Geospatial Planning of Electricity Access Expansion

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MITei

With the collaboration of

Universidad Pontificia ICAI ICADE Comillas Madrid
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Instituto de Investigación Tecnológica

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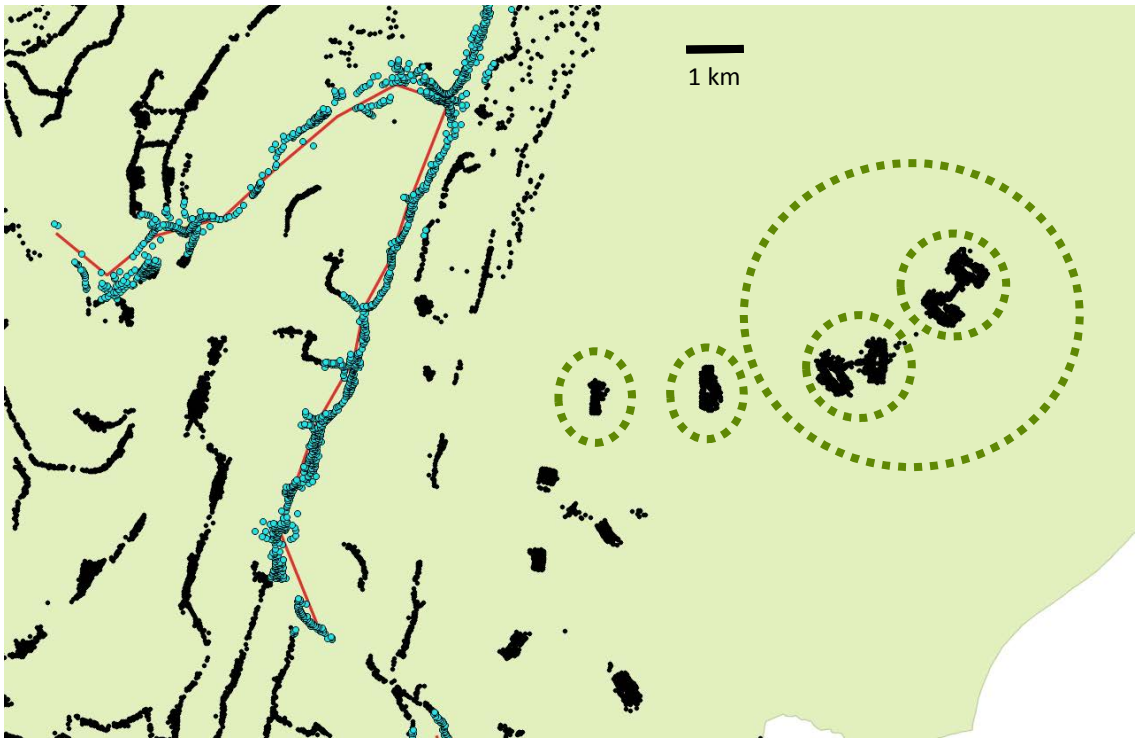
The geospatial planning problem

