Power Melbourne: Proof-of Concept of a Network of Community Batteries in the City of Melbourne

Carmen Bas Domenech, Antonella de Corato, James Naughton, and Pierluigi Mancarella
Department of Electrical and Electronic Engineering, The University of Melbourne, Melbourne, Australia

1 Project Objective

- "Power Melbourne" aims to establish a network of **community batteries (CB)** across Melbourne allowing residents to access benefits from battery technologies.
  - Proof-of concept with three CB installed in commercial buildings

City of Melbourne

- **Is the network of CB commercially feasible? It will depend on what value streams the CB can access.**
- This work proposes a techno-economic framework to co-optimize and orchestrate CB participation in different markets and services[1,2]

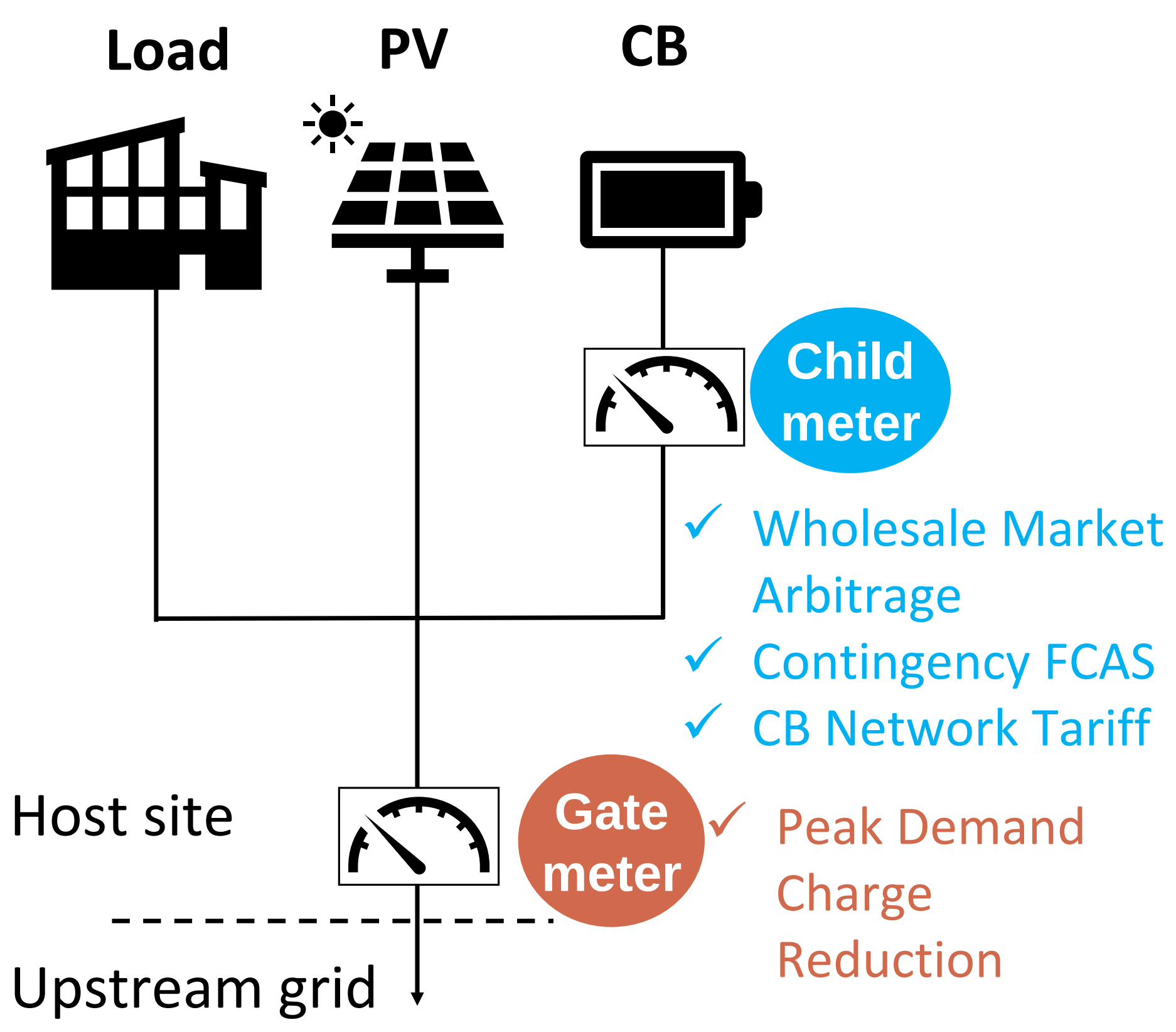
2 CB Architecture

We studies a two-meter architecture to maximize the accessible value streams of the CB:

- **Gate meter** measuring the net demand of the host site, PV and CB;
- **Child meter** measuring the CB performance in markets.

Transactions between the host site and CB are accounted for to avoid double-counting energy.

