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Regulation of electricity access case studies

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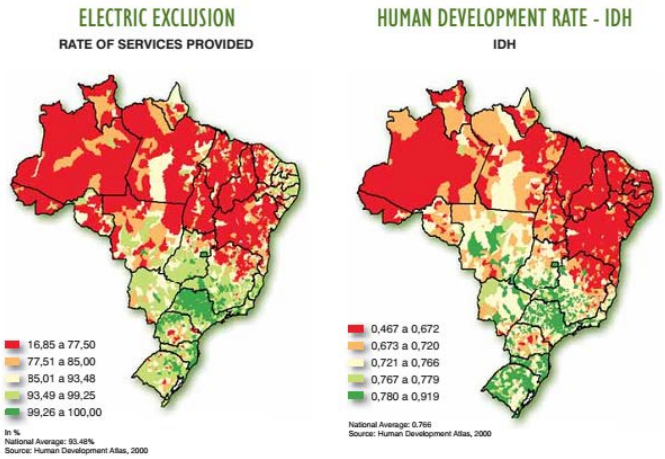
Energy access as an international challenge.

- Access to modern energy and Millennium Development Goals, Electricity access it is not considered a MDG but undeniably it is a prerequisite for the achievement of most MDGs.
- There is a strong correlation between access to modern energy and socio-economic development (ie. Energy Development Index and Human Development Index). This is the base for most electricity access programmes, strategies and policies at international level



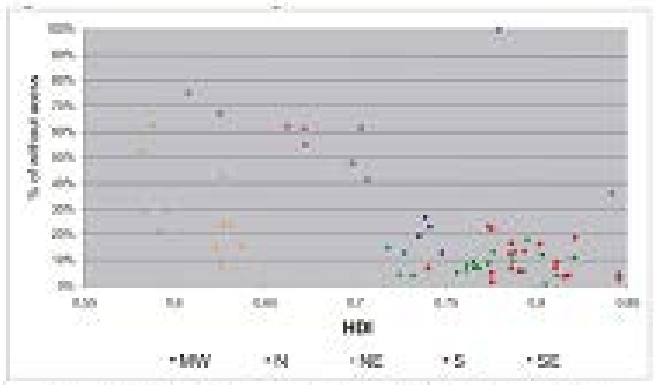


Figure 1. Electricity Access in Brazilian regions versus Human Development Index

Millennium Development Goals

IEA world energy outlook

Table 2.4 ▷ Number of people without access to modern energy services by region in the New Policies Scenario, 2011 and 2030 (million)

	Without access to electricity		Without access to clean cooking facilities	
	2011	2030	2011	2030
Developing countries	**1 257**	**969**	**2 642**	**2 524**
Africa	600	645	696	881
Sub-Saharan Africa	599	645	695	879
Developing Asia	615	324	1 869	1 582
China	3	0	446	241
India	306	147	818	730
Latin America	24	0	68	53
Middle East	19	0	9	8
World	**1 258**	**969**	**2 642**	**2 524**

IEA - New generation requirement

Table 4: **Generation requirements for universal electricity access, 2030** (TWh)

	On-grid	Mini-grid	Isolated off-grid	Total
Africa	196	187	80	463
Sub-Saharan Africa	*195*	*187*	*80*	*462*
Developing Asia	173	206	88	468
China	*1*	*1*	*0*	*2*
India	*85*	*112*	*48*	*245*
Other Asia	*87*	*94*	*40*	*221*
Latin America	6	3	1	10
Developing countries*	379	399	171	949
World**	**380**	**400**	**172**	**952**

