Measuring sustainable energy projects to orient strategies for access to energy: why does it matter?

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Multiple interconnections among energy, environment and society

Interlinkages on
- Socio-Economic Development
- Quality of life for the people
- Global Security (raw materials, food, water)
- Environmental protection

GOAL 7

COP21 & COP22

SE4ALL

Energy Services Development
Human and economic activity goes along with the capacity of using natural resources.

The concern about overexploitation of natural resources has come to be global:
- are limited
- their misuse affects the environment
- The non-equitable distribution affects international security
Energy, Economics and beyond

Total Primary Energy Supply \textbf{Versus} Electric energy Consumption

Gross National Income

Human development index \textbf{Versus} Energy Development index

\( R^2 = 0.78 \)
Some Philosophical achievements

• Energy does not determine **human dignity**.
• With zero/poor access, **fundamental rights** may not be guarantee

Energy comes to be an **instrumental right**
Energy Access beyond a binary metrics

**QUANTITY access to energy**

- **Low income countries**: 1.1 billions No access to electricity
- **Middle Income Country**: 2.5 billions use traditional biomass
- **High Income Country**: 50-75 millions in EU affected by “fuel poverty”

**QUALITY affordable, reliable, safe & clean…**
Energy access in Africa

Lack of Energy access

690 millions people no electricity

780 millions no clean cooking

Access
~50%

Electricity use
~1/5 world av.

Intensities
>2 times OECD

~ 150 GW uneven share

Underinvestment is still an issue
Energy access in Africa

Lack of Energy access

LAST TEN YEARS: Africa Energy System could not keep pace with population growth.

LOOKING FORWARD: Africa is expected to become more energy demanding due to its growing population and economy.

LAST TEN YEARS:
- Population: World 6,352 Million, Africa 872 Million (4%)
- TFES (Mtoe): World 11,223, Africa 586 (5%)
- EE (TWh): World 15,985, Africa 477 (3%)
- CO2 (Mt): World 26,583, Africa 814 (3%)

2016:
- Population: World 7,246 Million, Africa 1,156 Million (16%)
- TFES (Mtoe): World 13,699, Africa 722 (6%)
- EE (TWh): World 21,963, Africa 657 (3%)
- CO2 (Mt): World 21,381, Africa 1,105 (5%)

Lack of access to other services:
- Broadband <5%
- Internet <30%
- Passengers ~5%
- Goods ~3%
- Rails ~15%

Further ‘leapfrogging’ opportunities may be enabled by inter-sectorial synergies among energy, transport and ICT.
Energy access in Africa

The Energy Paradox

- Few Energy: 16% of population => 6% TPES, 3% EE, 5% CO2
- Not Reliable: 30% of global O&G discoveries and top potential for REs
- Not affordable: Technical losses in the power sector are twice the average
- Not clean nor safe: Sales lost for SMEs are huge (5-15% of the total sales)
- Not improving fast: Electricity tariffs are among the highest in the world
- No domestic market: 2/3 investment are for export
- Not clean nor safe: 67% population rely on biomass (fuelwood/charcoal)
- 40% rise in bioenergy => forestry stocks + health
- 0.6-0.8 billion still affected by poor energy access in 2040
What is missing?

From the Energy Paradox into the Energy Power for Africa

Energy Debate for Africa

- Progresses has been achieved
- the goal of SE4All is still far
- GOAL 7 will not be straightforward
What is missing? **Measuring Impact**

Measuring the impact of our Actions

Learning from the past

“Whoever wishes to foresee the future must consult the past.” Niccolò Macchiavelli

Evaluation metric to address the complexity and interconnections of current energy challenges

**Accountability**
Assess project performance

**Strategic Planning**
To guide future interventions
Measuring the impact of our Actions

Performance and Impact Assessment Framework

Learning from the past

Accountability
Assess project performance

Strategic Planning
To guide future interventions

Metrics for IMPACT has to take into account

(i) The induced change on the community
(ii) The relation between effects & costs or needs

TAKING PROFIT FROM ...

