

A world map at night, showing city lights in yellow and orange against a dark blue background. The map is centered on the Atlantic Ocean, with North and South America on the left and Europe, Africa, and Asia on the right.

Lateral Electrification

Towards a new power infrastructure development path for Africa based on smart energy management systems

The Future of Energy : Leading the change

Topic 2 - Smart Energy Management Systems : economics and selection criteria



This study has been carried out
thanks to the financial contribution
from Tuck Fondation

The logo for Tuck Fondation consists of two overlapping teal-colored shapes that resemble a stylized infinity symbol or a figure-eight. The text 'FONDATION TUCK' is positioned above the shapes, and 'The Future of Energy' is positioned below them.

FONDATION TUCK
The Future of Energy

INTRODUCTION

What smart energy management systems can offer to electrification in Africa ?



Sustainable development : UN Agenda for 2030

Environmental



Social



Economic



Electrification of Africa is a society and technology challenge

Experimentation of a new lateral electrification model in Madagascar led by Nanoé Company

AGENDA

Answering 6 questions on lateral electrification

1

Why ?

Need for a new electrification model for Africa

2

What ?

Lateral electrification model

3

How ?

Implementation of the lateral electrification model

4

Who ?

Stakeholders of the lateral electrification model

5

When ?

Deployment roadmap for the lateral electrification model

6

How Much ?

Deployment costs of the lateral electrification model



Why ?



Need for a new electrification model for Africa

CHALLENGES

Access to energy & employment

ACCESS TO ENERGY

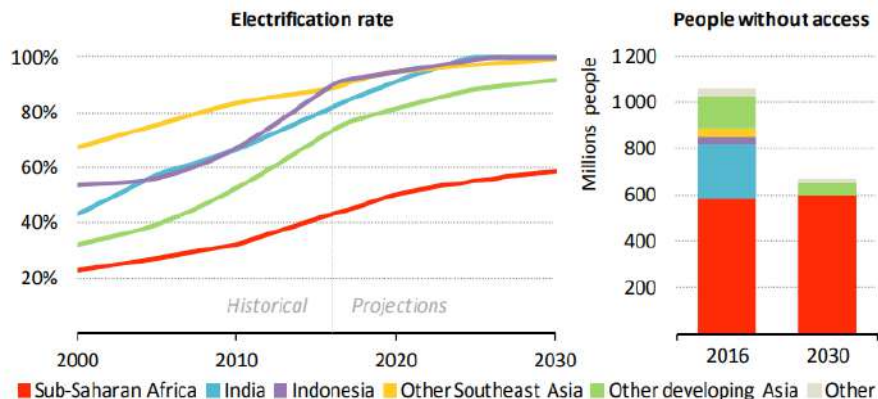


9 / 10

People without access to electricity in 2030 are african

> 600

Millions africans without access to electricity by 2030



ACCESS TO EMPLOYMENT

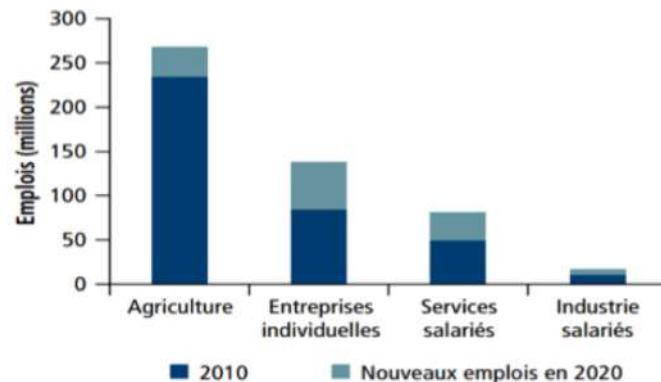


2 / 3

Africans under 35 years old

> 12

Young africans entering each year the labour market



CAUSES

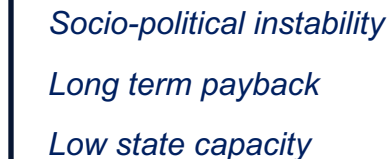
Failing tentatives to replicate the XXst century european electrification model in Africa

The XXst century european electrification model ...



Centralized
Top-down
Public-led
Fossil-based

... is not easily replicable in the african context ...



Socio-political instability
Long term payback
Low state capacity

... nor is it desirable.



New energy stakes
Obsolete technologies



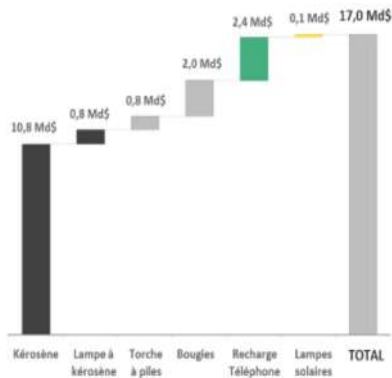
Need to develop a new power infrastructure development path for Africa

OPPORTUNITIES

An energy access market in creation at the base of the pyramid

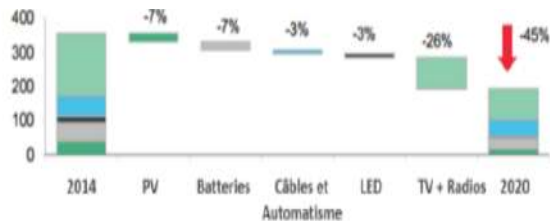
INCREASE IN ELECTRICITY DEMAND

- ➔ Population
- ➔ Individual household's energy consumption
- ➔ Traditional energy costs



DECREASE IN DECENTRALIZED ELECTRICITY COSTS

- ➔ PV modules costs
- ➔ Storage costs
- ➔ Energy efficient appliances costs



NEW ECONOMIC OPPORTUNITIES

Structuration of an energy access market for different decentralized energy services

