Mini-grids as examples of application of Elinor Ostrom's thesis on polycentric governance of the tragedy of the commons

Jean-Claude Berthélemy

Professor, Paris 1 Panthéon Sorbonne University & Senior Fellow, FERDI

Introduction

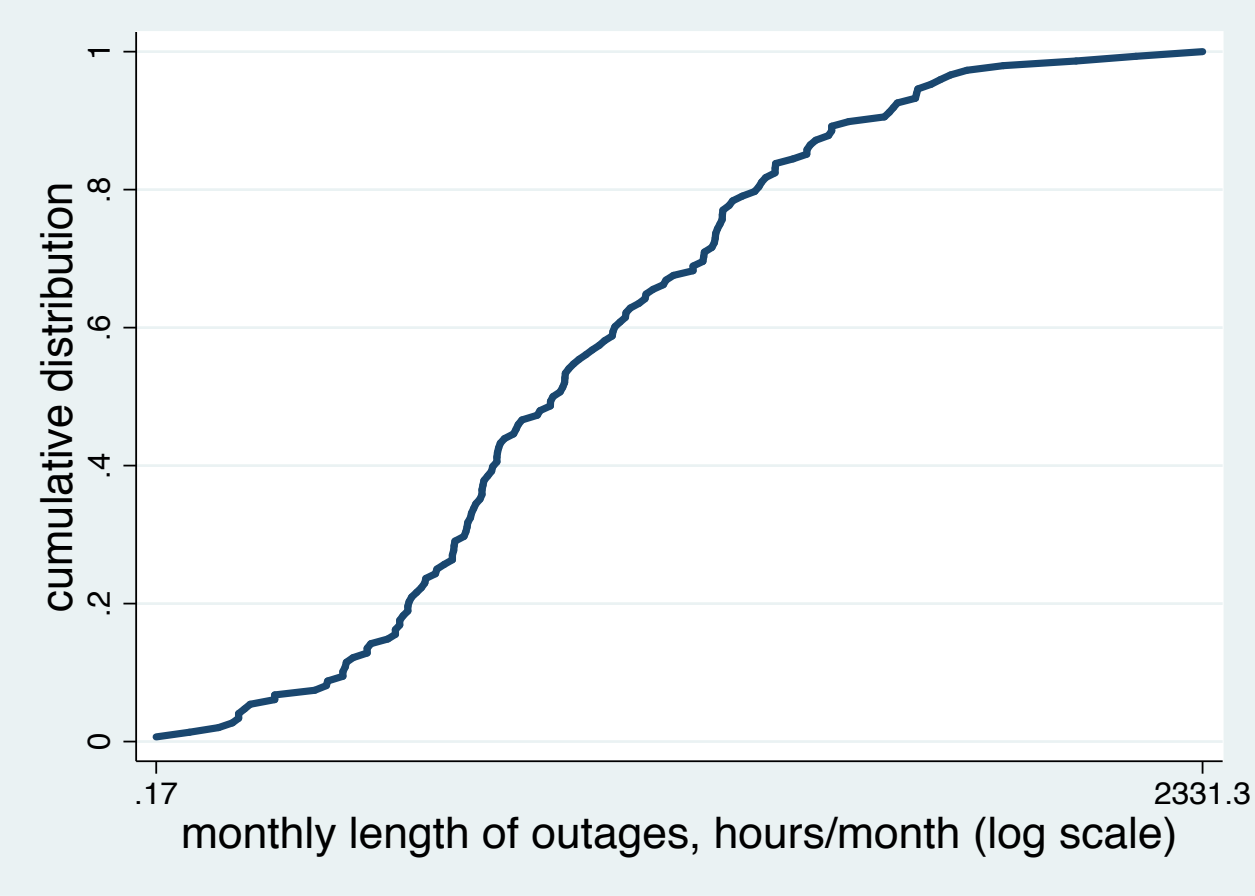
- National electric grids as counter-examples of Elinor Ostrom's thesis?
  - Electrification policies are considered as optimally organized through large interconnected grids
  - In the case of electricity geographical distances are almost abolished
  - Centralized management provides significant economies of scale
  - Smart grids technologies help optimize adaptation of supply to demand

