

Energy efficient & safe Sub Saharan African peri-urban electrification



Benoît Dôme
Director Copper Benelux
European Copper Institute
Building Wire Manager
Europe & Africa

Slum Electrification – Poverty & Energy:

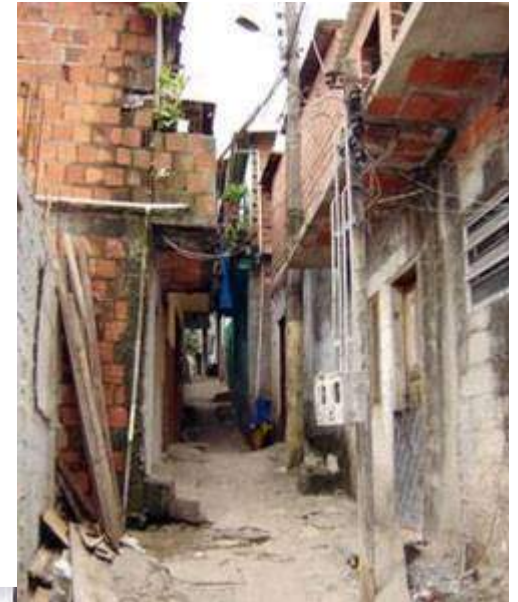
	Population (million)	GDP/Pop (US\$/capita)	Electricity Consumption (kWh/capita)
Brazil	164	4.9	1,969.5
USA	268	30.3	12,235.1
China	1,244	0.7	768.5
India	966	0.4	411.0
Africa	731	0.6	478.8
(Source: EIA,2000)			

- Close relationship between poverty and energy access
- Need for quality electrification programmes based on best practice to improve these living conditions.

Brazil - Sao Paolo - Paraisópolis



- Theft - criminality
- Urban concentration
- Energy consumption 300+ kWh pcm



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energias



Brazil - Sao Paolo - Paraisópolis



- Theft - criminality
- Urban concentration
- Energy consumption 300+ kWh pcm



- Reduced kWh → 200
- Anti-theft [external]
- Pre-paid meter
- Safe & efficient systems
- Urban integration
- Sustainable
- [Easily] replicated

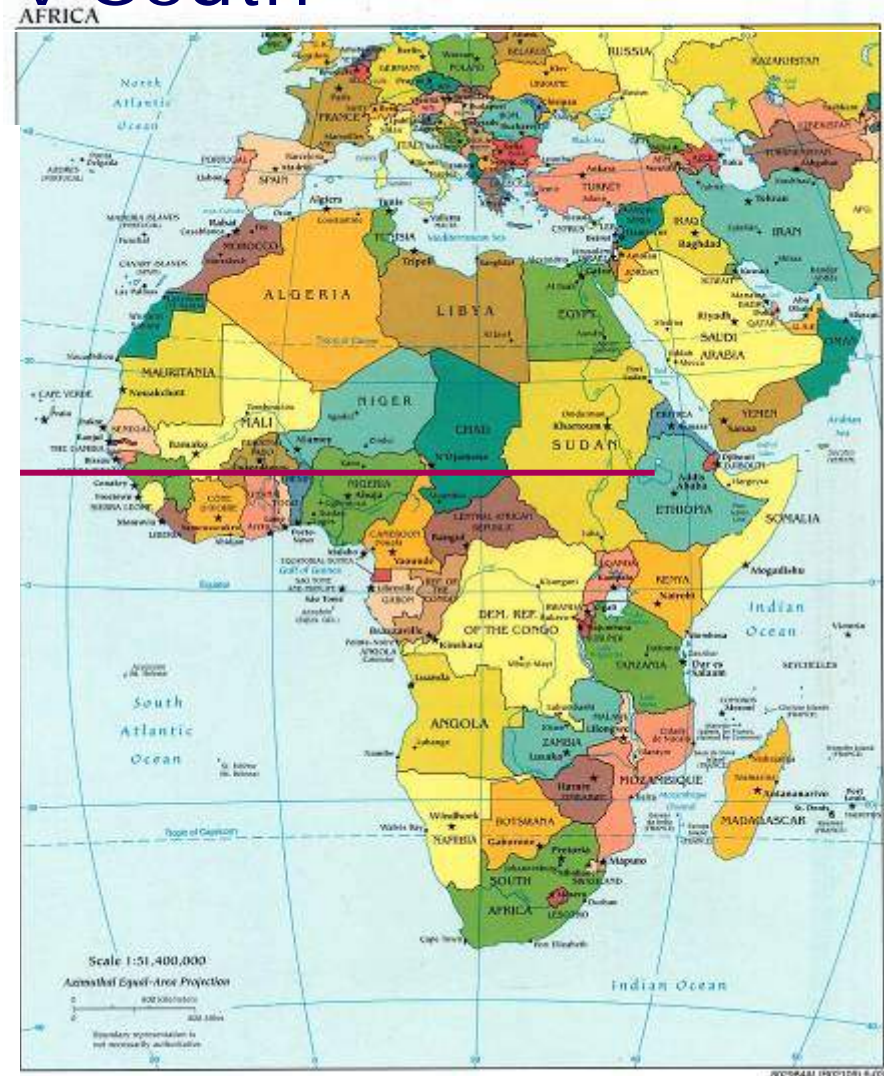
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- \$ collection
- Attitude change
[“free” electricity
→ thinking about
its use]