TIER 1



TIER 2



TIER 3



TIER 4



TIER 5



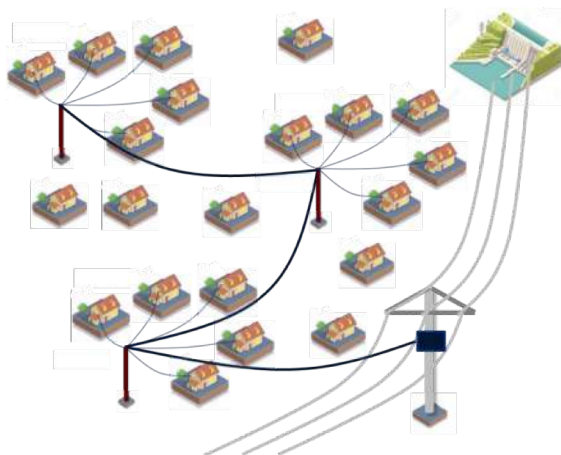
PANORAMAS OF CURRENT ELECTRIFICATION SOLUTIONS

Technologies and approaches

GRID SOLUTIONS

Micro-grids, Mini-grids, Grids extensions

T5



TECHNOLOGIES

OFF-GRID SOLUTIONS

Solar lanterns

T1



Solar kits

T2



Solar Home Systems

T3



Motors

T4

T4



T5

APPROACH

Building and Operation of power infrastructures

Regulated public service

Sale of power


Manufacturing and distribution of power equipments

Free-market

Sale of goods

PANORAMAS OF CURRENT ELECTRIFICATION SOLUTIONS

Pros and cons

	GRID SOLUTIONS	OFF-GRID SOLUTIONS
PROS	<p>High local impact on sustainable development</p> <ul style="list-style-type: none">Economic developmentHigh service qualitySocial development	<p>Rapid impact on households' welfare</p> <ul style="list-style-type: none">Rapid and affordable diffusionHigh replicabilityLiving conditions improvements
CONS	<p>But slowly and hardly replicable</p> <ul style="list-style-type: none">Expensive and slow diffusionLimited potentialUnflexible and obsolete technologies	<p>But unable to sustain this impact on the long term</p> <ul style="list-style-type: none">No impact on economic and social developmentUnflexible serviceUnsustainable solution
	LONG-TERM ONLY SOLUTION	SHORT-TERM ONLY SOLUTION

What ?



The lateral electrification model

AMBITION

Core objectives of the lateral electrification model

Answering both short-term and long-term challenges of the african power sector more efficiently than current electrification solutions

SHORT-TERM CHALLENGE : Energy access

Quickly provide african off-grid population with basic and affordable energy services

LONG-TERM CHALLENGE : Sustainable development

Progressively build XXIst century power infrastructure able to support the continent sustainable development

DEFINITION

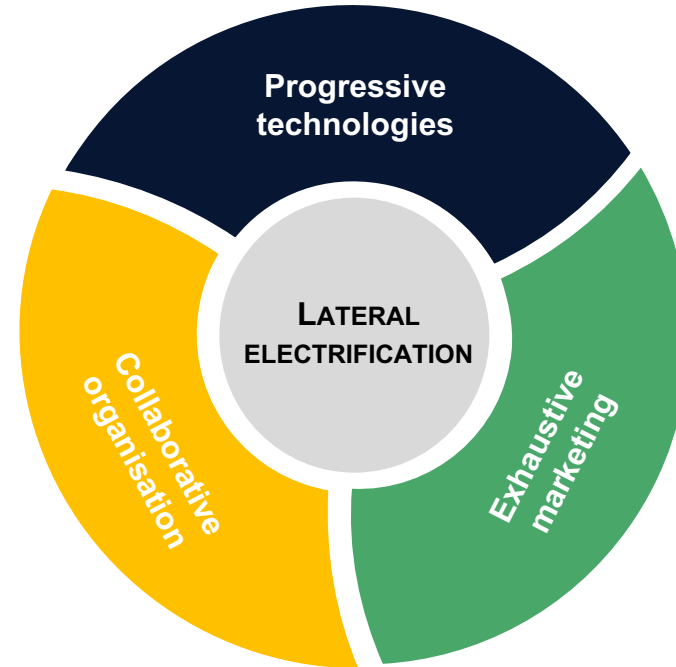
Fundamentals of the lateral electrification model

The lateral electrification model is a progressive and collaborative process for building smart, decarbonized and decentralized power infrastructures in the african context based on renewable energies, digital technologies and local entrepreneurship.