Rwanda

Kayonza, ~40,000 buildings

Planning questions

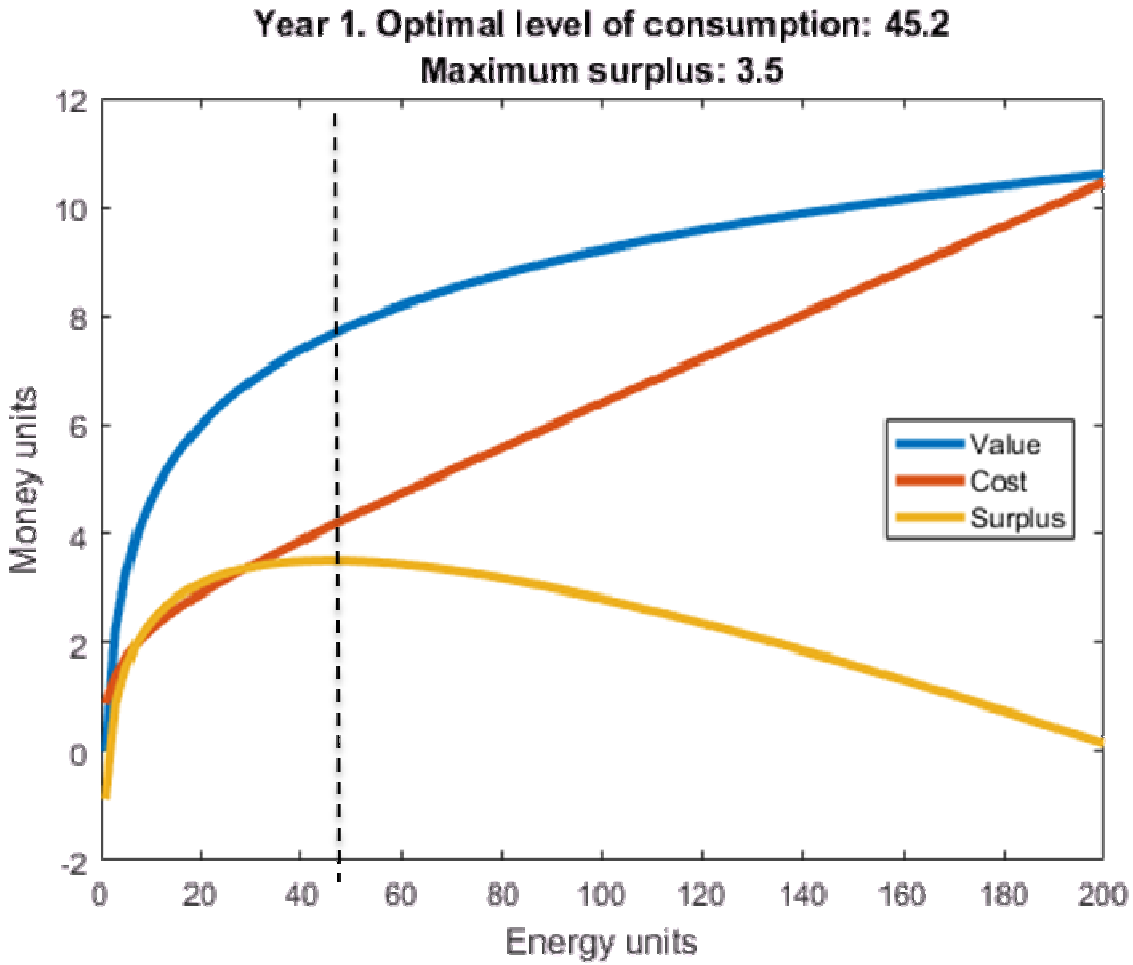


1. Best electrification mode?
2. Best technologies?
3. Service “tier”?
4. Rate structure?
5. Subsidy allocation?
6. Level of aggregation ?
7. Time horizon?