Introduction

- Reasons why decentralized electrification, based on distributed power generation systems is now attracting more attention
  - Low electrification rates, particularly in rural areas
  - Failures of electric grids characterized by frequent outages, which reflect an inability to allocate efficiently the resource produced
  - Technological changes, which have reduced the cost of distributed power generation systems using renewable sources of energy (such as solar, hydro, wind, biomass)

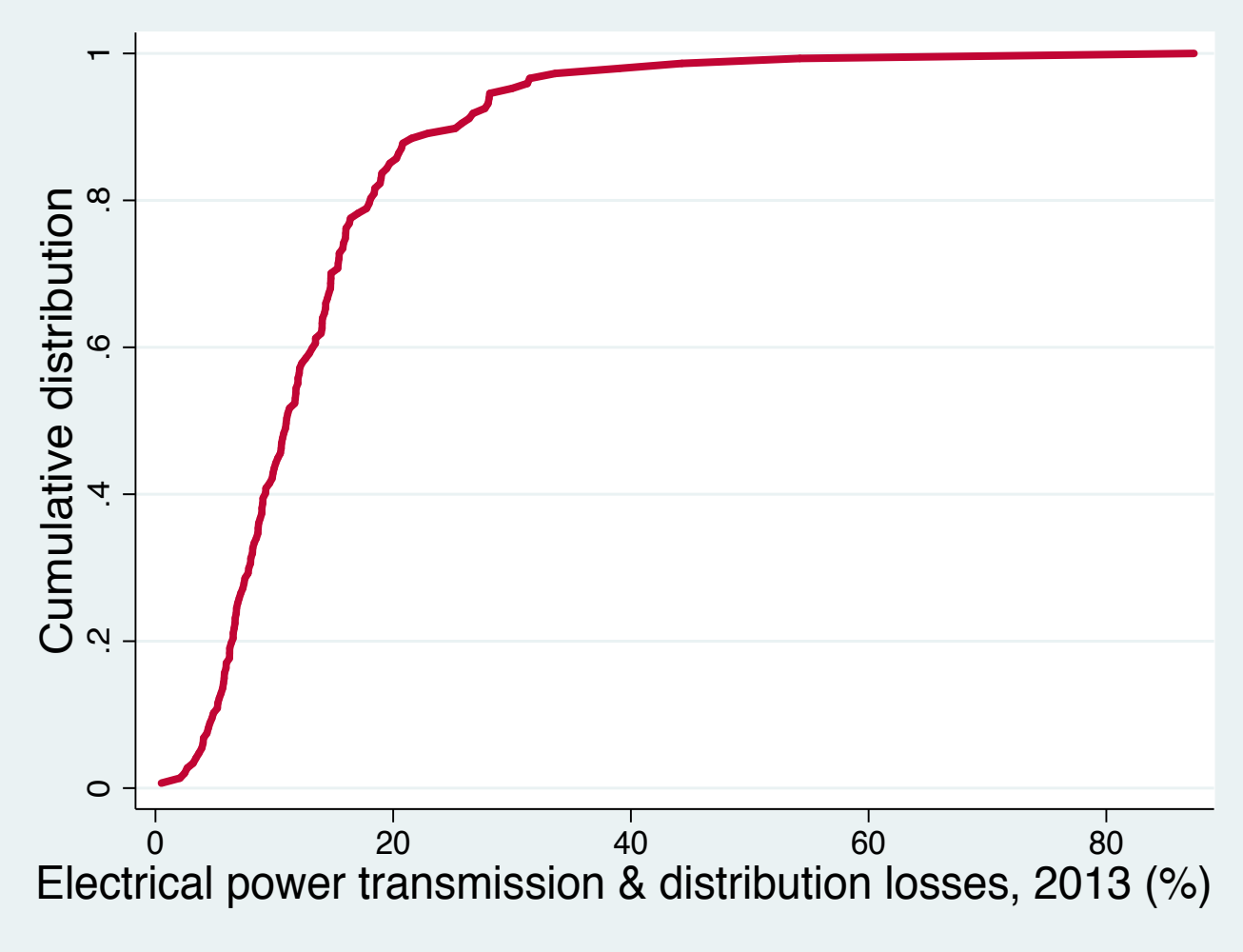
Failures of large scale grids

- Reliability issues: frequent and costly power outages (in30% of countries the monthly length of outages is higher then 1 day)