It is a combination of technological, social and business principles

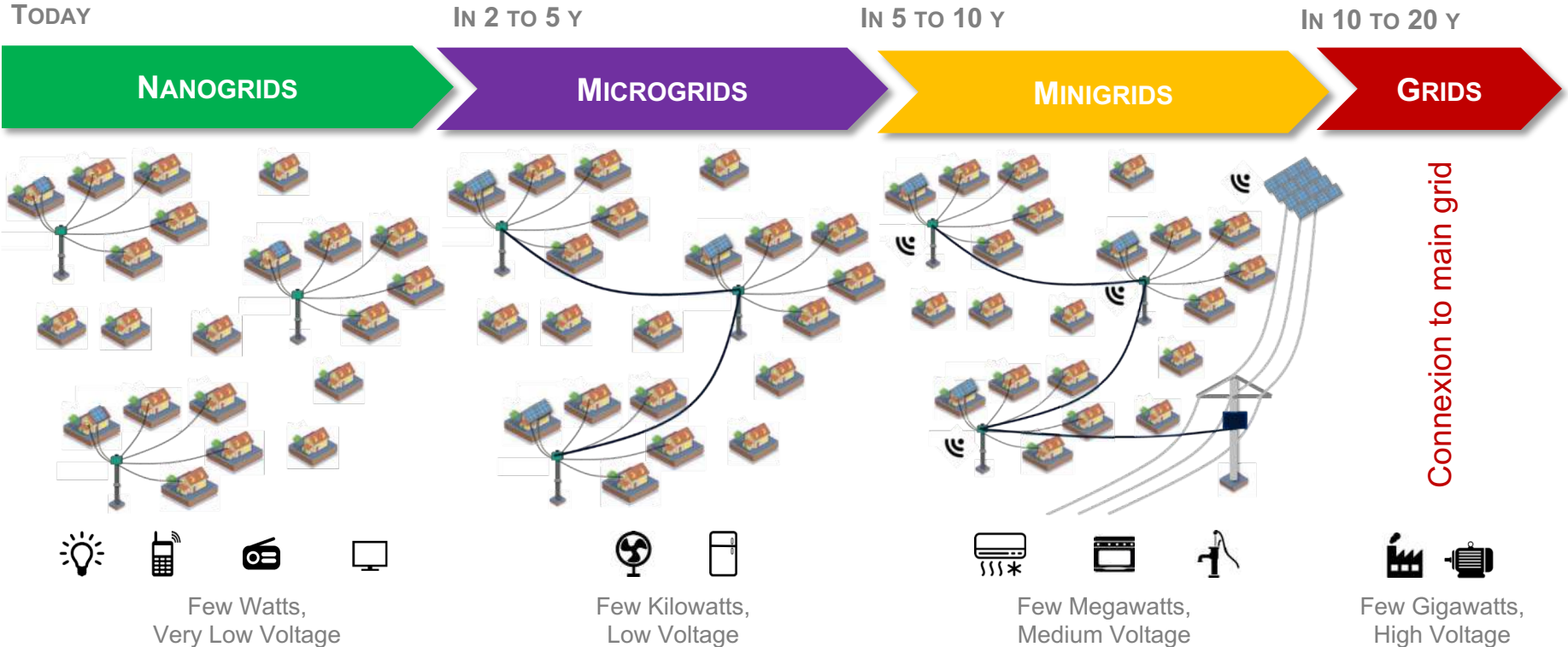
3 PILLARS



PILLAR 1 : A PROGRESSIVE TECHNOLOGICAL APPROACH

Presentation

Building smart power infrastructures by successive aggregation of smaller power production, storage, distribution, metering and balance units following territories growing energy needs.



PILLAR 1 : A PROGRESSIVE TECHNOLOGICAL APPROACH

Feasibility and interests

FEASIBILITY

ECONOMIC

Cheaper than alternatives at each step

Less risky than alternatives at each step

More flexible than alternatives at each step

SOCIAL

Club effect

Modernity effect

Progressive implication of growing social structures

ENVIRONMENTAL

Extremely high replication potential

Operational effectiveness thanks to grouping of users

INTERESTS

1

Breaks enormous and long-payback investment needs in modern power infrastructures in multiple successive small and short-payback investments

2

Position electrification activity within the technical and financial reach of local entrepreneurs !

PILLAR 2 : A COLLABORATIVE ORGANIZATIONAL APPROACH

Presentation

Structuring an horizontal power industry composed of small local entrepreneurs developing more and more complex infrastructures and more and more complex businesses

	NANO-UTILITIES	MICRO-UTILITIES	MINI-UTILITIES	UTILITIES
ROLE	B&O of nano-grids	B&O of micro-grids	B&O of mini-grids	B&O of Grids
STRUCTURE	Individual informal entrepreneurs	Individual formal Entrepreneurs with aids	Small or medium enterprises	Medium or large enterprises
SKILLS	Qualified worker	Qualified technician	Manager	Executive Manager
INVESTMENTS	Unit CAPEX < 1k\$ Payback < 3 years	Unit CAPEX < 10 k\$ Payback < 4 years	Unit CAPEX < 100 k\$ Payback < 5-6 years	Unit CAPEX > 100 k\$ Payback < 8-10 years
FINANCING	Capital : Own Debt : Micro-finance Grant : Family, friends	Capital : Local notable Debt : bank personal credit Grant : Diaspora	Capital : Local prof. investor Debt : bank enterprise credit Grant : NGOs	Capital : Industrial partners Debt : Investment funds Grant : International aid agencies