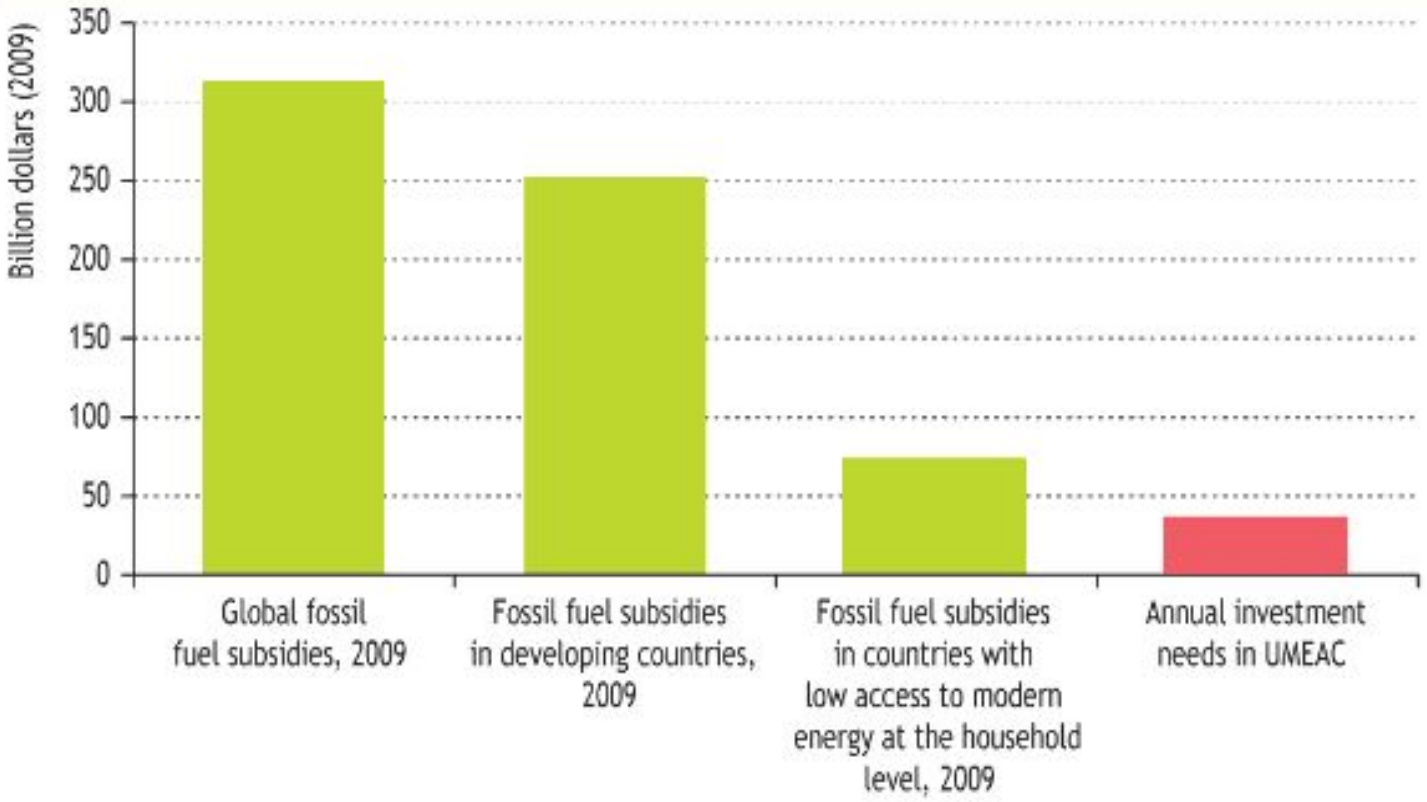
*Includes Middle East countries; **includes OECD and transition economies.

Table 7: Investment requirements for electricity in the UMEAC* ($ billion)

	2010-2015	2016-2030	2010-2030
Africa	4	9	14
Sub-Saharan Africa	*4*	*9*	*14*
Developing Asia	16	24	40
China	*7*	*9*	*16*
India	*5*	*8*	*14*
Other Asia	*3*	*6*	*10*
Latin America	1	1	2
Developing countries**	21	35	56
World* **	**21**	**35**	**56**

*Compared with the New Policies Scenario; **Includes Middle East countries; ***includes OECD and transition economies.

Figure 15: Annual average additional investment needs in the UMEAC* compared with fossil-fuel subsidies in developing countries in 2009



Regulatory implication

- The right of people to access modern forms of energy, specifically electricity, may be translated into the national electricity company Statute
- Specific electricity access targets may be included in the public utility concession agreement
- Regulatory bodies can take the lead in the definition of energy access national strategies (*luz para todo in Brazil*)
- Tariff equalization is often needed within companies/territories if a single electricity price is applied for all customers in the country
- Electricity access targets may originate for several different policies priorities, not necessarily from energy policy, (development, education, agriculture, urbanization)

The main barrier to extend electricity service in remote areas

Conflict of objective between financial performance and universal access

- Rural customers are usually scattered on a wide territory,
- They are not always able or willing to pay the cost of the services
- Limited demand often not enough to pay back the investment

- Rural electrification necessarily become a low priority for utilities

- This is exacerbated in case of private companies
- Specific energy access policies/rules may accompany the liberalization/privatization process especially in the distribution/sales sector.