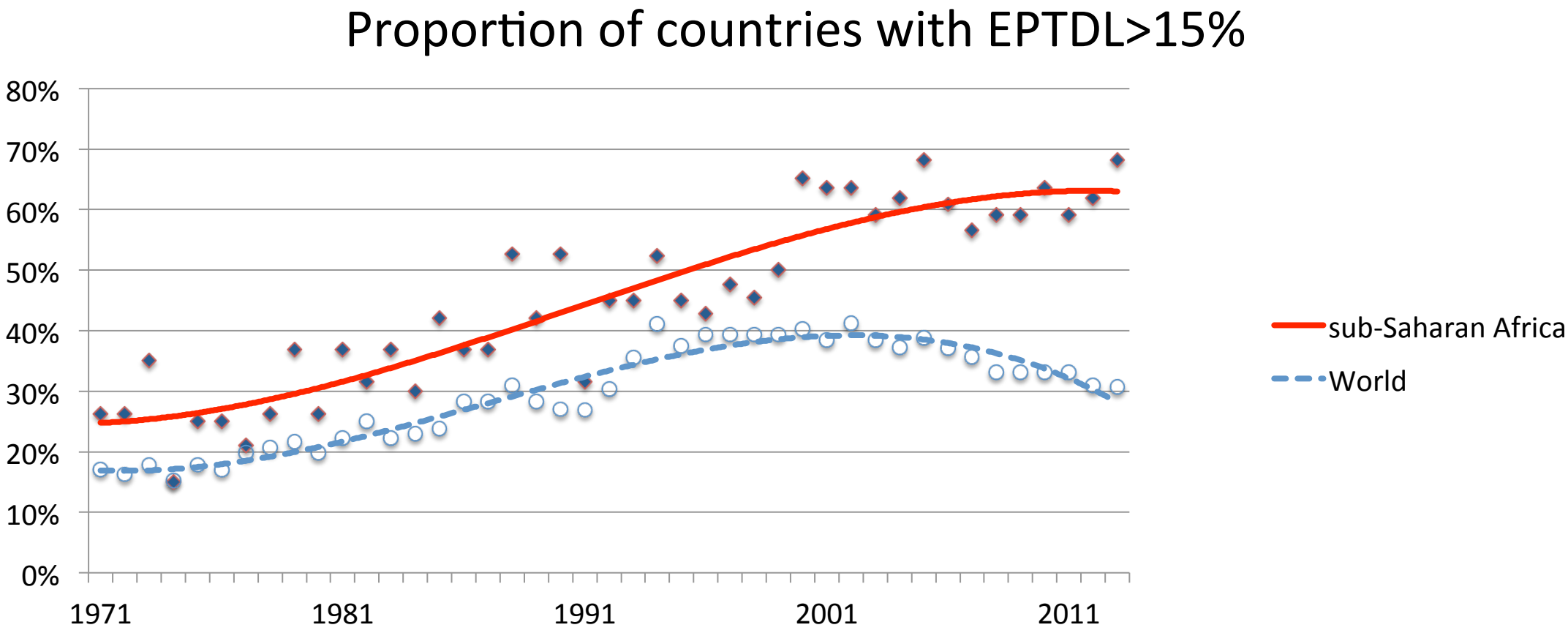
Failures of large scale grids

- Governance issues: large scale and expanding electricity thefts in some countries (above 15% in one third of countries globally)



