

How Green is A Smart Grid?

A Multi-Agent Life-Cycle Approach

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Scenario

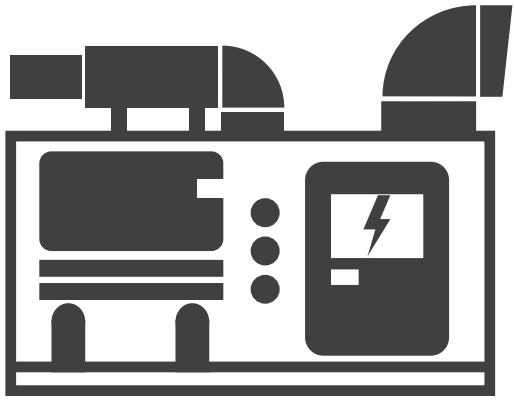


Island profile

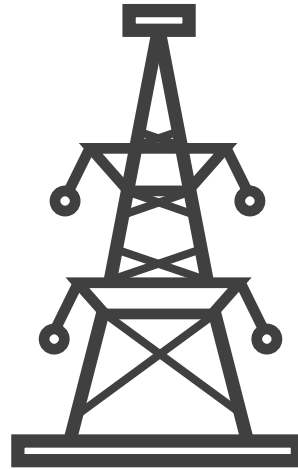
Population: 500

Climate: Usually sunny and breezy

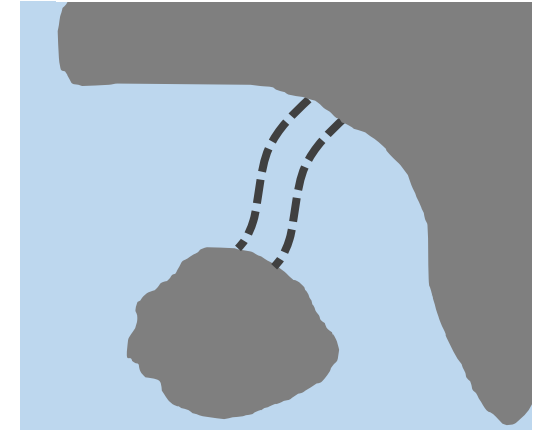