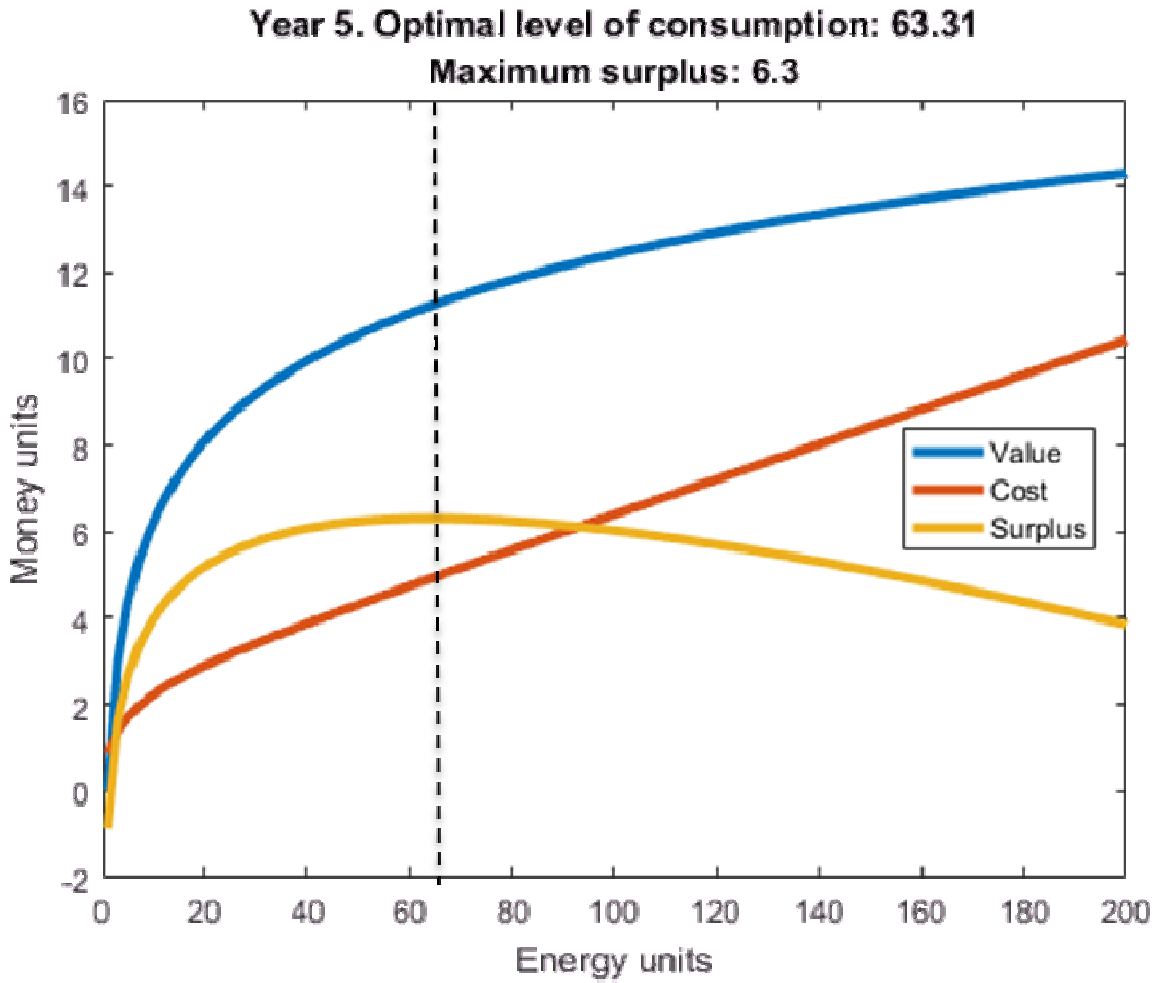
Electrified building
Non-Electrified building
Existing grid

Can we create a method in which both **technoeconomic** considerations and **social, political, and regulatory** factors can be combined to create a comprehensive regional planning tool?