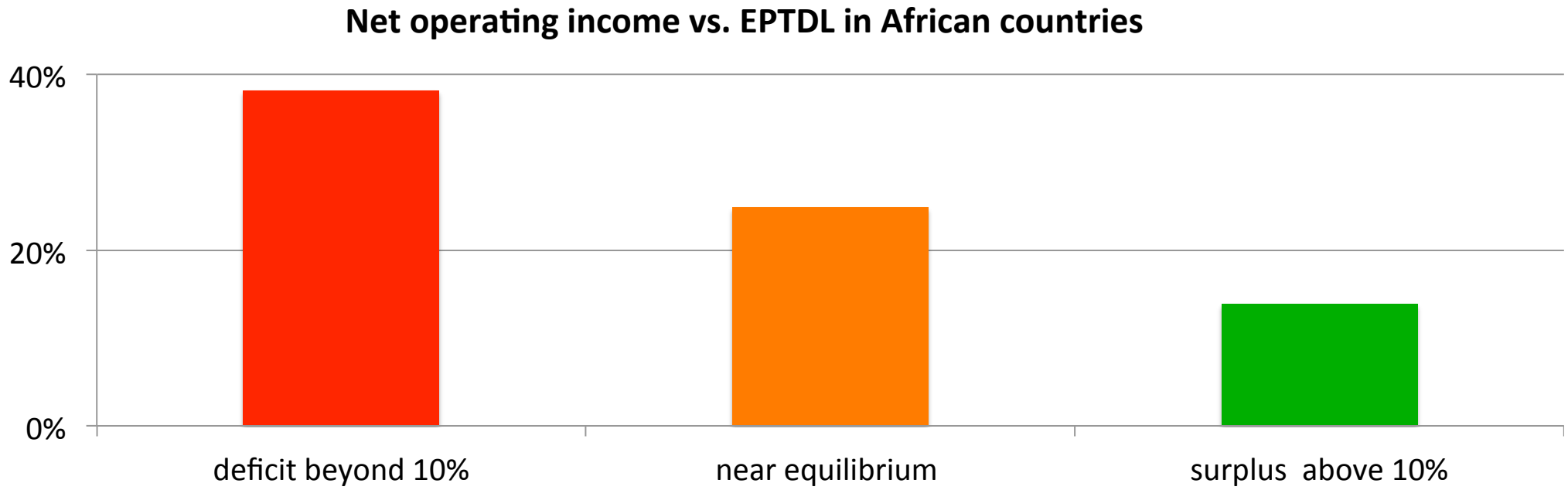
Failures of large scale grids

- Governance issues: large scale and expanding electricity thefts in some countries



Failures of large scale grids

- In sub-Saharan Africa, electricity thefts lead to operating losses and inability of companies to meet their objectives