Electrification Options



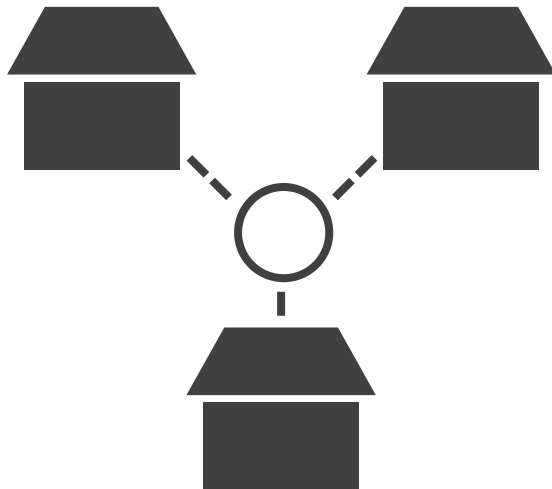
Diesel generator



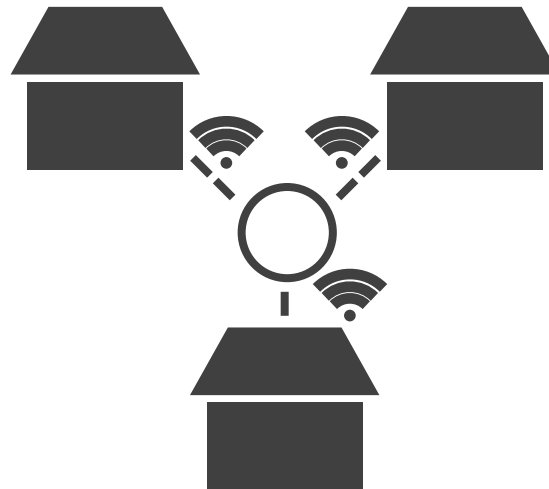
Overhead lines



Sea cables

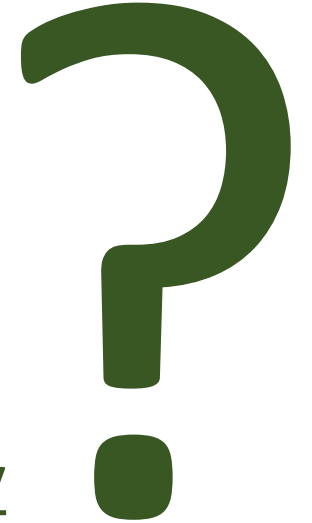


Microgrid

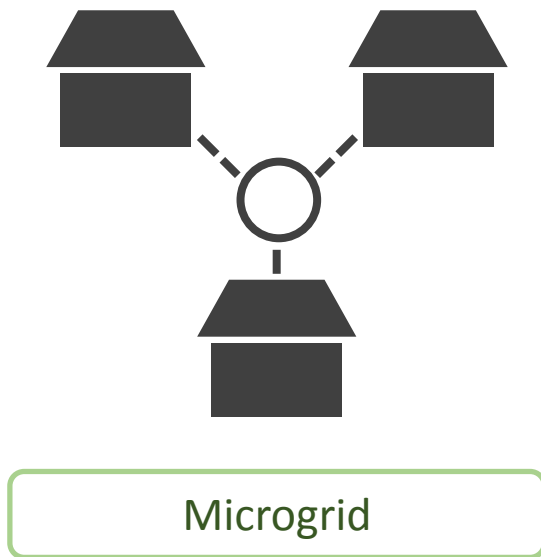
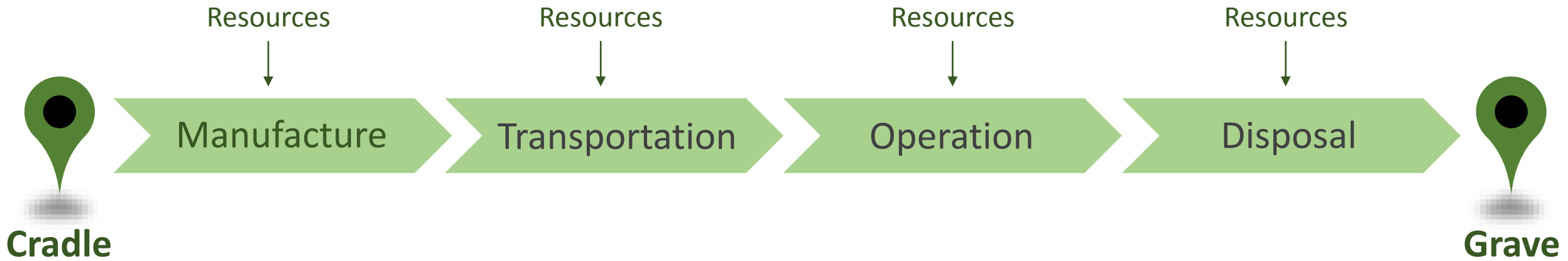


