NP5004 POST-CARBON RESILIENT FUTURE CITIES

EFFECTS ON GHG EMISSIONS FROM ALTERNATIVE INFRASTRUCTURES FOR SERVICE PROVISION IN URBAN AREAS

Research Questions

Alternative infrastructures, mainly distributed, localised and networked configurations, can potentially reduce greenhouse gas emissions (GHGE) in urban areas, democratise services of provision and improve urban resilience. Unlike current centralised systems, which are well understood from both, societal and technical perspectives, the socio-technical interplay of alternative infrastructures across different urban scales and the changes of GHGE are not well understood.

This is why it is important to know:

- How to develop a scalable model that better represents socio technical systems for energy provision from household to precinct level, with alternative system configurations (e.g. varying degrees of service integration and distribution)?

- How to quantify the changes of GHGE over time from different alternative infrastructures?

- What are the key policy interventions that will facilitate a transition to preferred alternative future configurations?

Methodology and Methods

To answer these questions, this research proposes both, a conceptual framework and the service of provision module (SPM). Both, the SPM (Fig. 1) and the conceptual framework (Fig. 3) will be the basis for a spatial specific model and simulation tool to (i) obtain in-depth understanding of the socio-technical interplay of alternative infrastructures; (ii) quantify their related GHG emissions; (iii) and to test different policy interventions. The definition of the model can take advantage from techniques as agent base modelling and spatial microsimulation.

Theories of complex system, modular systems and sustainability transitions studies aided in the conceptualization of the model, which will be used to generate the socio-technical layouts for the Melbourne context.

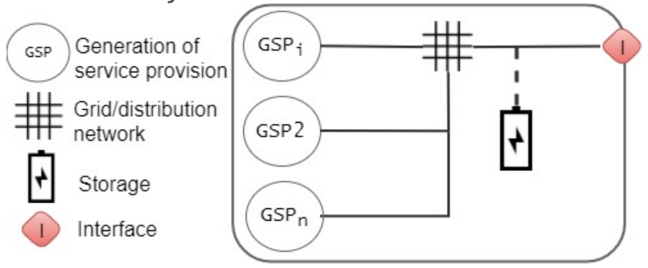

Figure 1 Service of provision module and its components.

The SPM shown in Figure 1 has the technical specifications of the infrastructure, but it also has a societal configuration attached to it, which are the composite actors from Figure 2.

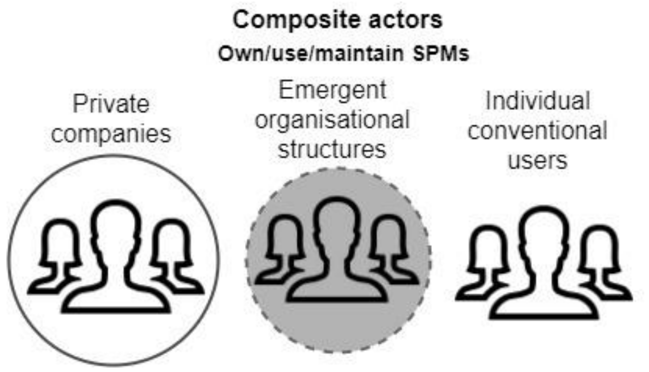

Figure 2 Composite actors.

The composite actors are the individuals, companies, or cooperatives who own, use and maintain an SPM.

As shown in Figure 3, the conceptual framework has various input, with external and internal data, and different processing layers. Within the initialisation layers, there is a first layer for spatial representation of the area under study with its weather condition data – solar radiation, temperature, wind speed, and relative humidity-. A second layer holds the corresponding demographic and land use data. There are also two libraries with the information about different technologies for the SPM and different modes of organisation, characteristics and requirements for the composite actors.

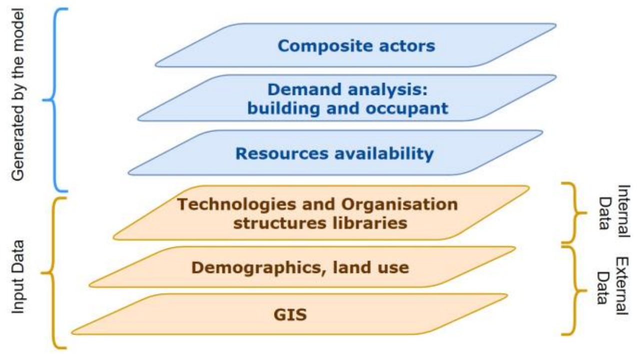

Figure 3 Conceptual framework.

The model generates a *socio-technical layout*, which is **an instance of the societal and technological solutions in a given area.** The socio-technical layout has certain energy consumption and GHG emissions associated.

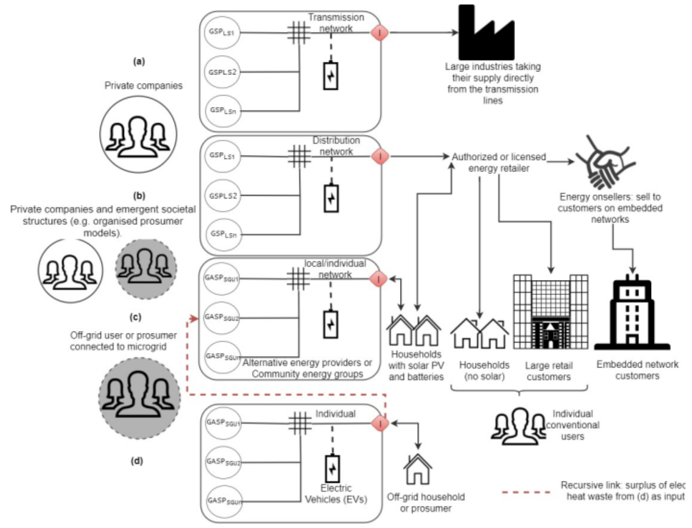

Figure 4 Australian electricity sector with SPMs. (a) Centralised large scale power plants owned by private companies connected to large industries through the transmission network; (b) energy retailers or other intermediaries; (c) alternative energy providers; (d) stand-alone system or prosumer to micro-grid.

Taking electricity as starting point, Figure 4 shows the Australian electricity sector represented with SPMs, as an example of the concept's applicability, modularity and flexibility.

Conclusions

This research will help uncover the most appropriate interventions to reduce GHG emissions in Melbourne precincts. This can be achieved by modelling and simulating alternative infrastructures for service provision using the conceptual framework and service of provision modules described in this poster.

Anticipated impacts

The results from this research will back up decisions of industry, government and community on how to transition to a low carbon and resilient living.

Industries will be able to identify new roles in a decarbonised society, local governments will be able to visualise tailor made solutions for areas under their administrative authority and people will be empowered from alternative infrastructures with distributed configurations and system synergies.

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