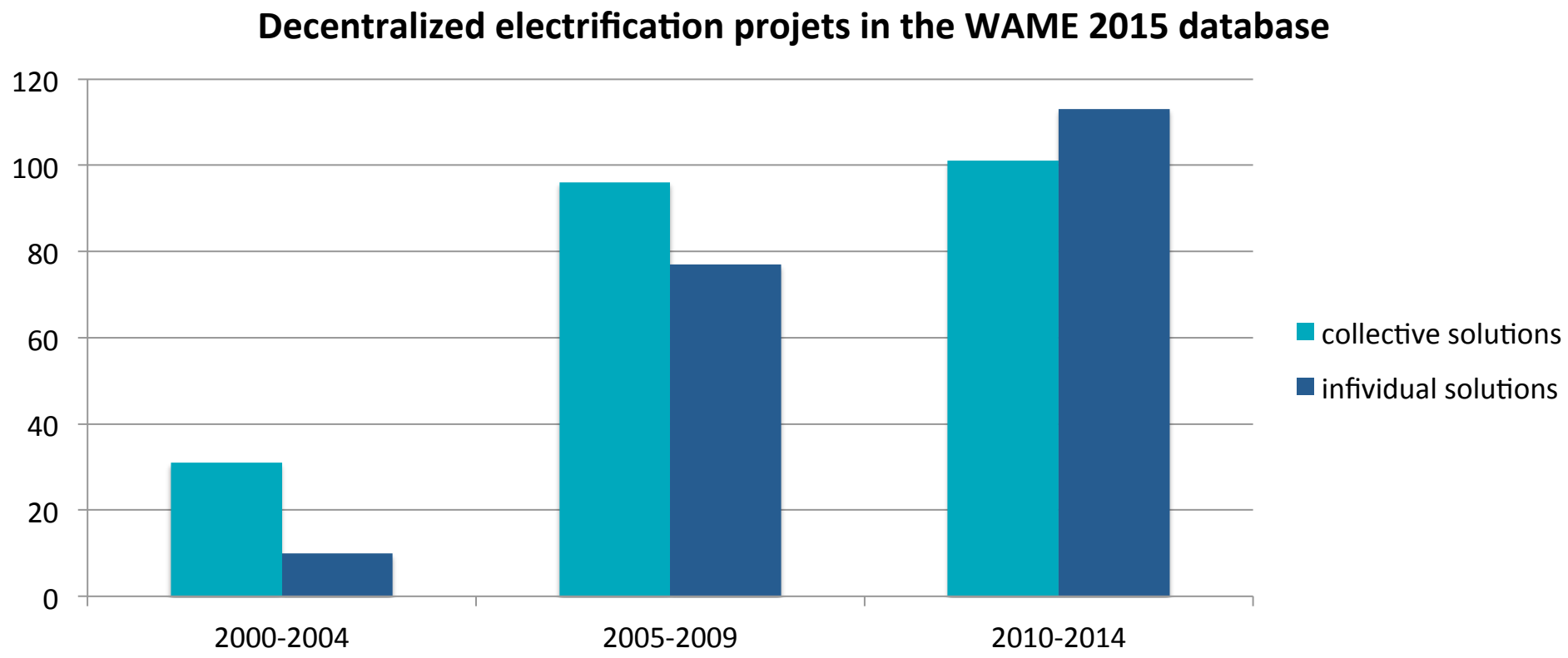
deficit beyond 10%	Botswana, Senegal
near equilibrium	Cote d'Ivoire, Tanzania, Niger, Ghana
surplus above 10%	South Africa, Zimbabwe, Cameroon, Mauritius, Kenya, Zambia

Failures of large scale grids

- Consequences
  - Production losses in industry (more than 10% in the 20 countries most affected by outages)
  - Necessity to invest in costly backup diesel generators
  - Loss of economic growth (up to 2 percentage points in su-Saharan Africa according to Andersen & Dalgaard)
  - Many under-grid households do not connect to the grid, partly due to unreliability (Millien: reducing severe outages by 1% would increase by 0.67% connections to the grid)

