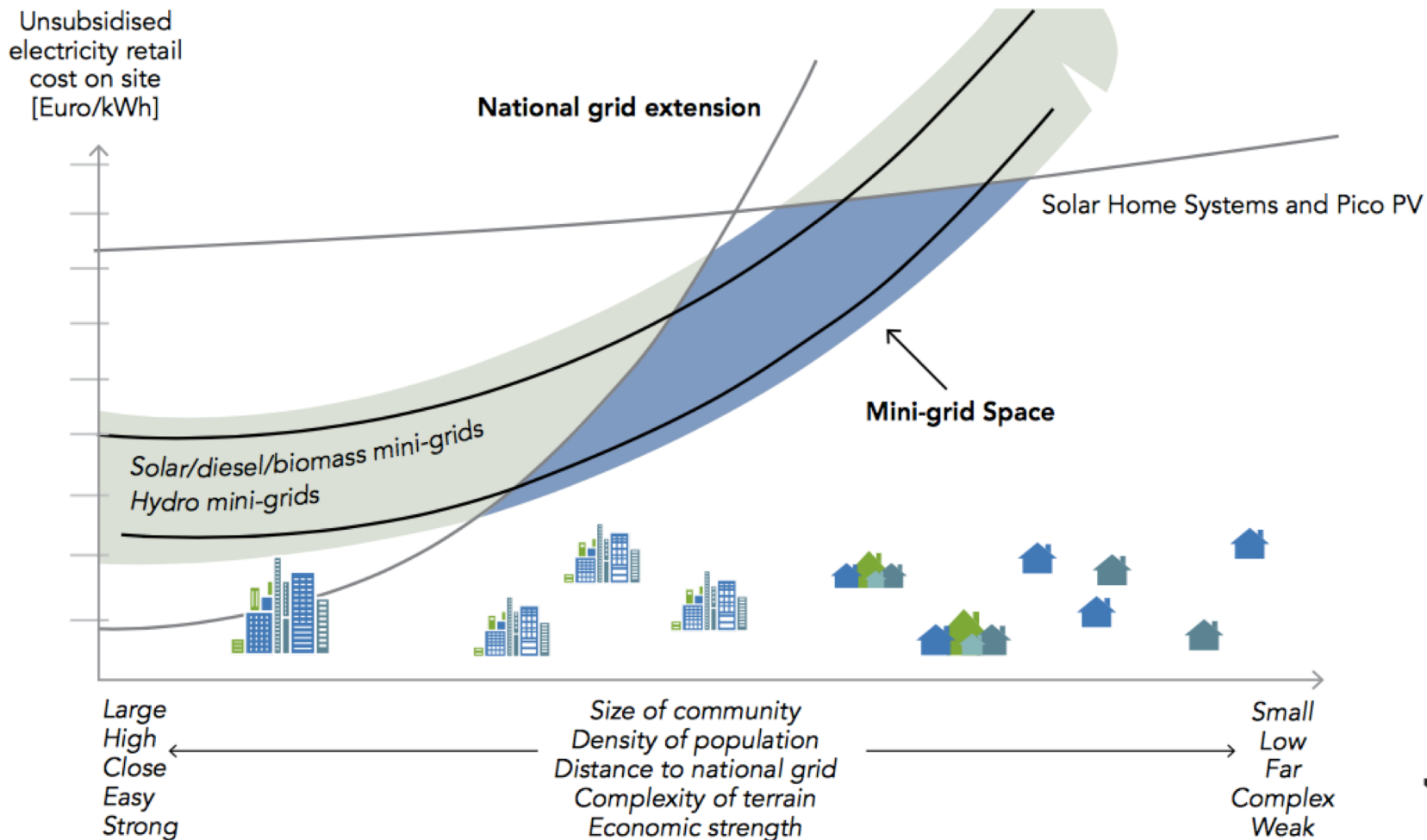
# On-grid and off-grid

- Adding power plants and
- Extending high-voltage transmission lines and distribution networks into rural areas.
- Mini grids ( <10 MW, 50 km)
- Micro grids (<100 kW, 8 km)
- Hybrid grids
- Solar Home Systems
- Pico solar appliances



## FIGURE O.6 A growing role for mini grids and renewables

(Opportunities for grid extension, mini grids, and distributed renewable energy systems)



# On grid opportunities and challenges

In the past two decades more than 1.7 billion people have been added to national electricity networks worldwide, mostly in urban areas.

The biggest challenges:

- lack of sufficient generation capacity
- poor transmission and distribution infrastructure
- the high costs of supply to rural and remote areas
- the inability of low income households to pay high connection charges, and the weak financial state of the utilities.

Barrier to household access is the cost of connection.