Adequate access level: the social welfare perspective

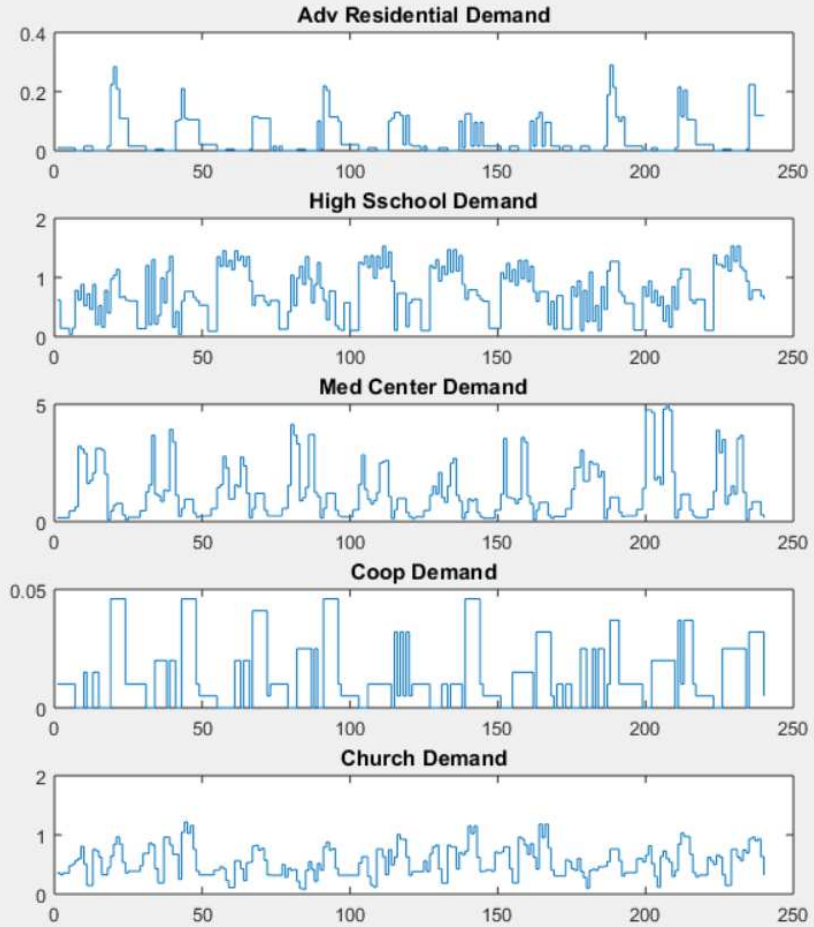


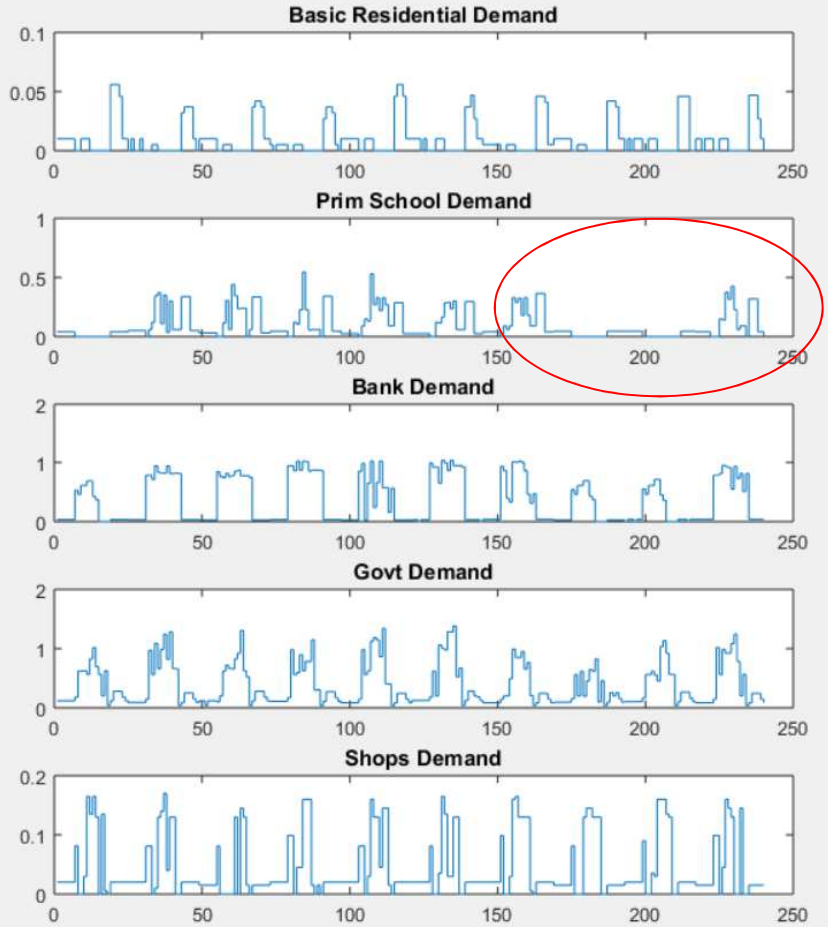
Demand growth



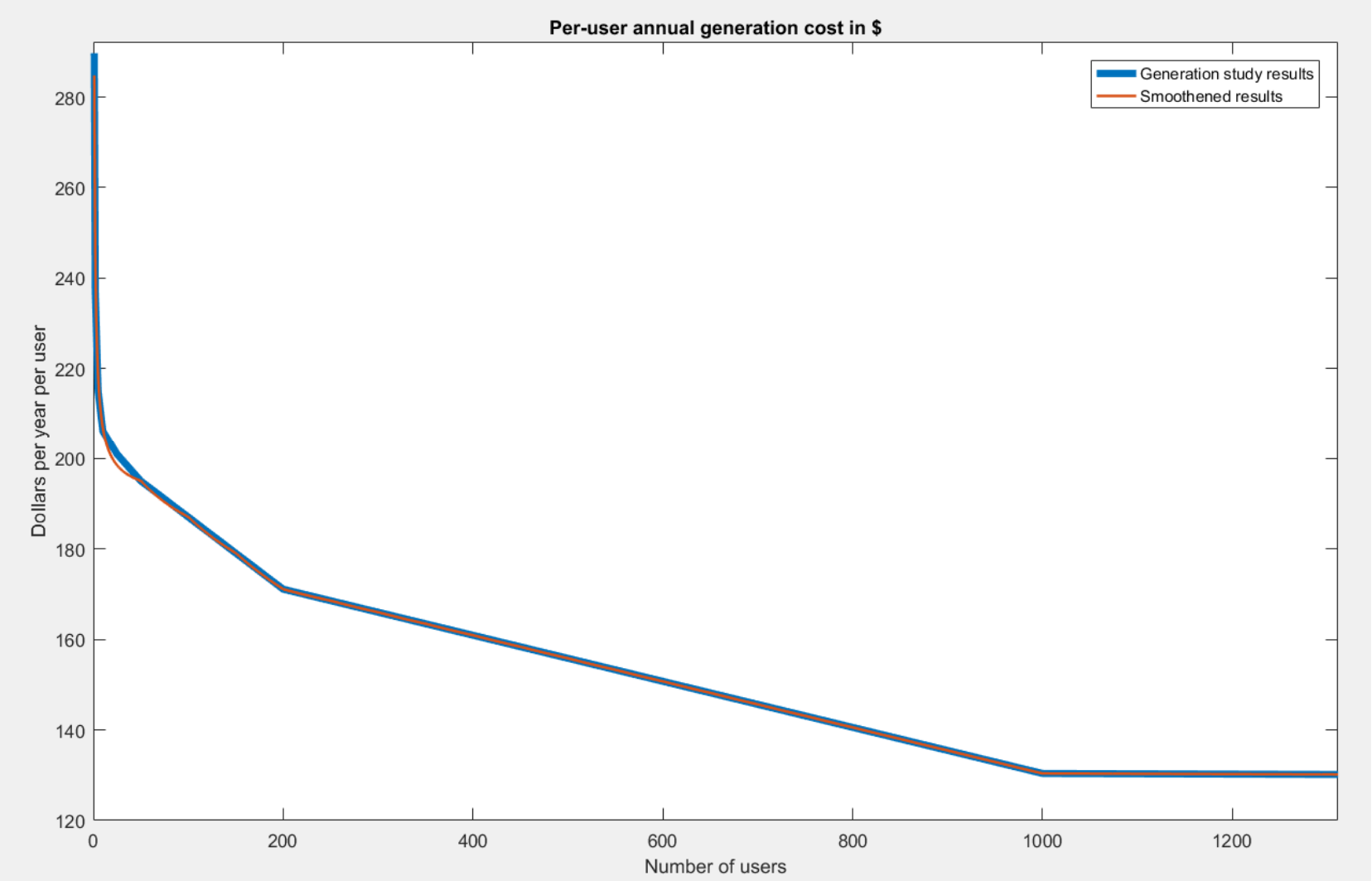
Surveyed potential demand for 24/7 availability. Karambi village, Rwanda

- Idealized demand gathered from survey study (preliminary)
  - Weekend demand may differ (example circled)