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Rural agencies and institutions in charge of RE

Most countries have established and identified an institution, sometimes a specific rural agency, to implement rural energy policy, to supervise technical standard, to deal with specific local energy priorities and challenges

CLUB ER

Club des Agences et Structures nationales en charge de l'Electrification Rurale

Club of National Agencies and Structures in charge of Rural Electrification

Rural development agencies and funds

In some countries a rural fund to orient economic resources to close the energy access gap has been opened

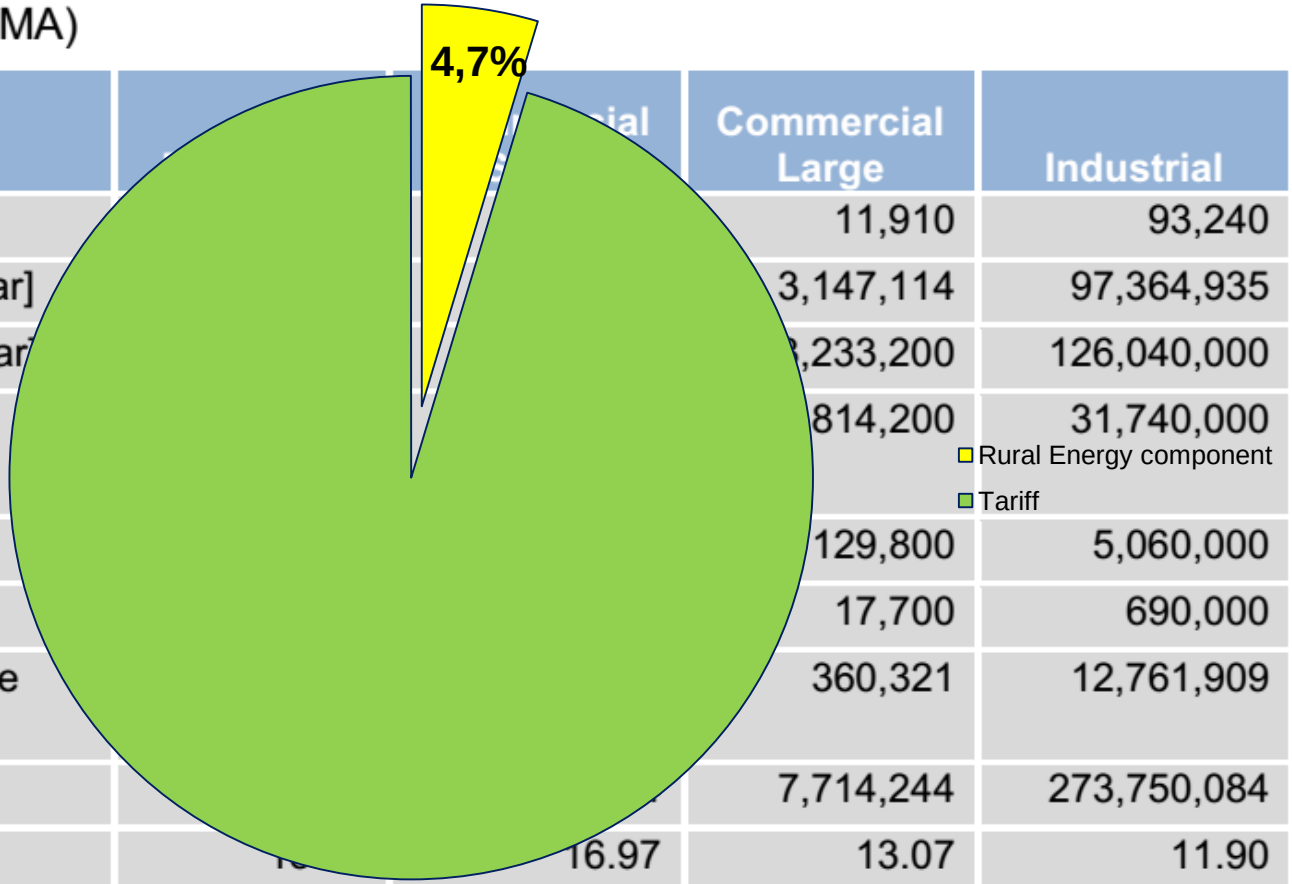
- The resources of the fund may come from national budget, international funds and electricity tariff.
- In case of tariff a specific component is added in the electricity bill to finance the fund.
- Regulatory authorities in that case are called to translate the cost into the tariff and sometime to verifiy the company performance