Smart grid

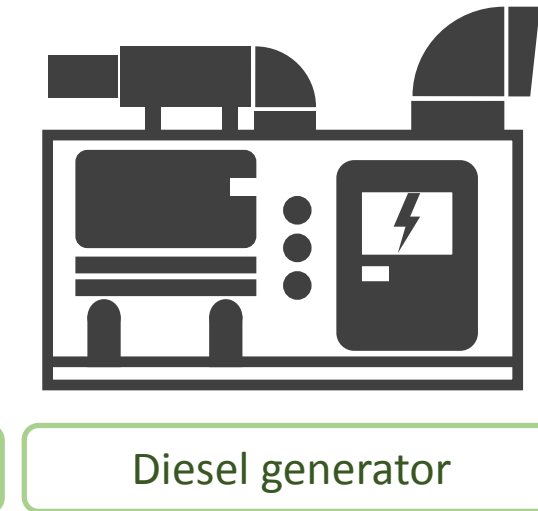
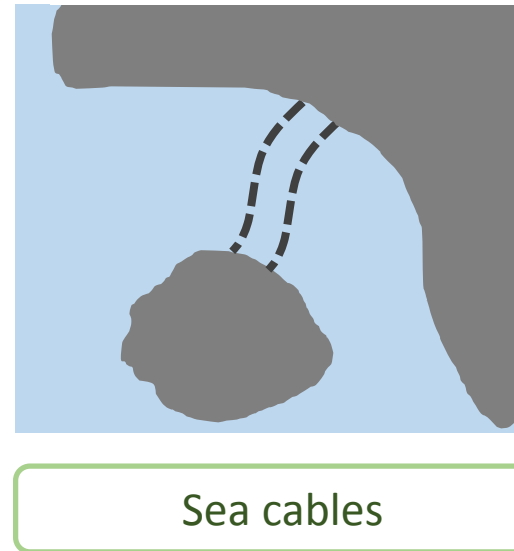
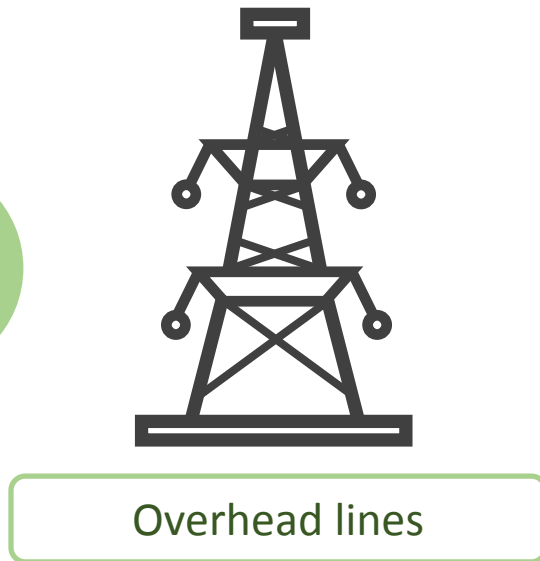
Which electrification method is the most environmental friendly



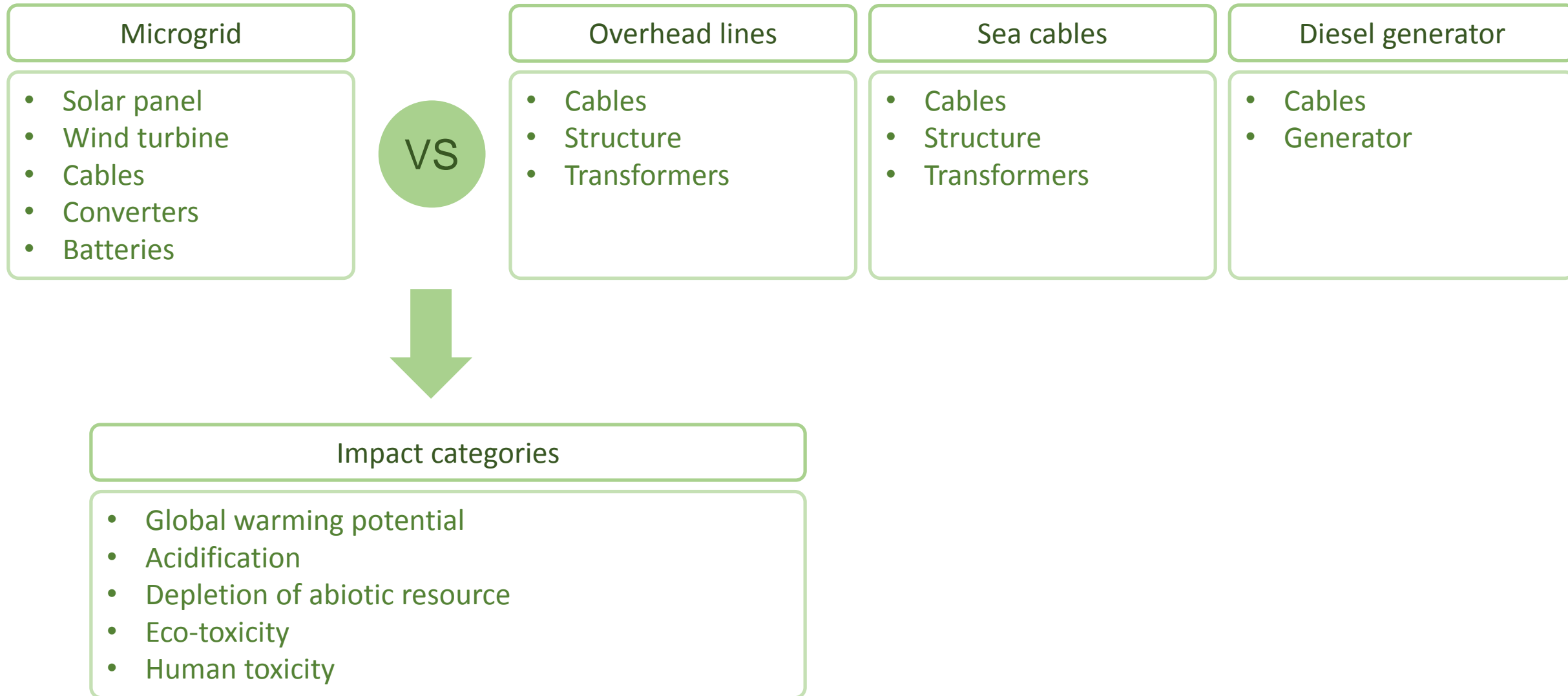
Comparative Life Cycle Assessment (LCA)