PILLAR 2 : A COLLABORATIVE ORGANIZATIONAL APPROACH

Feasibility and interests

FEASIBILITY

TECHNICAL

Progressive development of power infrastructure management lacking skills

First steps within the reach of almost all educated young african

SOCIAL

High availability of motivated youngs to work in this field

Individual entrepreneurship is more common in africa than employment

FINANCIAL

Availability of appropriate financing sources for all steps

INTERESTS

OPERATIONAL

Limiting frauds

Ensure ultra-local presence

Reducing operating costs

SOCIETAL

Maximize the job content of the electrification process

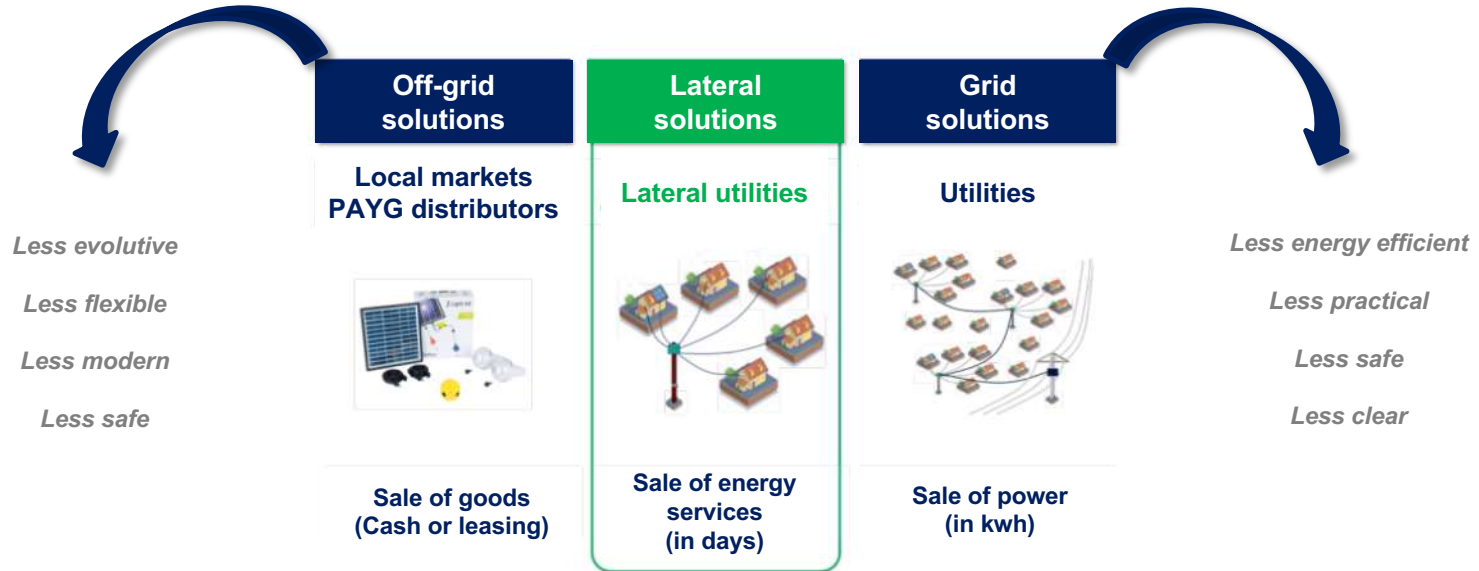
Maximize the local added value of the electrification process

PILLAR 3 : AN EXHAUSTIVE MARKETING APPROACH

Presentation and advantages

Proposing to users to buy daily accesses to standardized energy services covering :

- *The provision, installation and maintenance of their electric appliances (Bulbs, Radios, TVs, etc)*
- *The daily delivery of the energy necessary to use them during a certain amount of time*



How ?



Implementation of the lateral electrification model

INNOVATIONS AT THE SERVICE OF THE LATERAL ELECTRIFICATION MODEL

3 types of innovations needed to implement the model

The social venture Nanoé currently experiences in Madagascar the implementation of the lateral electrification model thanks to 3 types of innovations :

HARDWARE INNOVATIONS

Smart energy management technologies necessary to apply the 3 pillars of the lateral electrification model

SOFTWARE INNOVATIONS

IT platforms necessary to efficiently pilot the diffusion of the lateral electrification model by securing and coordinating its stakeholders

BUSINESS MODEL INNOVATIONS

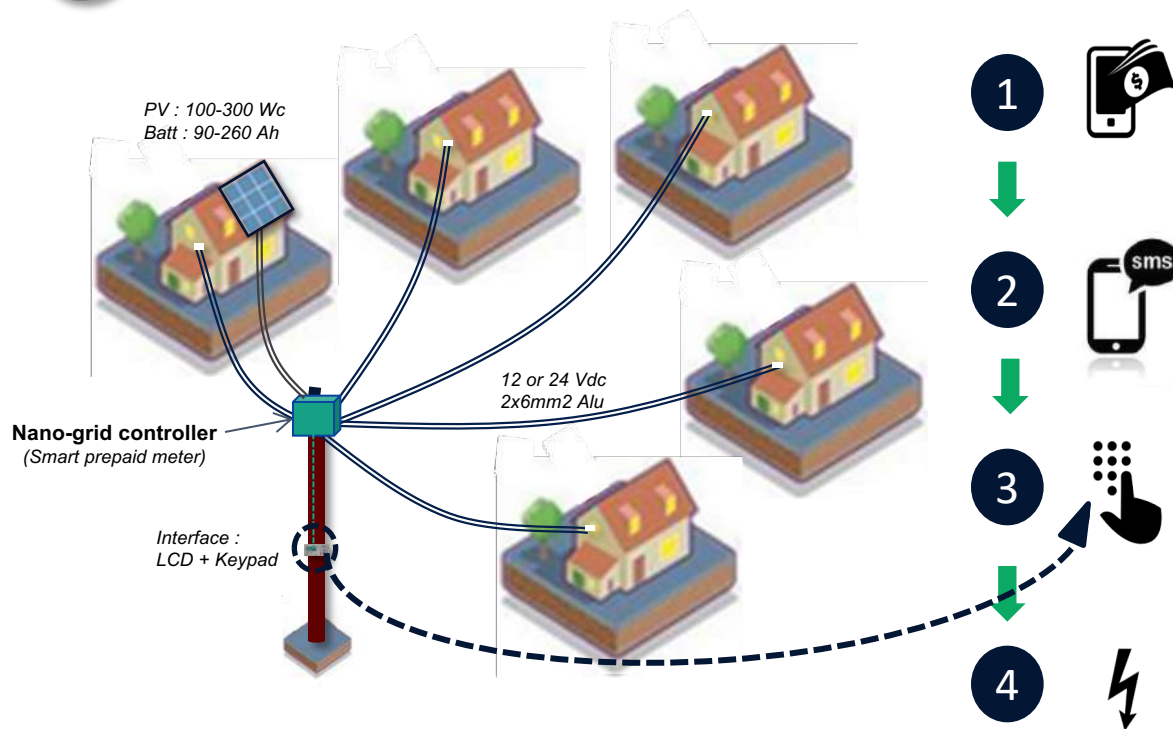
Strategic positioning to catalyse the large scale diffusion of the lateral electrification model

1 – HARDWARE INNOVATIONS

Smart energy management solutions for lateral power systems

Technologies developed & deployed

1 Nano-grid management system



Main features of the energy management system :

- Control maximum power and daily energy allocated to each user
- Block/unblock users based on received mobile prepayments
- Monitor users load curves and system technical events
- Optimize battery charging and modules production