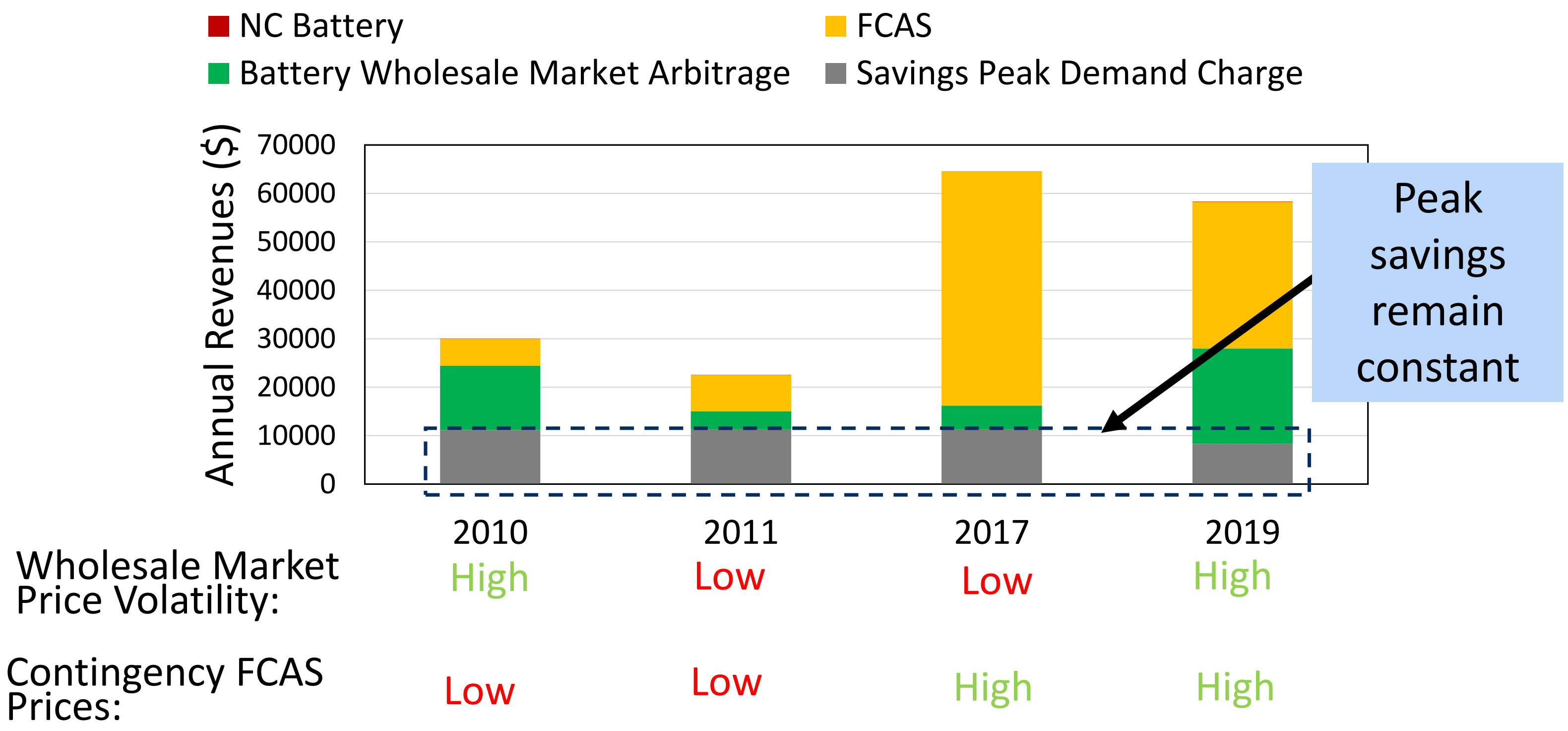
Hybrid Architecture



3 Impact of System-level Markets

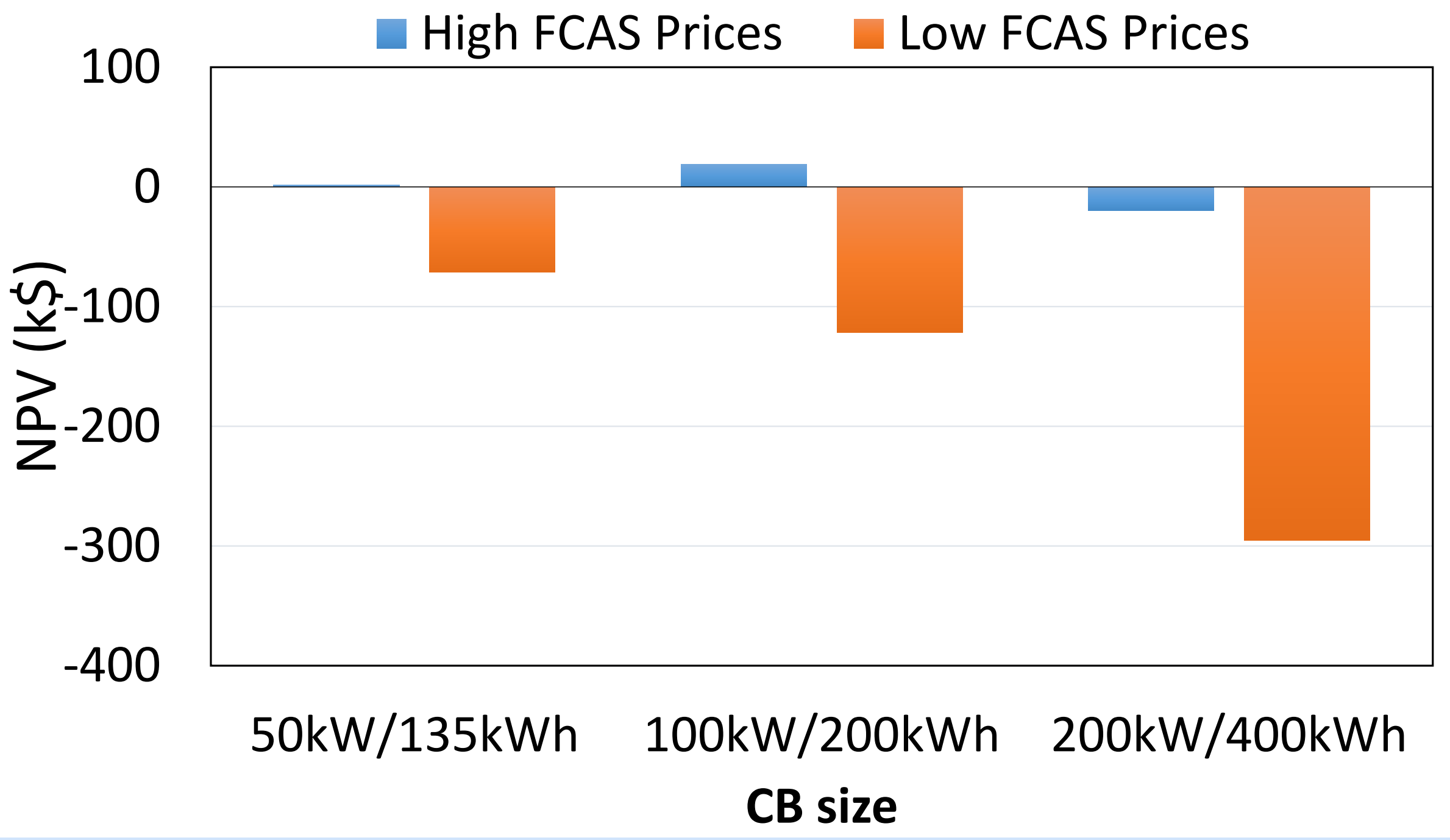
- With the current accessible value streams, **CB Revenues** are **highly dependent on system-level markets** prices, thus increasing uncertainty in the commercial feasibility of the project.

200kW/400kWh CB installed in a host site with 120 kVA peak demand charged on a 12-month rolling basis



4 Commercial Feasibility

- Net present value (NPV) can inform on the project commercial feasibility.
- **Lifetime analysis** was done for a **CB** with **30-min granularity** on a 120 kVA peak demand host site charged on a 12-month rolling basis:
  - **FCAS prices** highly affect NPV, with larger batteries being more susceptible to different system-level markets price scenarios;
  - Negative NPV for low FCAS prices shows **uncertain commercial feasibility of the project;**
  - Larger CB display larger differences in NPV between FCAS scenarios.



5 Ongoing Work on Aggregation and Coordination

- Preliminary studies are being carried out to understand if there is a benefit of coordinating the three CB:
  - **Potential benefits in wholesale market and FCAS participation,** especially as CB capacity degrades over time and CB are more energy constrained.
  - **Potential challenges in co-optimizing value streams in a coordinated manner** when each CB is operated to reduce peak demand charges of their respective host site. Missing the benefits from the diversity within the community.
