Techno-economic Assessment of the University of Melbourne Virtual Power Plant

Introduction and motivation

- Aggregated flexibility from small-scale **distributed energy resources (DER)** and **loads** is presently an untapped potential
- The key barrier is to find mechanisms that enable **efficient integration** of a large number of resources in existing market structure
- The **Microgrid (MG)** concept is able to address the challenge by clustering DERs, loads, and other resources, supported by appropriate decentralized control strategies
- A MG takes into account the **constraints of different resources** coupled with **network and power flow restrictions**
- Moreover, by operating as a **Virtual Power Plant (VPP)**, a MG could also participate in various **markets** (e.g., energy and frequency control), similar to a conventional generator

University of Melbourne VPP

- The **feasibility studies** look at the **University of Melbourne (UoM) MG** to be operated as a VPP in its Parkville and Dookie campuses
- Relevant DERs include **diesel generators**, **solar photovoltaic (PV)**, **battery**, and **demand response (DR)**
- The UoM VPP is able to participate in **energy markets**, provide various **grid services**, such as frequency control ancillary services (FCAS), peak-shaving DR, and possibly system restart ancillary services (SRAS), and provide **cap options** for retailer's price hedging
- These services can lead to **substantial revenues** and therefore economic benefits for the VPP

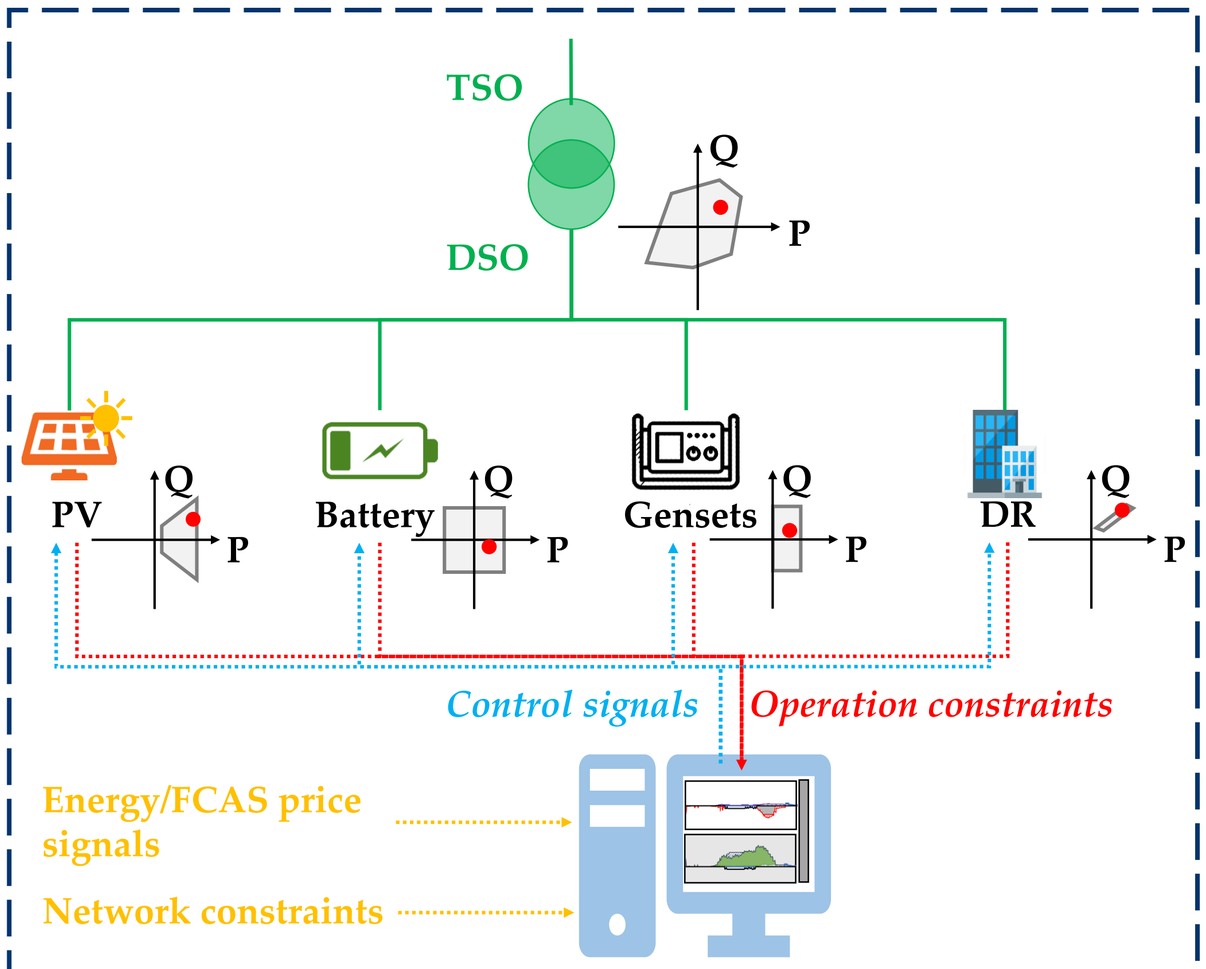

Fig. 1 University of Melbourne Microgrid operated as VPP

Results