« Smartness » focused on:

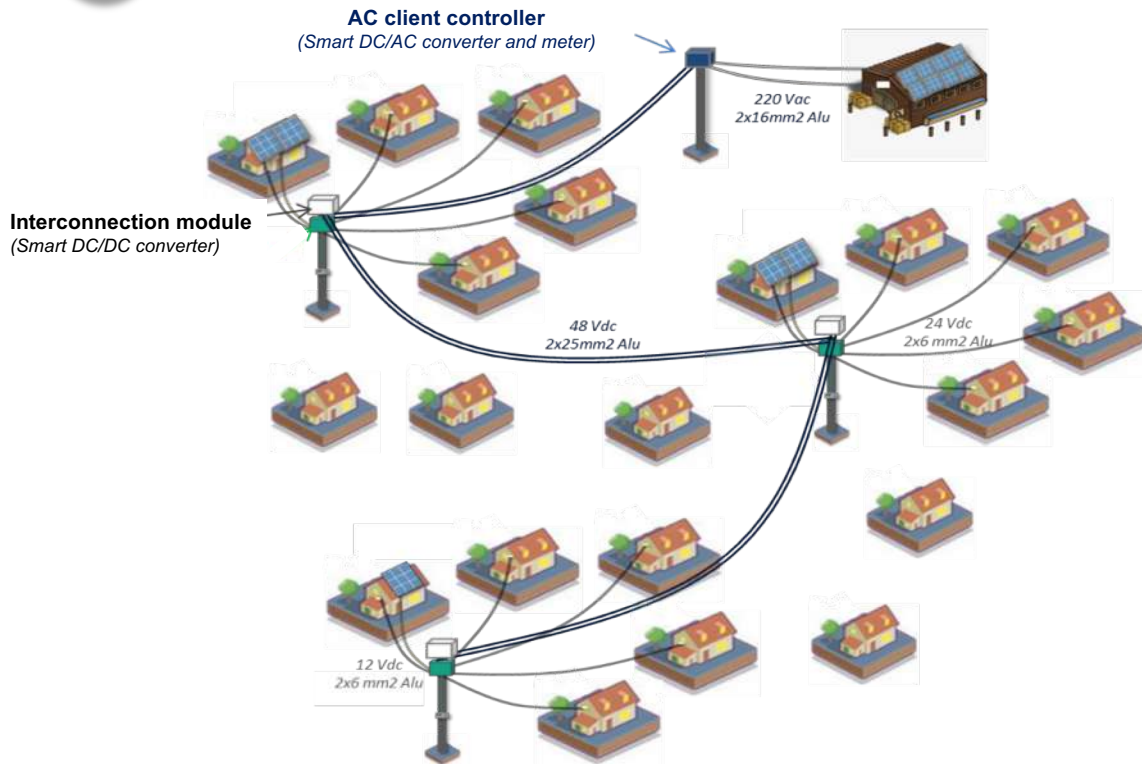
- Manage energy scarcity
- Secure users payments

1 – HARDWARE INNOVATIONS

Smart energy management solutions for lateral power systems

Technologies
under
development

2 Micro-grid management systems



Main features of the energy management system :

- Ensure balance of the Grid
- Optimize energy flows between interconnected nanogrids
- Monitor energy flows
- Optimize PV production and battery charging
- Allow the connection of AC clients

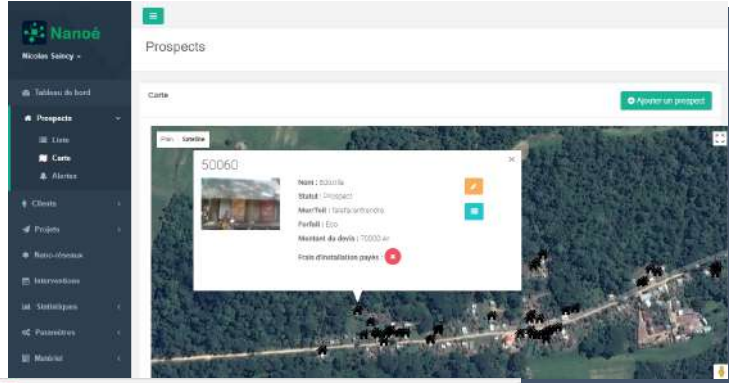
« Smartness » focused on :

- Reduce investment needs in additional production and storage capacities
- Flexibility of the grid

2 – SOFTWARE INNOVATIONS

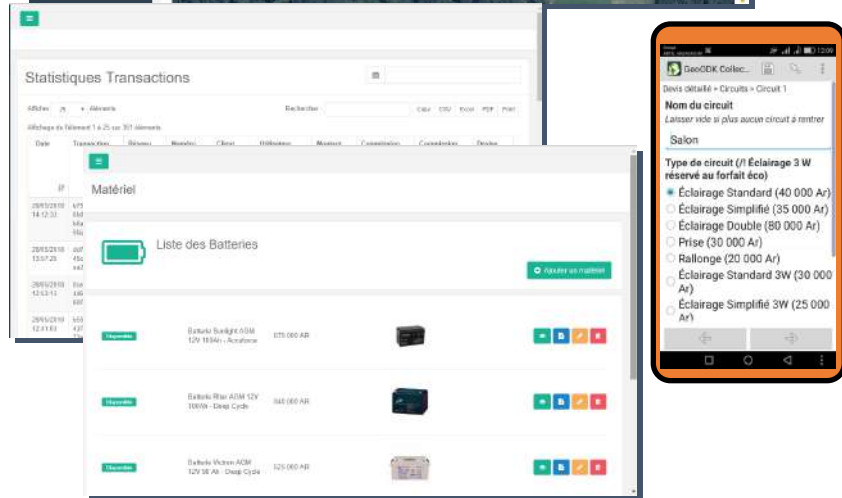
An “Uber-like” IT platform

Technologies
deployed and
constantly
upgrading



Main features :