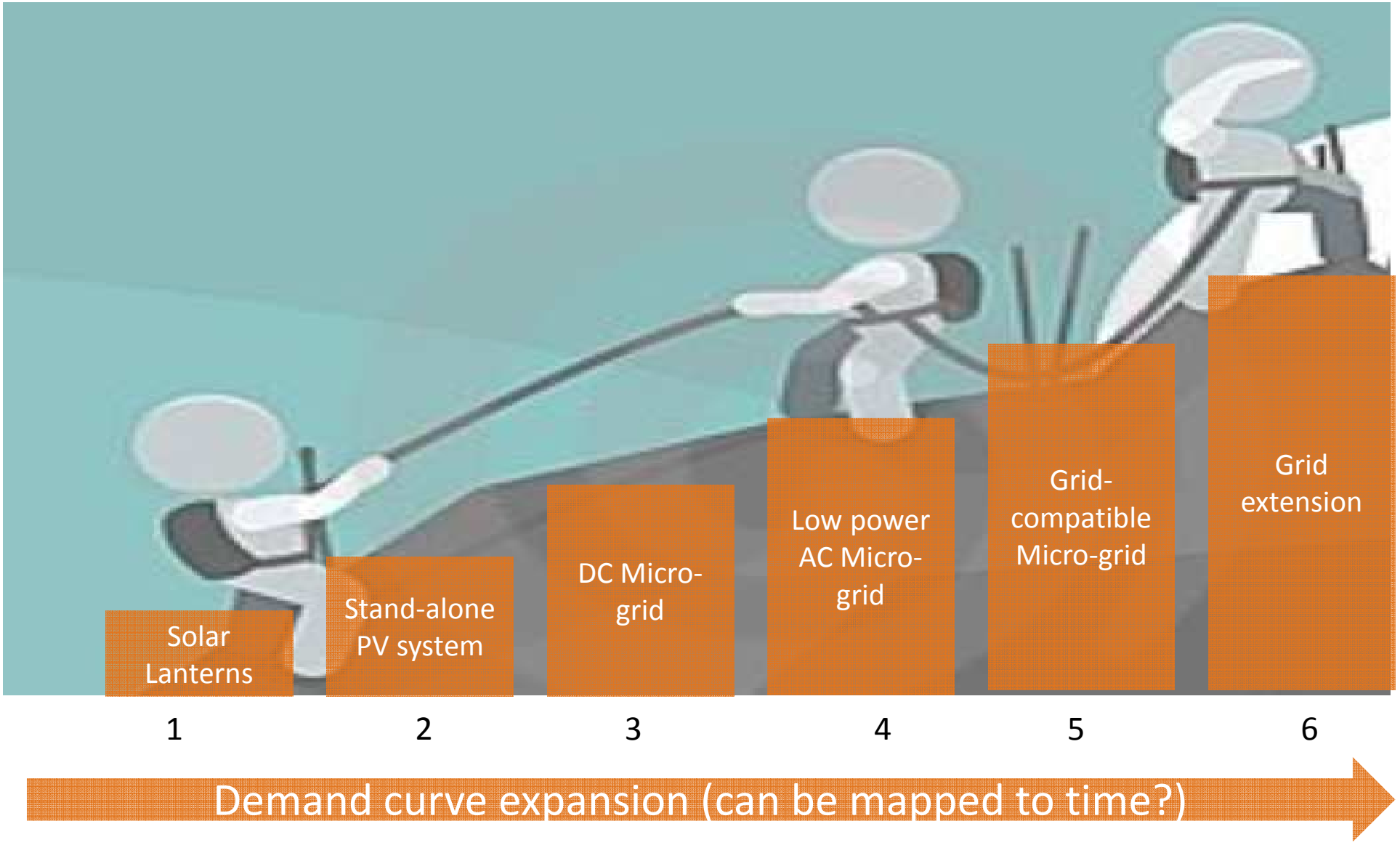




Economies of scale in generation



Incremental perspective



Signs of lack of coordination

- A multiplicity of entrepreneurs are offering to cover the basic demand requirements with unregulated & non standardized approaches that cannot be scaled up or to be eventually connected to the grid