Sub-Saharan Africa – peri-urban business plan –North v South

- Africa – 900 million people
 - 60% Sub Saharan Africa [SSA]
 - Urban – rural split ~ 40%
 - Peri-urban range from 38% → 90+ %
 - Peri-urban – SSA growing 4% pa
- Affluence
 - From the very poor [GDP pc @ \$188ppp → \$16,450]
- Range of energy consumption – 0.013 BkWh → 209+ BkWh
- Nature of “non-technical” losses
 - Fraud [“legal” clients selling on to multiple households]
 - Theft exists but in many cases far less than eg Brazil



Peri-urban access to electricity - Africa

- Relevance to Sub-Saharan Africa [SSA]
 - Poverty / legal access paradigm throughout
 - Peri-urban growth +/- 4% pa [Mahgreb ~ -1%]
 - Issue of urban integration
 - Electricity demand v capacity
 - All MDGs dependent on electricity
 - Energy inefficiencies clearly identifiable
 - Energy efficiency improvements significant & realisable.

Current situation: growing & unfair



Massive urban new build



.. most with TV aerials.

- Irregular access up to 80+% of these expanding zones
- Household avg. consumption 128 kWh – legal or illegal
- Non-conforming users waste ~50% of their electricity through energy inefficiencies
- Their quality of service is far lower because of non-conforming connections
- “Theft” not as common as in Brazil – users pay ~ 65% more than regular clients
- Consequently ability & willingness to pay greater

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Current situation: dangerous & inefficient



Dangerous
& inefficient
bared wires



Up to 1000m
to nearest legal access point



Red line shows illegal connections openly cross common ground endangering animals and people alike.

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Peri-urban access to electricity - SSA

- Where to start the roll out & why Dakar?
 - A manageable zone representative of the many and varied prevailing conditions
 - Dakar - Pikine
 - Large enough to provide benchmark data
 - Neither most/ least affluent
 - Prevailing conditions to be found throughout SSA
 - Electricity balance ..
 - FISUEL /PROQUELEC active
 - Utility share the aims

Choice of where to start – Sénégal – Dakar – Pikine district

- Small enough to be manageable
 - 87,000 peri-urban homes
 - 1,250 to start
- Large enough to act as a basis for replication – Sénégal:
 - ~750,000 + peri-urban homes
- FISUEL/ PROQUELEC, USAID, UN, EdF/ AfD & liberalising Utility presence
- Median characteristics representing the above
 - Scores around the middle in everything
- Typical fraud circumstances.