Kenya tariff structure

ITEM	PAYABLE TO
Fixed connection charge	Kenya Power
Consumption charge	Kenya Power
Fuel cost adjustment	Kenya Gen and IPPs
Foreign Exchange adjustment	Government
VAT	Government
ERC Levy	Energy Regulatory Commission
Rural electrification programme	Rural Electricfication authority
Inflation adjustment	Kenya Power

Table 7 Electricity costs per typical consumer for each consumer group, excluding 16% VAT (source: KEMA)

Item			Commercial Large	Industrial
Fixed Charge [KES/year]			11,910	93,240
Consumption Charge [KES/year]			3,147,114	97,364,935
Fuel Cost Adjustment [KES/year]			,233,200	126,040,000
Foreign Exchange adjustment (FERFA) [KES/year]			814,200	31,740,000
Inflation (INFA) [KES/year]			129,800	5,060,000
ERC levy [KES/year]			17,700	690,000
Rural Electrification Programme [KES/year]			360,321	12,761,909
Total costs [KES/year]			7,714,244	273,750,084
KES/kWh		16.97	13.07	11.90
EUR/kWh	**0.12**	**0.14**	**0.11**	**0.10**



Equalization of electricity tariff at national level, implication of renewable investments

- Supply electricity in off-grid areas implies higher cost to reach final customers.
- In most cases the final tariff is equalized among customers to adhere to the national electricity cost, in others off-grid customers pay higher electricity price
- On the generation side very often the national generating cost includes all cost of the national company without distinction among different areas
- When introducing feed-in tariff it is important to calculate the ACG in a specific area in order to give the right signal for the development of renewable in decentralized context

- For instance, the Tanzanian regulatory authority proceeds with two different ACG calculations on an annual basis: one is for national grid-connected renewable energy power plants and the other for renewable power plants connected to mini-grids
  - For grid-connected renewable energy systems, the ACG feed-in tariff is calculated as the average between the LRMC and the generation cost of existing generating infrastructure of the national public utility (TANESCO). The resulting value is then differentiated between the dry (August-November) and the wet season (December-July) through the introduction of a premium coefficient of 1.2 in the case of the dry season and a reduction factor of 0.9 when electricity is generated during wet season.
  - For mini-grid connected renewable energy systems, the ACG is the average between the LRMC of TANESCO and the calculated generating cost of a 1MW diesel generator.

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Energy Access in Brazil: establishment of a regulatory obligation to increase energy access

- Law 10.438/2002 institution of universal energy access with the purpose of taking energy to all households in the country
- ANEEL Order 223/2003 establishes the conditions for the elaboration of energy distribution company's Electricity Universalization Plant to reach residential consumers <50kW.
- Federal Decree 4873 'Luz para todo' programme. Universal Access by 2008-2012

Luz para todo regulatory role

- ANEEL approves electrification strategies prepared by each distribution companies together with the Brazilian Energy Ministries and Eletrobras
- It approves the necessary costs within each company tariff according to the amount of investment needed in their territory
- The companies or their implementing agents are choosing between different/alternative options grid connected or off-grid solution according to each territory characteristic and company strategy
- To provide services to 15 million people, there are plans of investments of approximately R$ 20 billion, of which R$ 14,3 billion will be from the Federal Government. The remaining financial resources, about 28%, will come from state governments and from executor agents.

Luz para todo economic resources for

- The economic resources are taken from
  - Energetic Development Account (CDE)/ Federal Government in the form of subsidies
  - Global reversal Reserve (RGR)/ Energy sector levy /financing
  - State government resources
  - Distribution companies own resources

	COSERN	Amazzonia
CDE Account	50%	55%
RGR Reserve	15%	25%
Government	20%	10%
Utility	15%	10%

- The resource mix is different from State to State. This is done in order to equalize the final cost on consumers as much as possible within the Federal State

