# On-Demand Batteries as a Peer-to-Peer Service

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***Abstract*—Currently, battery energy storage and peer-to-peer concepts have a number of barriers to their wide-spread adoption, regardless of their potential benefits for the grid and individuals. This paper models a financial use case of an innovative and speculative on-demand peer-to-peer (P2P) distributed Energy resource (DER) concept, Battman, that could overcome a number of these barriers. We explore the possibility for a novel way to trade excess solar energy through mobile batteries on the low voltage network. The concept and work presented is the result of a multidisciplinary collaboration of designers, network engineers and economists. Using the Ausgrid Solar home electricity dataset, optimisation based energy scheduling, and tariffs from a large Australian energy retailer, a trading scenario has been modelled between a prosumer (with PV and batteries) and consumer. The model has then been analysed to discover where profit and financial feasibility might be found in Battman to illustrate one of the many ways customers could benefit from this concept. For the prosumer, the findings show that in Australia it is not currently profitable to charge a second battery for use by another consumer using representative present-day batteries and tariffs. This concept and the results highlight areas that have potential for more innovative interactions with the grid and market, but where current technology and market structures hinder adoption of similar systems due to energy's lack of financial value.**

***Index Terms*—Battery energy storage, peer-to-peer trading, speculative design**

## I. INTRODUCTION

Battery Energy Storage (BES) is revolutionising the transmission and distribution of electricity and is integral to the adoption of DER. Batteries play a critical role in demand response and grid stability, providing far better response times compared to existing distribution-level storage solutions [1], creating substantial earnings to investors and consumers alike [2]. At the domestic level, batteries enable further opportunities for social welfare, grid stability and demand response through the facilitation of microgrids, Virtual Power Plants (VPPs) and P2P trading [3], [4]. In particular, P2P systems used together with BES could offer clear benefits in the variety of energy market products available (e.g. pure, grid-isolated, green energy), stability for microgrids, and greater autonomy for prosumers over the sharing and sale of their excess electricity [5].

Lengthy payback periods and non-price factors, such as network distrust, have kept BES adoption rates low among consumers [6]. Adoption is also almost exclusively limited to prosumers in the domestic market, [6] where batteries have very limited economic benefit for individual households who lack generation capability (e.g. solar panels) [7], [8]. In addition, participation in network/retailer-led demand response initiatives involving shared control of batteries (e.g. VPPs, P2P and controlled load) have proven difficult to incentivise [9]. Current technical and industry regulatory barriers also limit energy transactions between customers across the distribution network.

This paper details a proof-of-concept for a speculative and innovative P2P mobile BES solution (*Battman*), which overcomes present-day barriers to P2P. Battman involves a physical battery distribution service modelled on *gig-economy* services such as Uber and Lime Scooter. Unlike other studies to date, our solution mobilises DER *on demand* as needed on an LV network.

Battman is a product of an interdisciplinary Speculative Design process [10] involving designers, network engineers and economists. Speculative design involves suspending consideration of existing technical constraints to generate possible ideas for future energy technologies. The project goes beyond the design concept to model a potential outcome as a way to explore the feasibility of possible futures in more detail. This paper makes the following novel contributions:

- A novel P2P mobile Battery Energy Storage application concept.
- Models the economic feasibility for a novel P2P DER concept, where the focus is placed on human values and behaviour, and different ways for consumers and prosumers to interact.

## II. RATIONALE

DERs now play a growing role in energy generation on the grid, with the potential for managing operational challenges as they support two-way markets and enable the use of more renewable energy [5]. Solar and wind power, however, are inherently volatile. They lack the inertia required to keep mains frequency stable during peak load, potentially causing problems when major high-inertia generation is disconnected [11]. BES has strong potential for addressing some of the challenges of renewable energy volatility and energy security at both the utility [12] and consumer levels [8], with increasing importance in years to come as batteries become more affordable.

To make the most of DER at a consumer level on low voltage networks, P2P solutions have been studied from a variety of viewpoints, with concepts pointing towards potential savings for consumers, while limiting significant impacts on the distribution grid to which they are connected. To date, P2P systems research can be categorised into three distinct market schemes; centralised, decentralised, and distributed [5]. These schemes define the amount of control consumers have, the reliability of the system, and the amount of computation required to achieve greater equity and social welfare for those involved. P2P systems in feasibility studies often rely on common assumptions of uniform P2P providers, location-constraints, user behaviour, and core human values [5], which leaves opportunity for concepts to be explored from a more human-centred angle.