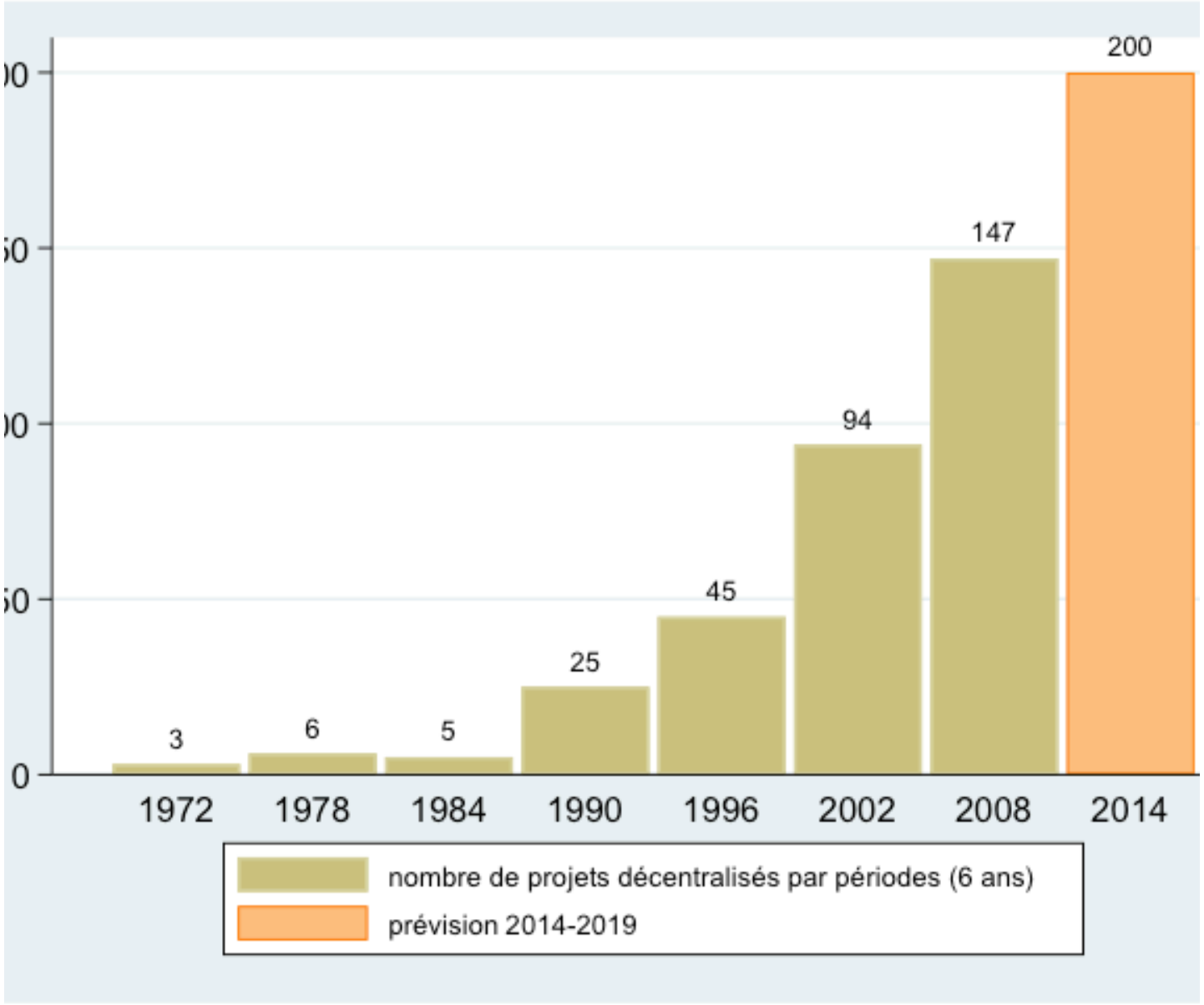
The renewed interest for decentralized electrification