Small grid regulation

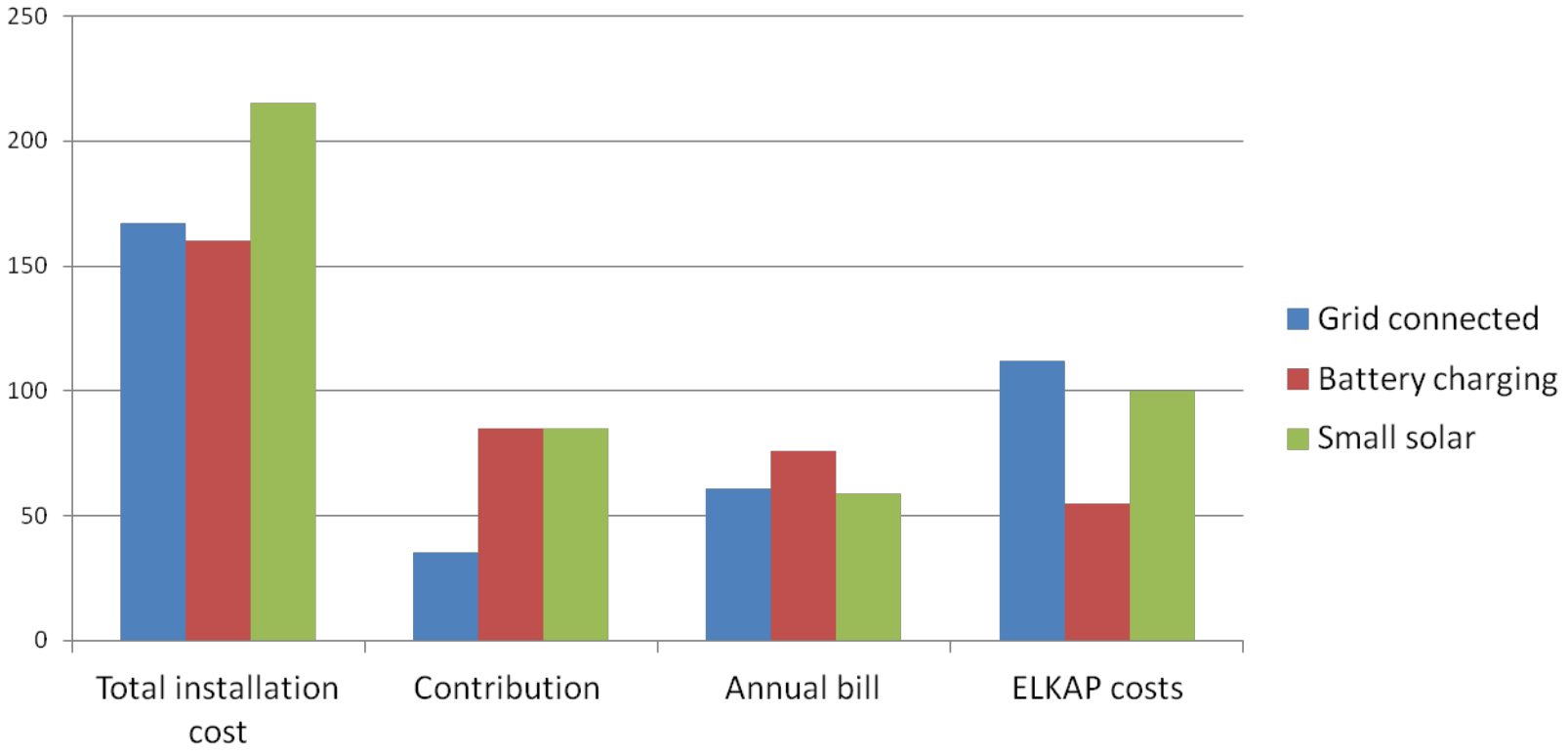
ELKAP 1 RDC case study

- Introduction of flat tariff by the implementing party based on expected variable costs (mainly salaries). No meters because of technical barriers and difficult logistic/management.
- No efficiency measures, no quality rules, no strategy to expand connection once the limited capacity 200kW was allocated.