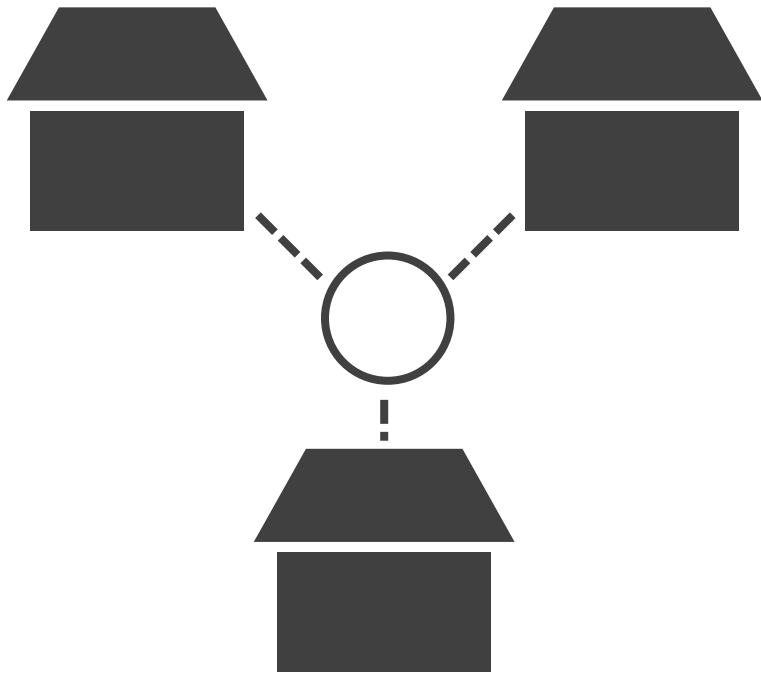
VS



Comparative Life Cycle Assessment (LCA)