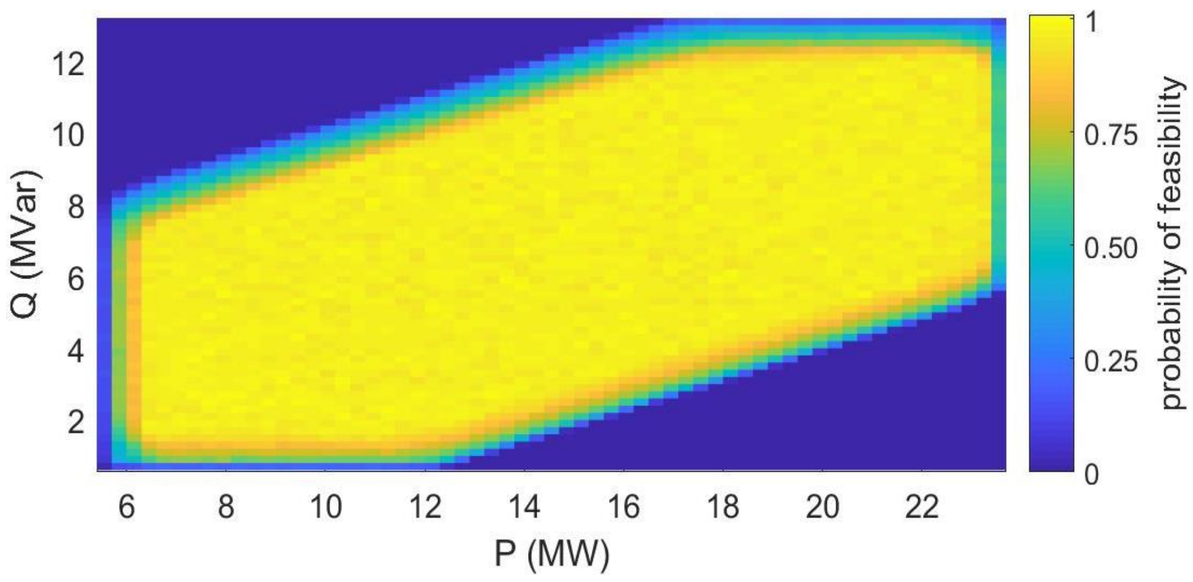

Fig 2. Feasible operating region (FOR) during midday

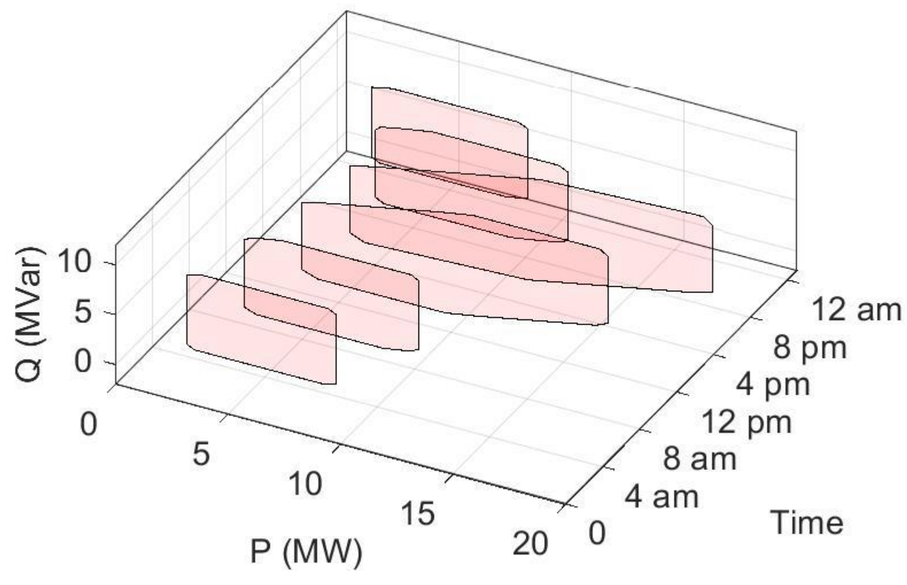

Fig 3. Evolution of FOR over 24 hours

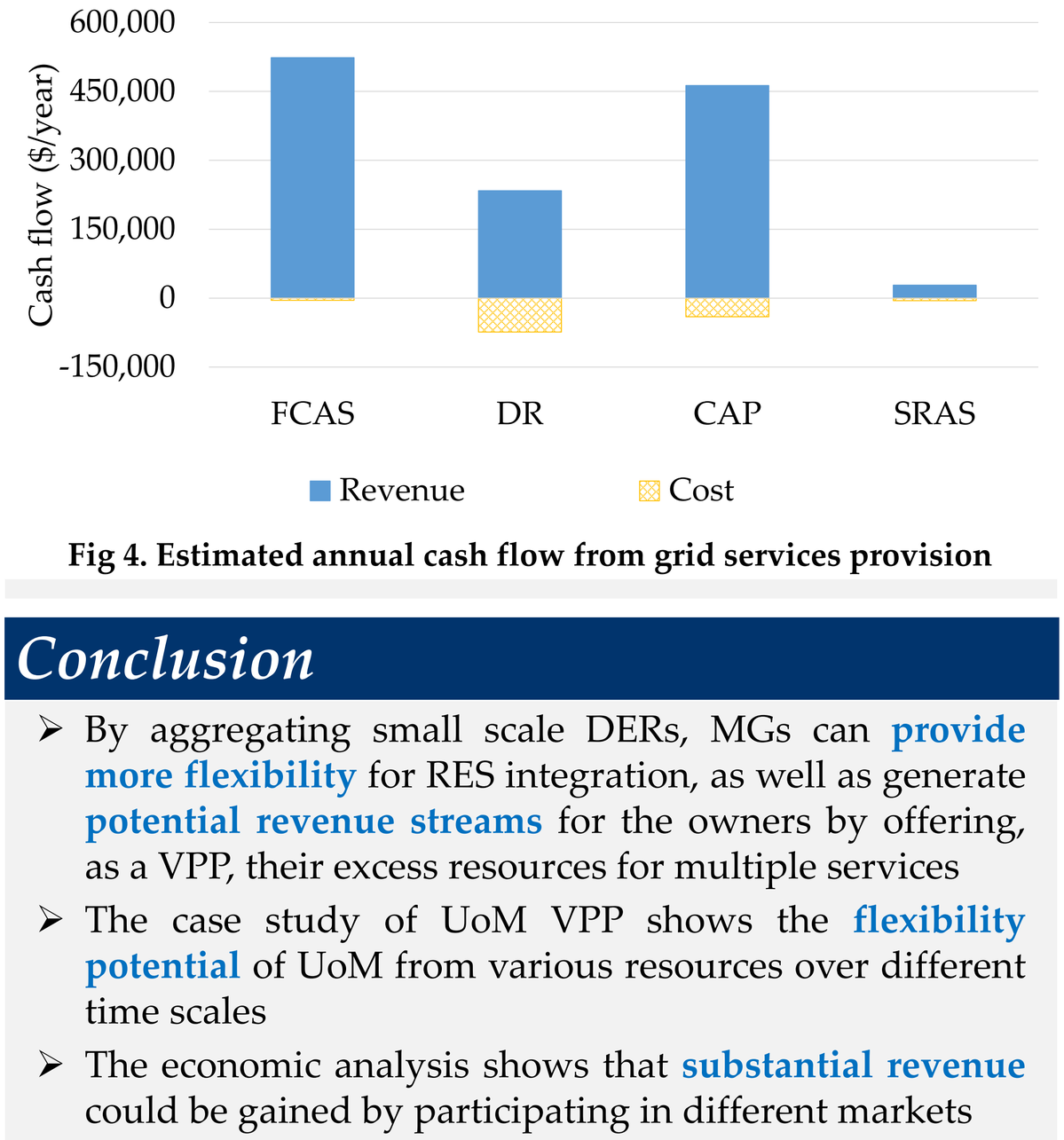

Fig 4. Estimated annual cash flow from grid services provision

Conclusion

- By aggregating small scale DERs, MGs can **provide more flexibility** for RES integration, as well as generate **potential revenue streams** for the owners by offering, as a VPP, their excess resources for multiple services
- The case study of UoM VPP shows the **flexibility potential** of UoM from various resources over different time scales
- The economic analysis shows that **substantial revenue** could be gained by participating in different markets

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