# Off grid opportunities and challenges

## **Policy**

- Regulation concerning on-grid and off-grid compatibility

## **Business models**

- Pay as you go

## **Finance**

- Lack of funding

COMPANY	OUTREACH	CURRENT TARGET	COUNTRIES	ENERGY SOURCE	SIZE RANGE	FOCUS/INNOVATION
E.ON	7 systems, 420 customers	1m people in 10 years	Tanzania	Solar, bio-diesel	6–12kW	Standardisation for scale; Establish track record for finance Cellphone payment
GHAM POWER	3 micro-grids	>100 micro-grids in 10 years	Nepal	Solar	1–10kW	PPA with N-cell (telecoms) for reduced risk revenue stream Rent-to-own agreements
HUSK POWER	15,000 households, several 100 businesses	75,000 households, 10,000 businesses, 125 agro units	India Tanzania	Biomass, Solar	15–250kW (biomass); 20kW (solar)	Accept >5 year payback Targeting 8–10 year loans Rural empowerment 3-year expansion plan Inclusive business model
INENSUS	Supports mini-grid development in Africa with related management systems and consultancy		Senegal	Solar, Wind	5–10kW	Low-cost smartcard meter Sale of “electricity blocks” “MicroPowerEconomy” delivery system—flexible tariffs & micro-credit
M-KOPA	340,000 homes (Mar 16)	+500 homes/day	Kenya, Tanzania, Uganda,	Solar	5–20W	PAYG business model Small SHS, LEDs & mobile phone charging services
POWERGEN (RENEWABLE ENERGY)	20+ mini-grids	50 mini-grids in 2016	Kenya & Tanzania, Zambia	Solar	1–6kW	Mini-grids compatible with central grid standards
POWERHIVE	4 sites, 1500 people (~300 connections)	100 villages	Kenya, Philippines (Africa/Asia expansion)	Solar	~20kW	Integrated tech system; Mobile money networks for pre-payment Dedicated software—predict revenue streams;
RUAHA POWER	1 pilot project (JV with Husk Power)	100 projects	Tanzania	Solar, biomass	300kW	Business model without subsidies Build Own Operate model Pre-payment meters
SPARKMETER	3 Earthspark mini-grids in Haiti	No fixed target	Asia, Africa, Latin America	Service for all types of mini-grids	0–500W	Metering with mobile payment system Cloud-based software “Gateway” usage dbase

# Minigrids: Rafiki power (E.On)



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## ABOUT US

Rafiki Power is a mini-grid company which provides access to clean and affordable energy and value-added-services (VAS) to people and businesses without access to the national grid. To date, we have successfully installed and are operating 8 mini-grids (solar PV & battery) in Tanzania, connecting more than 950 households and businesses. We manage everything with our

# Solar Home Systems: Mobisol

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## A Global Leader in Solar Power for Off-Grid Families

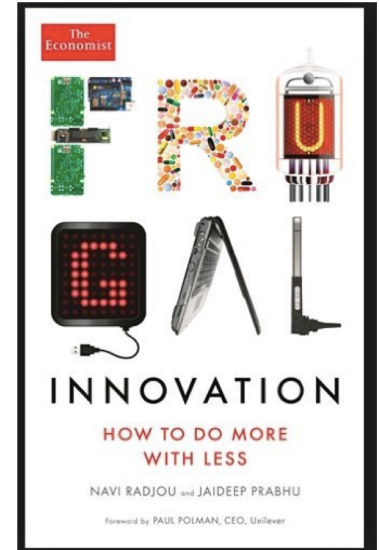


**The new d.light D330  
Available now**

# Frugal innovations



**Grassroots  
innovations**



**Grassroots  
innovations**

# Innovation in inclusive business models

Types of innovation needed for BOP business models				
Product innovation	Delivery innovation	Adaptation to Infrastructure	Relationship and labor innovation	Partnership and network innovation
<ul style="list-style-type: none"> <li>✓Affordability and quality</li> <li>✓Different functionality</li> <li>✓Commercial scale</li> <li>✓Resource efficiency</li> </ul>	<ul style="list-style-type: none"> <li>✓Efficient delivery process</li> <li>✓Group credit schemes</li> <li>✓Effective distribution systems</li> <li>✓Usable interfaces</li> <li>✓Last mile by local subsistence entrepreneurs</li> </ul>	<ul style="list-style-type: none"> <li>✓Design for hostile environment (e.g. erratic electricity, dirt roads)</li> <li>✓Hybrids: new technology in deficient infrastructure conditions</li> </ul>	<ul style="list-style-type: none"> <li>✓Deskilling work processes</li> <li>✓Local actor involvement</li> <li>✓Trust-based relationships</li> <li>✓Mutual benefit</li> <li>✓Capabilities development</li> </ul>	<ul style="list-style-type: none"> <li>✓Untypical business partners</li> <li>✓Multi-stakeholder relationships</li> <li>✓Common goals</li> <li>✓Utilization of complimentary resources</li> <li>✓Network assembling and coordination</li> </ul>

# Innovation: Products and solutions

- Create a new price performance of products and services  $\neq$  just lowering prices
- Prepaid is often the preferred payment method
- Product or service functionality in BOP might be different – start from BOP need and aspirations, forget developed market experiences
- Solutions for 4 billion people must be more resource efficient than in developed countries because of the carrying capacity of the earth



# Innovation: Labour & partnerships

- Inclusive innovation is often about co-creation. Therefore:
- Be prepared to work with untypical business partners (e.g. NGOs)
- Engage local actors to help in the process. They have the knowledge and influence
- Engage groups in the savings-credit schemes instead of individuals.
- Deskilling work – in most BOP markets lack of trained labour force
- The "last mile" to the customer can be provided by local subsistence entrepreneurs.



# Innovation: Infrastructure

- Design for hostile environments
  - Dirt roads, erratic or no electricity, deficient hygiene conditions
- Innovate hybrid solutions of new technologies and existing infrastructures
  - Advanced technology solutions, such as regional network of PCs, must coexist with poor and mediocre electrical and telecom infrastructures
- Leapfrog!