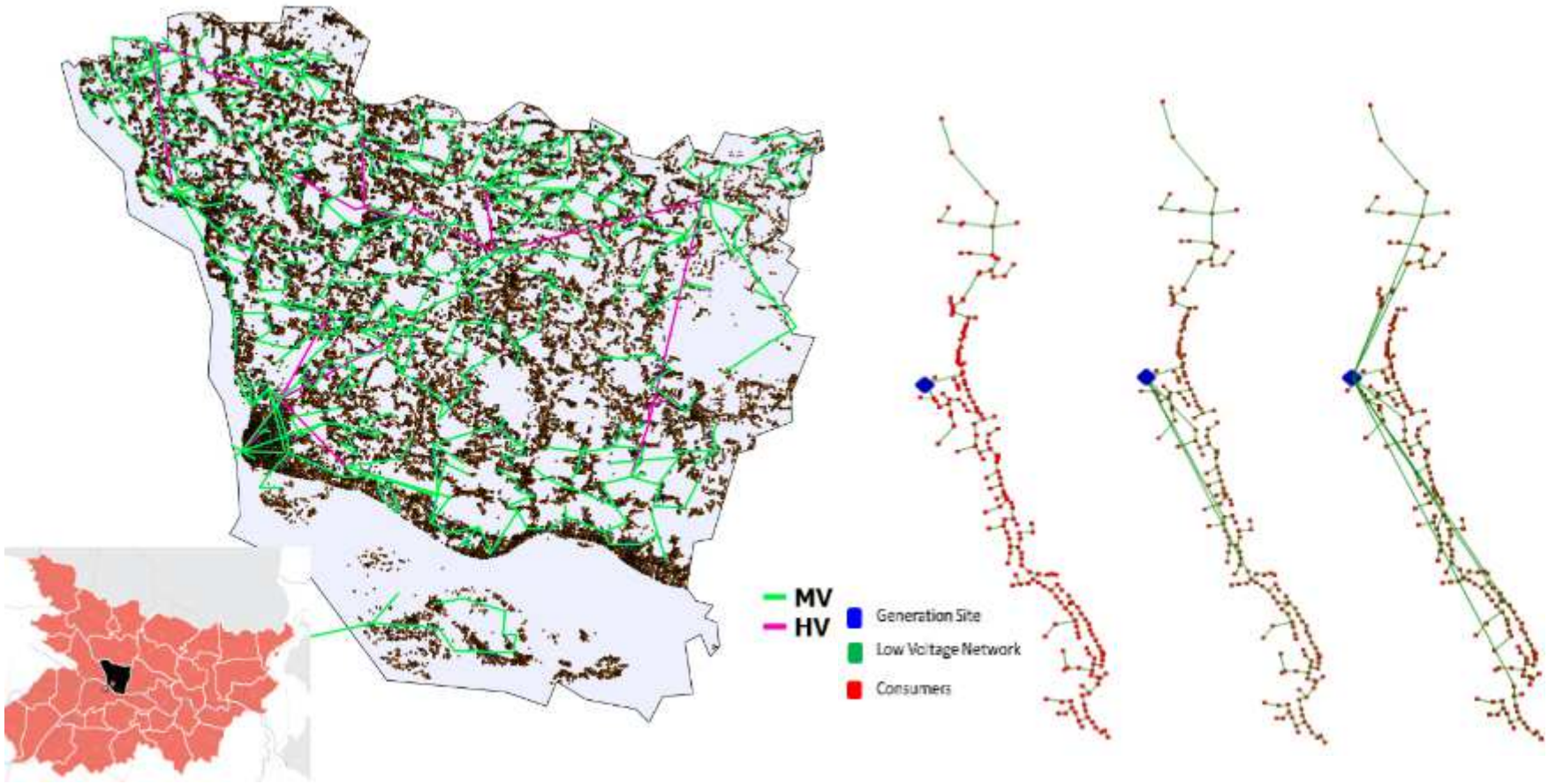
- This reduces the options of consumers to get out of poverty

- This leaves consumers exposed to potential abuse of monopolistic power

- This creates risk for investors, since their assets might be stranded if grid connection becomes an option for their consumers

- This makes it likely that the decentralized & mostly renewable technologies will be replaced by on-grid generation

Planning and regulation: the Reference Electrification Model



Discussion points

1. Usefulness of reference master plans
    - Fidelity v/s data needs
    - Persistence in time
    - Legitimacy
2. Representation of emerging technologies and business models
3. Incorporation of non-quantitative factors
4. Multi-stage planning
    - Grid integration
    - Assets obsolescence
5. Differentiated quality of service
6. Technical standards
7. Influence of topography: elevation maps, restricted areas
8. Financial aspects
    - Cost of capital by system type
    - Sensitivity of billing, operation and maintenance to spatial aggregation
    - Subsidy allocation
    - Rate design