Proposed tariff principles

- Calculation of generating, transport, distributions and sales costs. (no capital cost included, but only the necessary installment to pay back the infrastructure once lifespan is over)
- Tariff based on flat rate + variable component where:
- The flat rate is enough to pay back running utility costs. This is more than 50% of final bill but in line with the principle that capacity is scarce in the area.
- For small consumers 110, 440W connection, no meter and flat rate only
- Flat rate includes a maximum amount of consumption. For higher consumption level each kWh is paid a variable cost based on new capacity developmnet costs. This to promote energy efficiency
- A specific component is included for network expansion and metering technology
- Large consumers are offered a discount if they accept to be curtailed

ELKAP costs of different options



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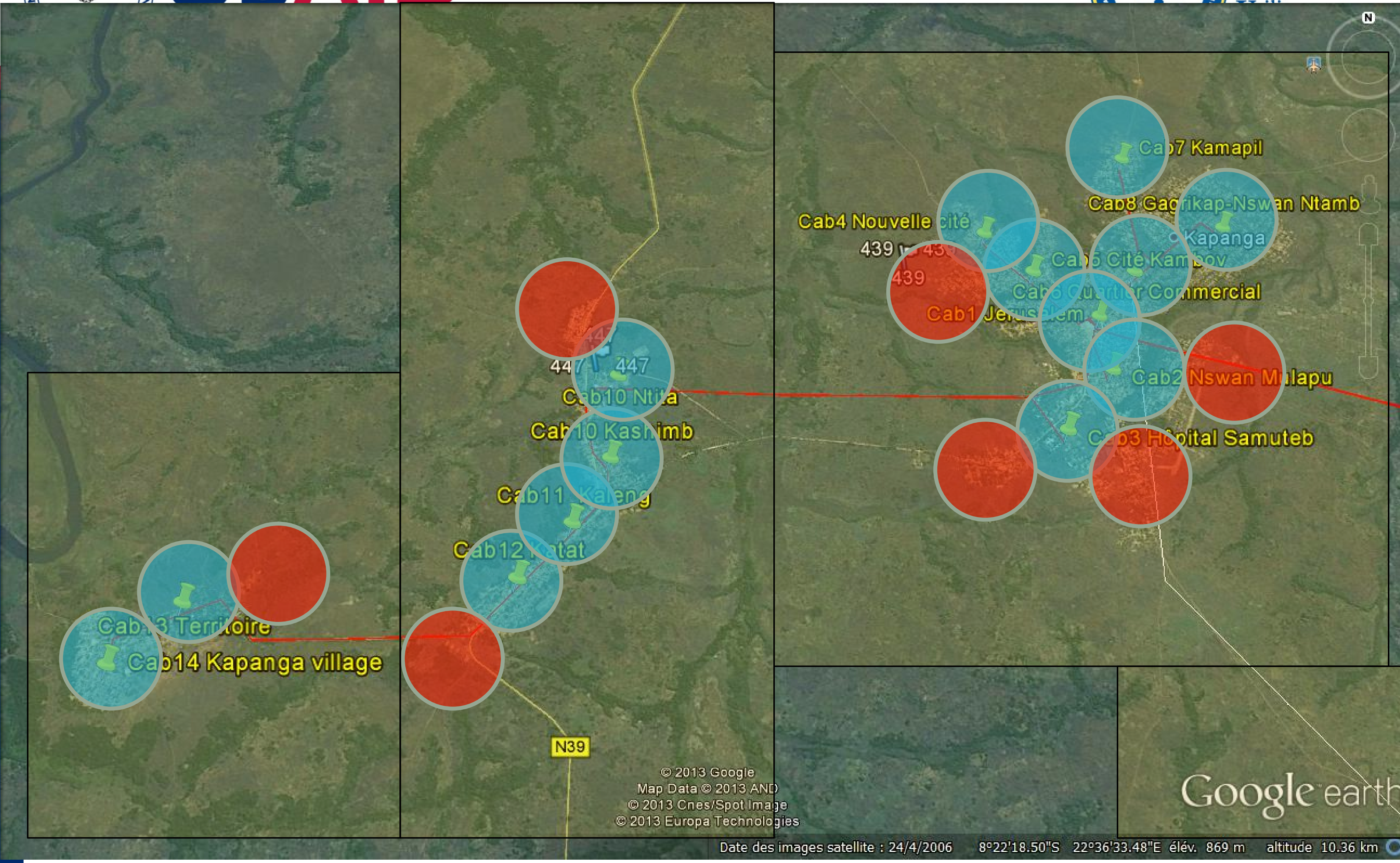

Reaching new households

- a simple calculation was run in order to find out the most efficient solution to reach households with limited electricty demand
- The calculation proved that for a distance > than 200m an isolated 40W solar panel system was economically more efficient than mini-grid connection
- The challange is now to include isolated off-grid solar system as an utility option.