- Transaction securization
- Data management (marketing, financial & technical)
- Assistance and supervision of all stakeholders (entrepreneurs, clients, etc)
- Performance monitoring



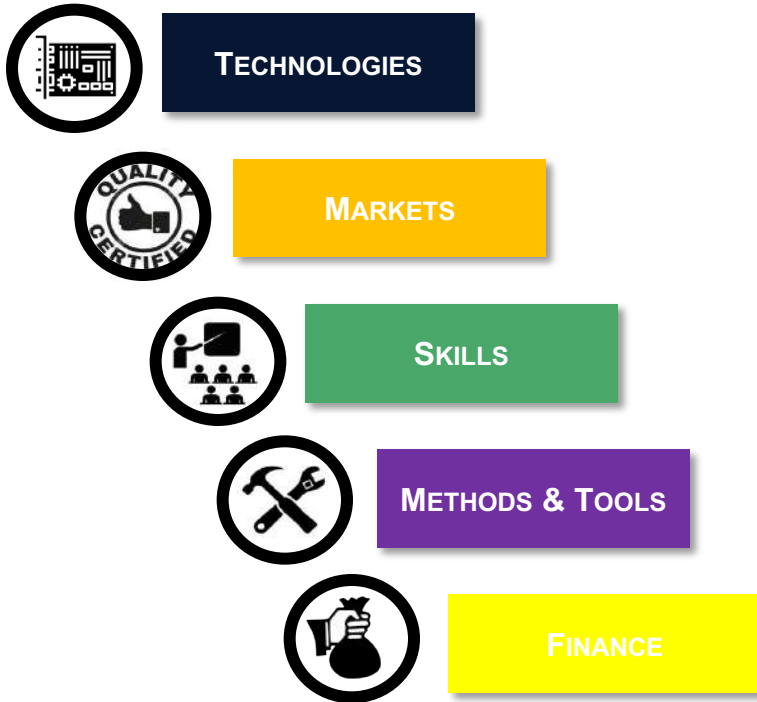
Main functionalities :

- Field data collection through offline apps
- Geographical Information System
- Computer-based maintenance and asset management
- Automated financial transactions with mobile money
- And much more to come ...

3 – BUSINESS MODEL INNOVATIONS

A franchising model

Under a franchising model, Nanoë facilitates local lateral electrification entrepreneurs access to :



Who ?



Lateral Electrification Stakeholders

STAKEHOLDERS

Key players concerned by the lateral electrification model



1 – INTERNATIONAL AID AGENCIES

And other actors of the official development assistance to Africa

Current Positioning

AFD, Banque Mondiale, BAD... : Leading financing institutions in the power sector in Africa

Their goals

- Promote the development of sustainable electricity infrastructure
- Increase access to electricity
- Strengthen the public electricity sector (recovery or rescue of national electricity companies)
- Encourage private sector intervention
- Improve the electricity sector governance
- Promote professional training in the power sector

Orientation

- ✓ Massive increase in public development assistance in the energy sector
- ✓ Increasing the share of aid allocated to private sector
- ✓ Supporting public-private partnerships

2 – STATE AUTHORITIES

At the national level

Limits of Current Positioning : Opening the power sector to private actors in rural areas

For micro-grids : Investment subsidies for electrifying priority areas

Only a few thousand households benefit where more than 20 million people do not have access to electricity

For individual kits : Taxes exemption on equipment importation

Potential high impact on African states' budget whose main tax revenue comes from customs

The lateral electrification model is an opportunity both for national and local authorities

- ✓ More sustainable electrification for rural areas
- ✓ Reducing public planning needs
- ✓ High local impact on jobs



3 – LOCAL AUTHORITIES

At the local level

Current Positioning : Priority to local development

But

Municipalities are facing following issues :

- **No control over the distribution** of individual kits
- **Attracting grid developers**
- **Projects in stand by for several years**
- **Non-respect of contractual commitments** by operators
- **Very limited budgets** ⇒ **no investment**
- **No technical service**



The lateral electrification model is an opportunity for local authorities



- ✓ Less risky than grid electrification and micro grids
- ✓ Increased involvement of the municipality compared to individual kits
- ✓ New momentum to municipalities

4 – STATE UTILITIES

National electricity companies

Current Positioning Low investment capacity: maintain existing facilities, minimal service in urban areas

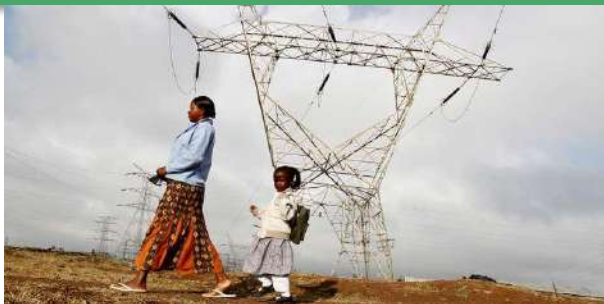
They face a combination of difficulties:

- Low prices
- High production costs
- Significant technical and non-technical losses
- Lack of skills

Production costs > Sales Tariffs



Lateral electrification model represents both a threat and an opportunity for public electricity companies



Deployment in rural areas would ease political pressure



Highlighting the failures of these companies, already discredited by the population

5 – INTERNATIONAL ENERGY COMPANIES

Non african multinationals

Current Positioning

Looking for the most profitable and replicable technologies and business models for Africa



The lateral electrification model represents an opportunity for international energy companies

A new setting up method in Africa much closer to utilities core business than the sale of electrical equipment

6 – LOCAL PRIVATE SECTOR

In various sectors

Current Positioning

Strategic support for developing access to electricity to:

- 1 Improve their production conditions
- 2 Open new markets for their products or services
- 3 Promote social responsibility

Agricultural or agro-industrial



Financial



Telecommunication



Satellite television



Mining or oil



When ?