- Rapid growth of decentralized electrification



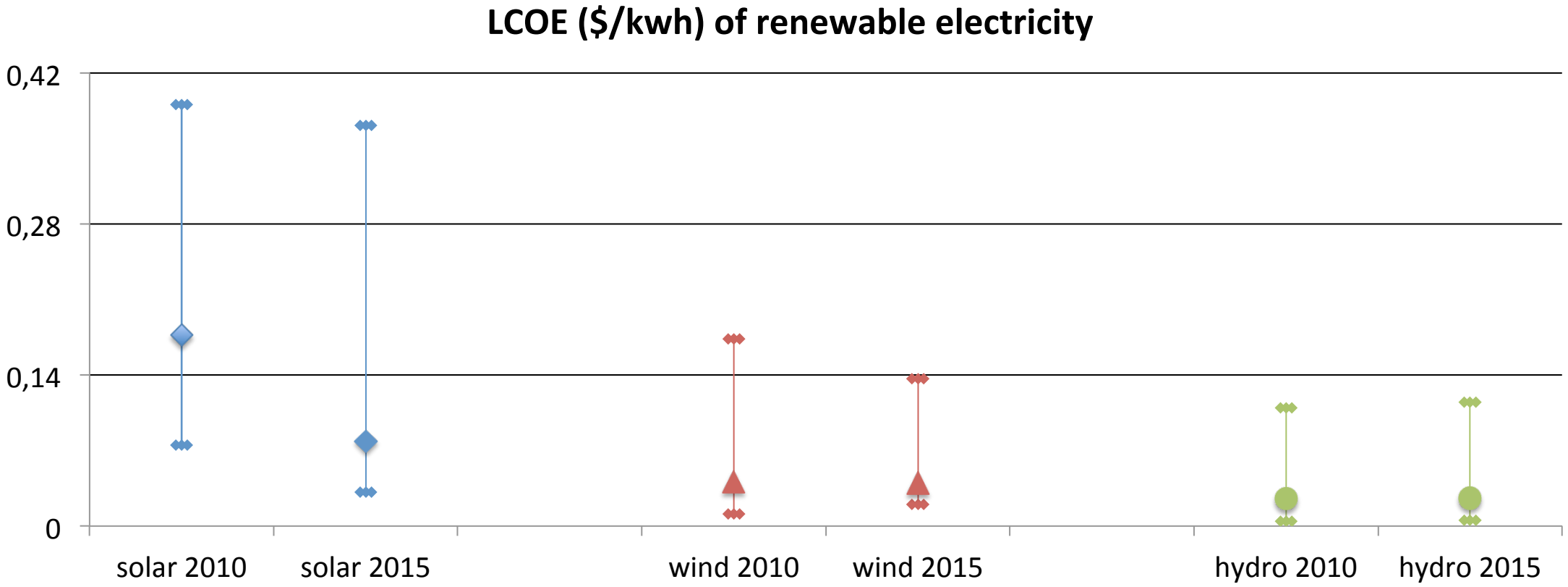
New evidence in our CoSMMA project

We have started collecting published information on observed effects of decentralized electricitication in our Collaborative Smart Mapping of Mini-grid Action project. We have so far collected more than 200 publications, reporting on a total of more than 300 implented projects. Numbers are growing fast



The renewed interest for decentralized electrification

- Electricity produced with solar PV panels is becoming increasingly competitive



Feedbacks from recent decentralized electrification projects

FACTS REPORTS, 2016

Mini-grids

- Mauritania (mini-grids, initially powered by diesel generators, then by hybrid systems), public service concession
- North Laos (mini-grid with pico hydro turbines), mixed initiative of villagers, provincial authorities and ESF
- Madagascar (mini-grid using hydro power), project implemented by GRET in cooperation with national authorities

Solar energy kiosks

- Madagascar, solar energy kiosks, initiated by a social enterprise(HERI)
- India, Integrated Energy Centers in informal settlements in Karnataka, initiated by SELCO foundation, in partnerships with local entrepreneurs, local NGOs and local community organisations.

Comparison with best practices identified by Elinor Ostrom

Elinor Ostrom's design principles	**Application to mini-grids**
Clearly defined boundaries	Yes: need physical connection to access the resource
Congruence between appropriation and provision rules and local conditions	Yes: does not need a proper metering system – possibility of a fixed fee depending on power requested/equipment possessed
Collective-choice arrangements	Variable
Monitoring (accountable to the appropriators)	Variable
Graduated sanctions	Few occurrences of violation of rules such as unpaid bill are observed
Conflict resolution mechanisms	Variable
Recognition of the right to organize	Potential conflict with the national regulator and/or the national electric power company

Conclusion

- Decentralized electrification is a necessary complement of large scale grids to improve access to electricity, particularly (but not only) in sub-Saharan Africa
- Feedbacks and identification of best practices are scarce, and needed to convince development agencies to pay more attention to decentralized electrification
- Elinor Ostrom's design principles provide a useful analytical toolbox to identify best practices at the institutional level
- The CoSMMA will help identify the best practices, and correlate impacts with characteristics (both technical and organizational) of Mini-grid projects .
- Preliminary results:
  - Technico-economic considerations: U-shaped curve of proven impacts as a function of power
  - Institutional aspects: more impact if the decision and the implementation center are close