Current situation: Dakar - Sénégal



Quarter



Exterior



Interior



Multi-selling on



Undersized
connections



Dangerous
connections

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Peri-urban access to electricity - SSA

- Programme outcomes
 - Energy efficiency actions:
 - New transformers to enable extra distribution
 - Installing efficient final distribution [0.85 mm² cable replaced by coaxial 6.5 mm²]
 - New poles enabling efficient access to households
 - Households earthed externally
 - New circuitry [1.5 mm² and 2.5 mm²]
 - Energy efficient bulbs replace current ones
 - Class G [at best] fridges replaced by 120litre Class A

Peri-urban access to electricity - SSA

Energy savings derived from regularising illegal home electricity users

	Cables	Lighting	Refrigerator	Transformer (per user)	Total
Share	27%	38%	33%	2%	
Monthly savings (kWh)	16	22.5	19.5	1.2	59.2
Yearly savings (kWh)	192	270	235	14	711



- 46% kWh reduction – no loss of use
- Equal QoS as the regular neighbours

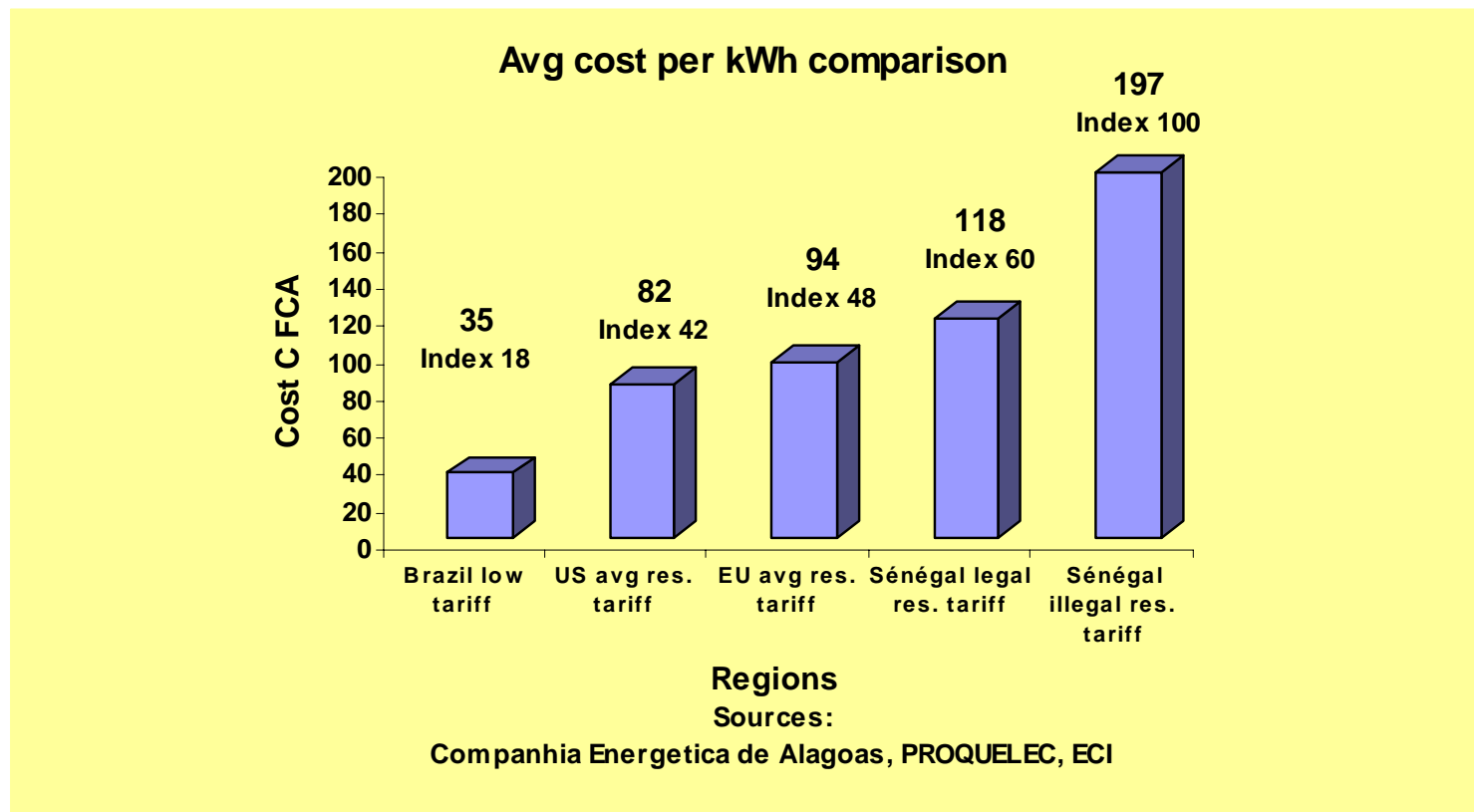
“Les venants” no longer

Peri-urban access to electricity - SSA

- Programme outcomes
 - Financial consequences:
 - Current non-conforming users pay ~50% more than they should due to energy inefficiency
 - Utility benefits – improved Demand Side Management
 - Fraud / “non-technical” losses opportunity for
 - New client opportunities for the Utility
 - Payment collection logically not/ far less of an issue than in the Pilot
 - Other Utility economies to be verified by the first 1,250 homes first Phase – order of magnitude of 20% energy efficiency savings.

Current status – PROQUELEC home condition survey

- Paying over the odds
- and expensive too by International comparisons!



Peri-urban access to electricity - SSA

	Sénégal Urban Households (745,000)	Peri-urban households (64% - 476,800)	Of which a high proportion need improved energy efficient systems and equipment (342,152)
At an annual consumption of 1,533 kWh	1,142,085 MWh	730,934 MWh	524,519 MWh
Forecast avg. energy savings of 711 kWh over 1,533 kWh = 46%			241,279 MWh
Net energy saving for SENELEC			~20%

- Savings from a more efficient grid / infrastructure
- Potential additional revenues available

Peri-urban access to electricity - SSA

- Programme outcomes
 - Financial consequences:
 - Current non-conforming users pay 68% more than their neighbours
 - No loss of revenues for the Utility
 - Payment collection logically not/ far less of an issue than in the Pilot
 - Other Utility economies not quantified as yet but potentially significant – 20% energy efficiency savings not out of the question