Deployment roadmap for lateral electrification model

PREREQUISITES

Conditions for successful deployment of lateral electrification model

Challenges

Success Conditions

Convince **public decision-makers** to support the model growth

Breaking down regulatory barriers

Disseminate the model at state level

Successful experience in a first region

Ongoing initiative by Club'ER

Convince **international donors** to finance the model growth

Enable faster development compatible with 2030 goals

Fund technology transfer and know-how

Valorizing the economic, social and environmental impact

Convince **energy industries** to accelerate the model growth

Structuring lateral electrification industry

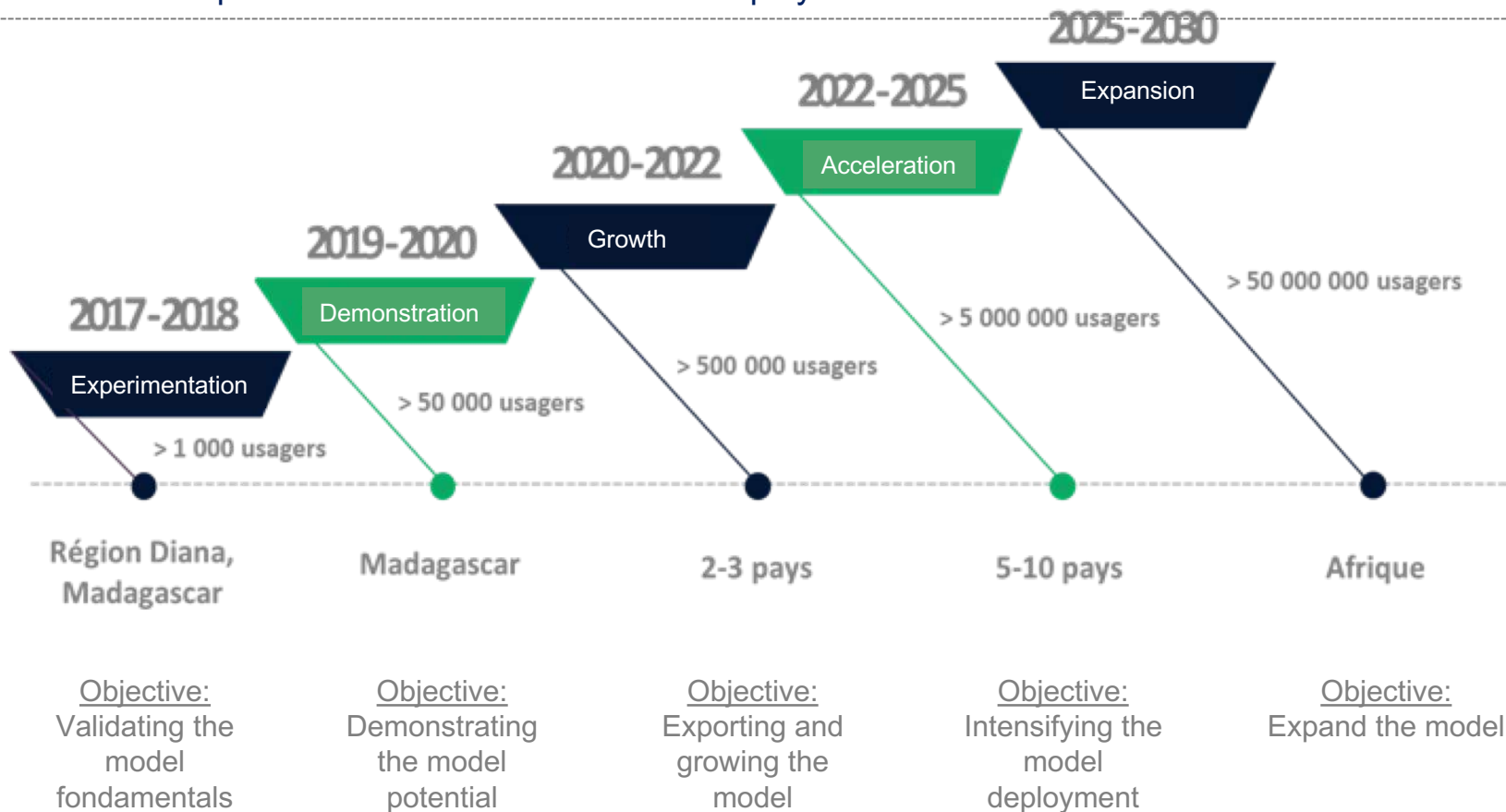
Equipment manufacturers: increase mass production

Develop hardware, software and business model innovations

Partner with existing players

ROADMAP

Tentative roadmap for lateral electrification model deployment



How Much ?