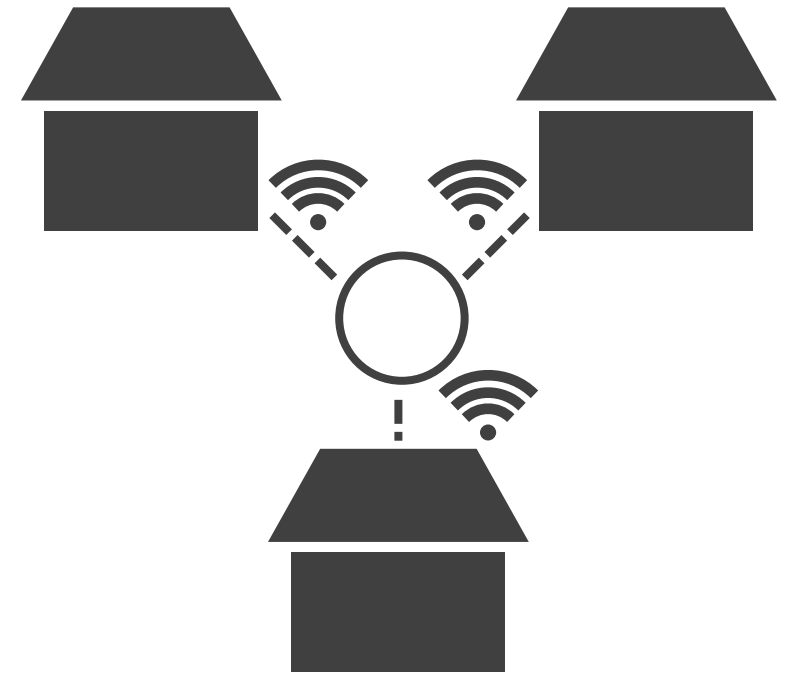


Becoming Smart



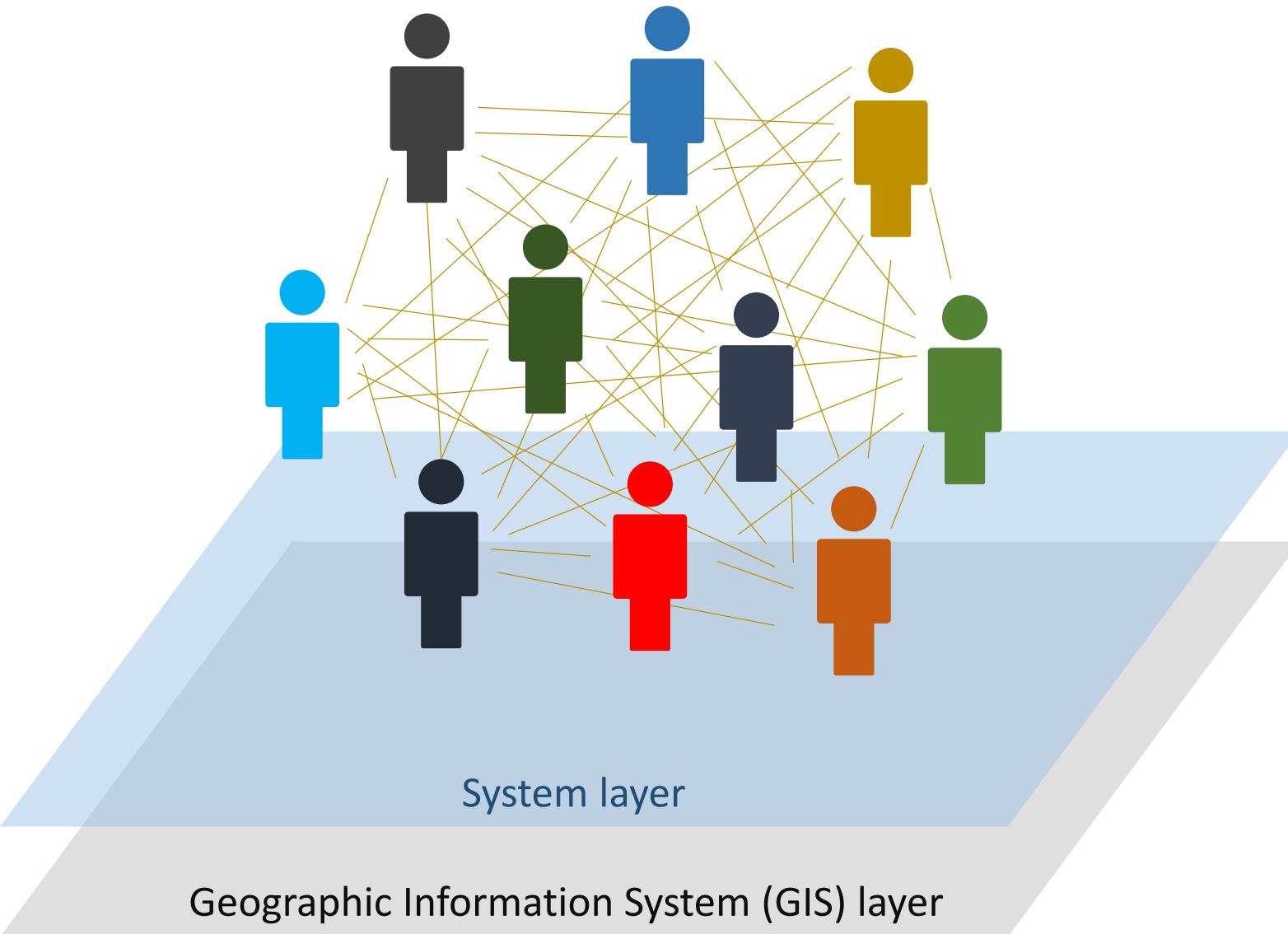
Microgrid

Agent Based
Modelling



Smart grid

Agent based modelling



- Heterogeneous agents
- Cooperative / Self-interested
- Different objectives:
 - Comfort
 - Economic
 - Environmental
- Complex interactions

Digest system dynamics
Simulate demand response
Optimise grid settings

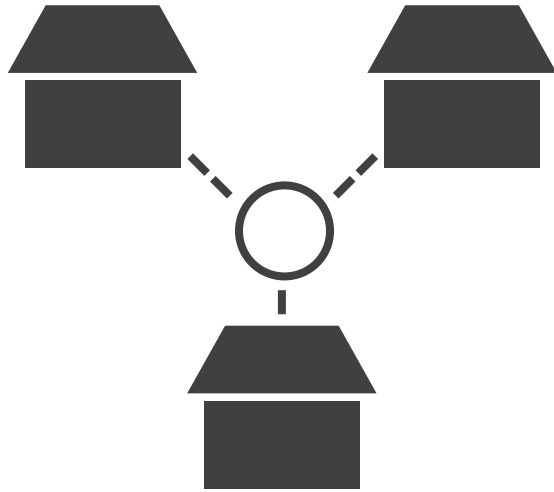
Complex interaction between users

Game Theory

Small World
Theory

Planned
behavior
theory