 - Neighbours likely to follow the energy efficiency [for them money saving too] example of the now-conforming households.

Peri-urban access to electricity - SSA

Savings in terms of Carbon emissions per household

	kWh	toe	Tons of CO ₂
Savings per household	711	0.061131	0.451

Total programme:

- 1,039,036 t.o.e.
- 7,437,267 tons of CO₂

Peri-urban access to electricity - SSA

- Programme outcomes
 - Re-cycling old materials:
 - Phase 1 – plan to extract energy inefficient and polluting refrigerators from the market
 - Subsequent Phases
 - Aim to set up a network of re-cycling centres throughout the region.
 - These centres will ethically recycle:
 - Refrigerators
 - Inappropriate cable and wire
 - Lamps
 - Other [up stream] materials
 - Potential collaboration with UNDP-GEF and SIMS Metal Management among others

Peri-urban access to electricity - SSA

- Programme outcomes
 - Social consequences:
 - Integration
 - Health
 - Injuries [eg electrical, fire in the home] can now be treated officially
 - Sanitation
 - Contribution
 - Access to being active members of the community
 - Benefits
 - Education

Peri-urban access to electricity - SSA

- Programme user benefits
 - Improved electrical safety, leading to reduced incidents of electrical shock and electrical fires
 - Improved reliability of supply, improving food quality and reliability of operations for small businesses relying on electricity
 - Improved energy efficiency and reduced greenhouse gas emissions.

Peri-urban access to electricity - SSA

- Programme Management
 - National – Utility, Safety Groups – Authorities
 - Work-in-kind
 - Network – staff & installer training
 - Home user education
 - National Financing
 - Micro-finance potential
 - Some of the household savings invested
 - Revenue from re-cycled goods
 - Clean Development Mechanism [CDM]
 - Potential for national programmes
 - Potential for voluntary CDM initiatives

Peri-urban access to electricity - SSA

- Programme Management
 - International –Donors and Work-in-kind
 - Network upgrade
 - Equipment - subsidies allowed for by volumes required
 - Communications, training and monitoring programmes financed by donors
 - Importance of a phased approach
 - Demonstration of auto-financing
 - Need for funding injection to “kick-start” the process.

Peri-urban access to electricity - SSA



- A viable “business” model
- Do not underestimate
 - The speed of non-conforming peri-urban growth
 - The economic, energy efficient and social benefits
 - The need to provide a bed rock of accessible energy to enable these improvements to happen.

Benoît Dôme

<https://eurocopper.box.net/shared/a4fkjl5jk9>



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