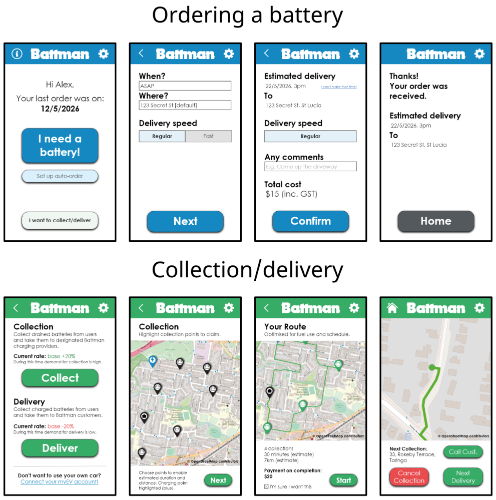
Irrespective of the P2P system design, a key limitation of the technology is current regulation that prevents customers genuinely sharing electricity or energy from a specific source – for example microgrids allow sharing behind the meter, but sharing electricity from one National Meter Identifier (NMI) to another is currently unsupported. In particular, virtual net metering (VNM) across NMIs is complicated by network effects (e.g. losses) and the problems associated with accounting for energy and network service costs. There is no agreed methodology for implementing VNM, and in Australia, there is no obligation for network companies or retailers to support it. As such, VNM does not yet exist in practice in Australia. Additionally, sharing energy through shared infrastructure removes the purity of ’green’ energy as it is exported to, and imported from, a pool of many energy sources (though blockchain-based provenance may prove successful in the future). The work described in this paper considers a novel alternatives such as mobile BES.

Research into mobile BES has previously explored utility-level applications of mass battery transport, and the potential of EV Vehicle-to-Grid (V2G) DER. Transporting large, utility-scale BES on trains has been evaluated as a potential method for supporting congested networks and improving system security and resilience [12]. Trucks (including electric trucks) have also been simulated as a method for distribution of energy sources, again at the distribution level for resilience [13] and for optimising the use of renewables in highly distributed EV charging locations [14]. Mobile BES for resilience is starting to gain interest from researchers and industry alike [15]–[17].

Mobile BES in the low voltage consumer-facing network, however, is currently under-explored. The *Battman* concept explores a low voltage network application of mobile BES, with a P2P control scheme that blurs the lines between the three established structures. The concept utilises DER of prosumers for green energy export, distributed beyond the constraints of localised feeders, microgrids and VPPs. In the following section we describe this concept in further detail, together with the methodology and purpose of its design.

## A. Battman Concept

Battman builds on the success of sharing and gig economy services such as Uber Eats, Lime Scooters and Doordash, to deliver fully-charged batteries on-demand to users of the system. When residents of Battman-enabled properties order charged batteries through the application (shown in Fig.1), local, general-public users are paid to collect the spent batteries, deliver them to local charging nodes, and deliver charged batteries. Prosumers with significant solar installations generate profit by becoming these charging nodes in the Battman network, and the spent batteries delivered to these locations are charged only with solar energy.



Hi Alex,
Your last order was on:
**12/5/2026**

**When?** ASAP
**Where?** 123 Secret St [default]
**Delivery speed** Regular | Fast

**Estimated delivery** 22/5/2026, 3pm
**To** 123 Secret St, St Lucia
**Delivery speed** Regular
**Any comments** E.g. Come up the driveway
**Total cost** $15 (inc. GST)

**Thanks! Your order was received.**
**Estimated delivery** 22/5/2026, 3pm
**To** 123 Secret St, St Lucia

**Collection**
Collect drained batteries from users and take them to designated Battman charging providers.
**Current rate:** base +20%
During this time demand for collection is high.
**Delivery**
Collect charged batteries from users and take them to Battman customers.
**Current rate:** base -20%
During this time demand for delivery is low.
**Don't want to use your own car?**
Connect your myEV account!

**Collection**
Highlight collection points to claim.
Choose points to enable estimated duration and distance. Charging point highlighted (blue).

**Your Route**
Optimised for fuel use and schedule.
4 collections
30 minutes (estimate)
7km (estimate)
**Payment on completion:** $20
☒ I'm sure I want this

**Next Collection:** 33, Rokeby Terrace, Taringa

Fig. 1. Screens of the Battman concept user app.

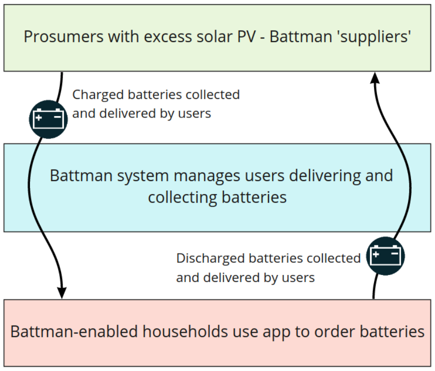


Fig. 2. Block diagram of the Battman system.

The Battman concept shown in Fig.2 presents an innovative alternative to current P2P and DER concepts, with promising aspects worth exploring to encourage greater innovation in the field. The specific novel aspects of the concept include:

- Operation on a local and wider scale, irrespective of infrastructure, as the energy is transported outside of LV network lines.
- Power delivery that could potentially circumvent network constraints and issues related to renewables on LV networks.

## B. Design Rationale

Speculative design is an approach to envisaging potential futures that is increasingly being used in Human-Computer

Interaction (HCI) research. It creates realistic prototypes of future technology which serve to incorporate diverse stakeholders in design, and suspend disbelief about change [18]. Conceived using this method, Battman represents a functional system from the near-future, where assumptions have been made about technology for the purposes of finding where current society and technology has potential for novel DER systems, which may be similar to but not necessarily the same as Battman. In particular, assumptions have been made about sufficient battery capacity (and energy density), hot-swappable battery interfaces installed in households, and social critical mass for the system to function.