• LFM, Livelihood approach, Results Chain
  • DAC-OECD 5 Criteria

Common tools exist

MITIGATING ...

Lack of harmonization

• few structured and quantitative assessments
Accountability ..... Measuring the process’s performance

Inputs ➔ Activities ➔ Outputs ➔ Outcomes ➔ Impact

Performance Impact Evaluation Framework

Accounting ➔ Strategic Planning

Process Performance ➔ Change in the community

Strategic Planning...measuring the change

Measuring impact beyond energy access project!
ACCOUNTING: measuring process performance

MODEL BASED APPROACH

FLOWS OF INPUT
- Materials
- Energy
- Other goods & services
- Externalities

RESOURCE CONSUMPTION
Overall estimation of
- resources consumption
- waste production

INTENSIVE INDEXES
- Efficiency
- Effectiveness
- Relevance
- Sustainability

Quantitative models from Energy System Analysis
- Exergy Based Accounting methods
- Life Cycle Approach
- Macroeconomic Input/output

... to calculate multidimensional reference metrics

Needs
- Local Assessment
Resources

Effects
- Energy produced
- Income or Value added
- Employment creation

Costs
- Monetary input
- Embodied energy, Virtual Water
- Carbon Footprints....

Process performance is accounted
- Intensive measure of DAC-OECD criteria
  Efficiency, Effectiveness, Relevance, Sustainability
STRATEGIC PLANNING: measuring impact on community

EVALUATION HIERARCHY

Induced change on community capitals

Based on the Sustainable Livelihood Framework

- Capitals are recognized
  - Natural
  - Physical
  - Human
  - Social
  - Financial
- Dimensions within capitals are identified 4 energy projects

Indicators definition

- Project based
- Scientific Literature
- Standards from Grey literature

Field-Base Survey (community perspective)

- Indicators measure
STRATEGIC PLANNING: measuring the impact on community

### EVALUATION HIERARCHY

| Evaluation of change in the community Ex-Ante/Ex-Post |

### FIVE-STEP PROCEDURE

#### COSTUMIZATION
- Indicators selection

#### DEVELOPMENT
- Data input and normalization
- Weights assignment
- Multi-criteria aggregation

#### RESULTS ANALYSIS
- Impact

- Possibility to compare project results with national averages to assess improvements
Lessons learnt

When applied to large number of projects it may allow comparisons
Offering a set of information either Ex-Ante or Ex-Post to different stakeholders

- **Policy Makers**
  - Local, national, regional
  - Feedback for local development strategies

- **Investors**
  - Private, public
  - Feedback on investment complement bankability indexes

- **Science Community**
  - Research Center, Academia
  - Feedback on effective strategies and research direction
What is missing? **Human capital**

Universal access requires «PEOPLE» at the center of the design

» Capacity building and empowerment
» Mix of Teaching Strategies and Tools
» Comprehensive and life cycle approach
» Diversified Targets for Diversified Skills

...beyond delivering «training hours»

Win-Win strategy for local communities and private investors
And an essential element for long term sustainability

"The greatest invention in the world is the mind of a child." - Thomas Edison

SEAR Special Report, 2017: The Power of Human Capital, the World Bank
Beyond traditional mission, while preserving science independence!

What is missing? *Science as Un-usual*

"We don't know who discovered water, but we're certain it wasn't a fish." - John Culkin

TARGETS
HOLISTIC
RESTITUTION

QUALIFIED EDUCATION
HIGH LEVEL RESEARCH

BASIC
APPLIED

IMPORTED
NATIVE

TRANSFER
COOPERATION

SHARING KNOWLEDGE PARTNERSHIP
SCIENCE DIPLOMACY
“The only way to discover the limits of the possible is to go beyond them, entering the impossible” - B. Pascal

Thank you for your kind attention!