  - A possible avenue to explore is **network tariffs charging the aggregate peak demand** of the whole community hosting the network of CB → requires regulatory developments.

6 Conclusions

- A **hybrid architecture** allows CB to access wholesale markets as well as behind-the meter value streams like peak demand charge reduction.
- With the current value streams CB can access, their annual **revenues** are **highly dependent** on wholesale and contingency FCAS **prices.**
- Among the battery technologies tested for a 120 kVA peak site, the NPV analysis shows that 100kW/200kWh CB provide the best **trade-off** between possible **profits and losses** in high and low FCAS price **scenarios.**

7 Acknowledgement

We would like to acknowledge the City of Melbourne for their support.

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[1] H. Wang, S. Riaz, and P. Mancarella, "*Integrated techno-economic modeling, flexibility analysis, and business case assessment of an urban virtual power plant with multi-market co-optimization,*" *Applied Energy*, vol. 259, Feb. 2020

[2] J. Naughton, H. Wang, M. Cantoni, and P. Mancarella, *"Co-Optimizing Virtual Power Plant Services under Uncertainty: A Robust Scheduling and Receding Horizon Dispatch Approach", IEEE Transactions on Power Systems*, vol. 36, no. 5

For more information contact:

Carmen Bas Domenech
PhD Student
The University of Melbourne
E: cbasdomenech@student.unimelb.edu.au

Pierluigi Mancarella
Chair Professor of Electrical Power Systems
The University of Melbourne
E: pierluigi.mancarella@unimelb.edu.au