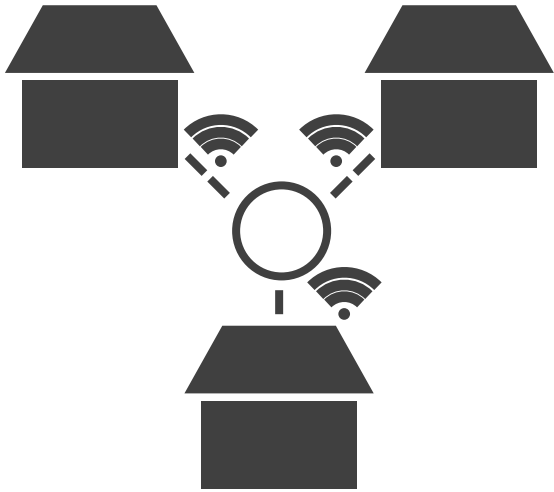
Multi-Agent Life-Cycle Approach



Microgrid

- Solar panel
- Wind turbine
- Cables
- Converters
- Batteries

VS



Smart grid

- Solar panel
- Wind turbine
- Cables
- Converters
- Smart meters
- Batteries

Contributions

Comparative LCA to
compare electrification
options

Agent based model as
test bed for smart grid
decision making

Opportunities to collaborate with CLP

Town Island Microgrid, Hong Kong



CLP Town Island - Prototype



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