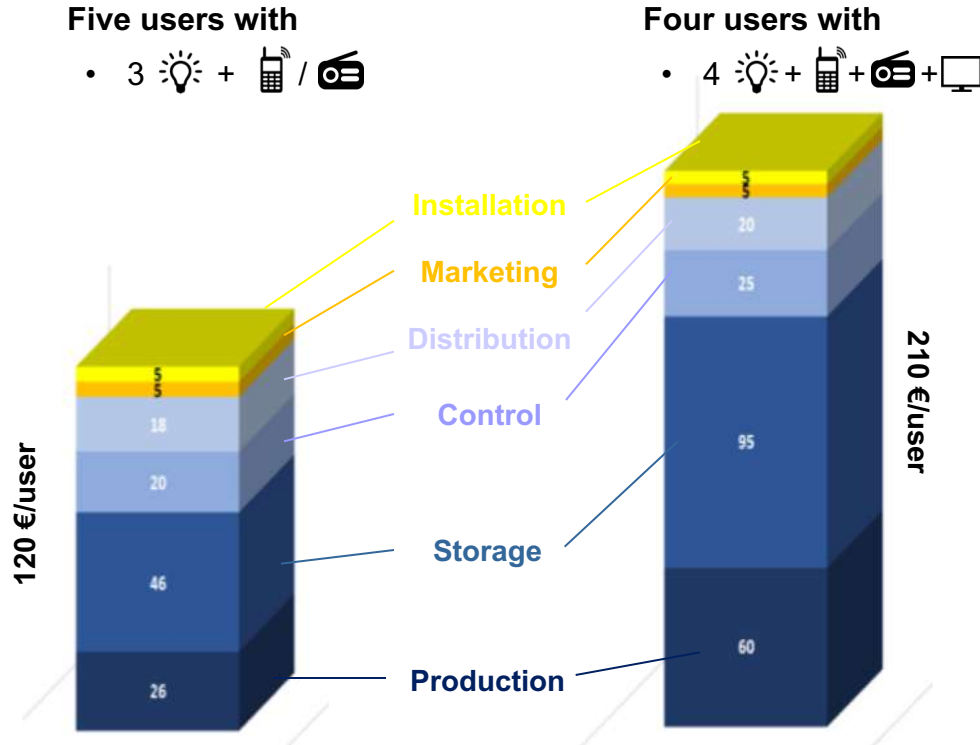


Deployment costs of the lateral electrification model

COSTS FOR THE OPERATOR

Investment costs in a Nano-grid

The investment cost in a nano-grid ranges between 100 and 300 € per user depending on the number of users and their subscribed energy services



**About
1/10th**

Of Grid solutions
investment costs

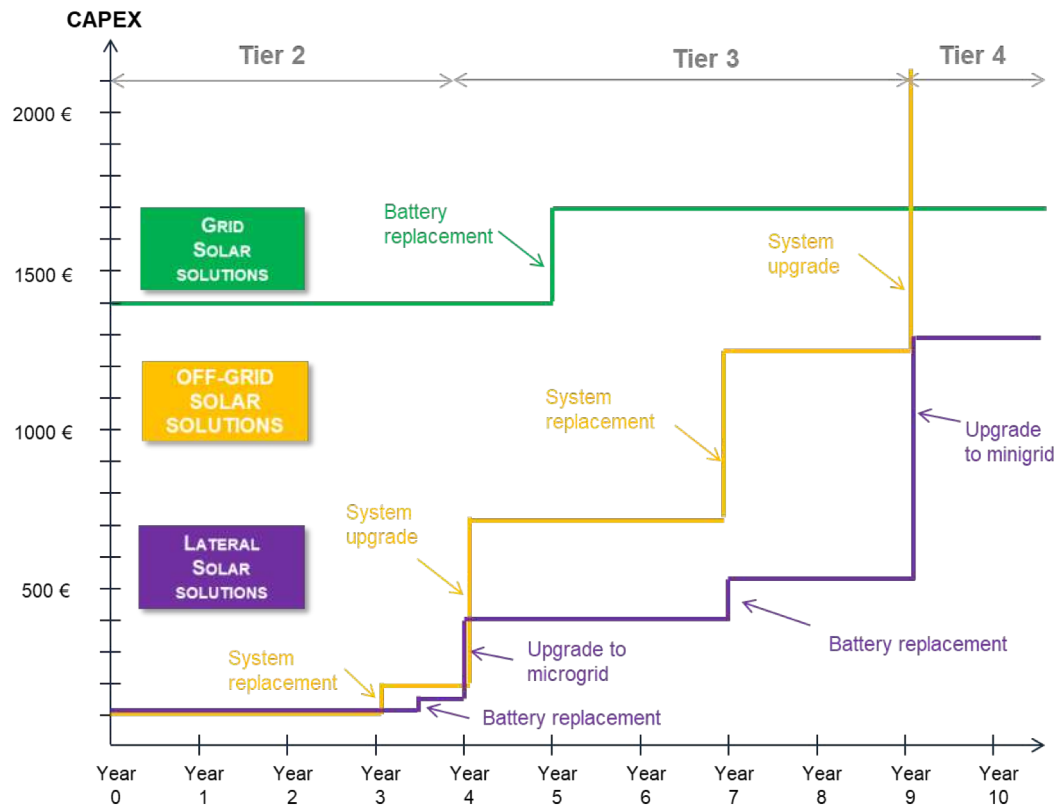
Eq

To Off-grid solutions
investment costs

- But potential over 20%
decrease in the short-term

COSTS FOR THE OPERATOR

Investment costs across a typical household electrification path




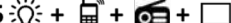



Given alternative solutions lifetime and the progressive increase of typical household's energy needs, the lateral electrification model could offer the most affordable electrification path for Africa

COSTS FOR THE END-USER

Tariffs comparison with alternatives across Africa

Thanks to lower investment costs, at a given profitability for the solution provider, the lateral electrification model should become the cheapest electrification solution for african households

	Initial fee (in €)				Monthly fees (in €/month)			
	Solar Kit Cash	Solar Kit PAYG*	Grid	Nano-grid	Solar Kit Cash	Solar Kit PAYG*	Grid	Nano-grid
2 	20 - 60	5 - 10	50 - 150	4 - 8	0	5 - 9	2 - 4	2 - 3
3 	30 - 80	10 - 15	60 - 160	6 - 12	0	7 - 12	3 - 5	4 - 5
4 	50 - 100	12 - 20	80 - 180	11 - 18	0	9 - 15	4 - 8	6 - 9
5 	120 - 200	60 - 100	150 - 300	60 - 80	0	14 - 20	6 - 12	10 - 14
6 	700 - 1500	300 - 500	300 - 500	N.D**	0	30 - 40	15 - 25	N.D**

* Assumptions : Lighting and phone charging circuits provided by the operator but other appliances independantly acquired by the end-user

** Offer under preparation by Nanoe but not yet commercialized

CONCLUSIONS

The last word

The lateral electrification model could open a new path for the electrification of the continent



Thank you for your
attention

