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)

Resources → Manufacture → Transportation → Operation → Disposal

Cradle VS Grave

- Microgrid
- Overhead lines
- Sea cables
- Diesel generator
Comparative Life Cycle Assessment (LCA)

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

Overhead lines
- Cables
- Structure
- Transformers

Sea cables
- Cables
- Structure
- Transformers

Diesel generator
- Cables
- Generator

Impact categories
- Global warming potential
- Acidification
- Depletion of abiotic resource
- Eco-toxicity
- Human toxicity
Becoming Smart

Agent Based Modelling

Microgrid

Smart grid
Agent based modelling

- Geographic Information System (GIS) layer
- System layer

- 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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