To date, evaluations of speculative designs are limited to those in HCI, which emphasise conceptual and social factors [19]. To understand the potential translation of Battman from a speculative design to an implementable standard for consumer-level energy sharing, we have taken a multi-disciplinary approach to evaluate the idea using optimisation based energy scheduling. The greater goal of this work beyond the modelling detailed in this paper, is to continue - with additional data on feasibility - the exploration of this concept in HCI studies in the energy industry, probing the ability of speculative design for encouraging innovation in this industry. Through this work we are also exploring how trans-disciplinary collaborations can bridge speculative design work with real, tangible possibilities through evaluating feasibility of concepts.

## III. MODELLING FEASIBILITY

Open markets allow consumers to decide their own way of using energy without being constrained, and while there are a multitude of ways in which prosumers and consumers could benefit from a system like Battman, we have considered one example of how customers could benefit financially in a way that is not yet possible with the current network. A vignette has been modelled of a exemplar prosumer, with a comparison between two scenarios of optimised battery capacity, load shifting, and use of excess solar power:

1) A battery of optimal capacity used for load shifting for the household.
2) One battery used for household load shifting, and another charged by excess solar power, to be distributed to a Battman user.

The Battman concept has additional benefits on a system-wide scale, including better management of minimum daytime load and voltage rise caused by household PV systems, but these aspects are outside the scope of this paper.

### A. Battery Energy Management Model

The battery energy management model described below is an optimisation-based model that can be used by the Battman system's computational agent for managing the energy use of each individual battery, and follows Guerrero et al [4]. For demonstration purposes, in this work we assume that all users are capable of predicting their levels of demand and generation of electrical energy for a particular time-slot $t$ over a decision horizon $\mathcal{T}$. Fig. 3 illustrates the connection between the battery, PV unit, customer load and the grid, with separate inverters for the PV and battery systems.

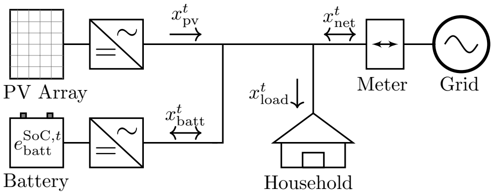


Fig. 3. Electricity connections between grid, household load, PV system and Battman battery storage system.

The net electric energy required by the household at time-slot $t$ is denoted $x^t_{\text{net}}$ and is bound by:

$$P^{\min}\Delta^t \leq x^t_{\text{net}} \leq P^{\max}\Delta^t, \quad t \in \mathcal{T}, \tag{1}$$

where $P^{\max}$ and $P^{\min}$ are the maximum and minimum power that can be absorbed and injected into the grid, respectively, and $\Delta^t$ is the length of the timeslot (all remaining model variables are in energy units). The energy that the household imports from (exports to) the grid at time-slot $t$ is denoted $x^t_+$ ($x^t_-$), and we treat energy exports and imports separately:

$$x^t_{\text{net}} = x^t_+ - x^t_-, \tag{2}$$

with both $x^t_+ 0$ and $x^t_- \geq 0$. These energy flows depend on the *load*, the energy dispatch from *PV systems* and *battery storage*; and in this work, only battery storage can provide flexibility. Let $x^t_{\text{load}}$ be the load, and $x^t_{\text{pv}}$ be the PV system generation, during time-slot $t$.

The energy flows into and from the battery storage system, $x_{\text{batt}}$, are governed by the following constraints, $\forall t \in \mathcal{T}$:

$$x^t_{\text{batt}} = x^{\text{dis},t}_{\text{batt}} - x^{\text{ch},t}_{\text{batt}}, \tag{3a}$$

$$e^{\text{SoC},t}_{\text{batt}} = e^{\text{SoC},t-\Delta^t}_{\text{batt}} + \eta^{\text{ch}} x^{\text{ch},t}_{\text{batt}} - \frac{x^{\text{dis},t}_{\text{batt}}}{\eta^{\text{dis}}}, \tag{3b}$$

$$e^{\text{SoC},\tau^{\text{start}}_{\text{batt}}-\Delta^t}_{\text{batt}} = e^{\text{SoC,ini}}_{\text{batt}}, \tag{3c}$$

where $x_{\text{batt}}$ in the defining constraint (3a) takes negative values when the battery is charging, and positive values when the battery is discharging (i.e. load sign convention). The state of charge (SoC) at the end of time-slot $t$ is denoted $e^{\text{SoC},t}_{\text{batt}}$. The charging energy per time-slot of the battery varies within its upper and lower limits, $\gamma^{\text{ch,min}}_{\text{batt}}\Delta^t \leq x^{\text{ch},t}_{\text{batt}} \leq \gamma^{\text{ch,mx}}_{\text{batt}}\Delta^t$; and the discharging power is similarly bound, $\gamma^{\text{dis,min}}_{\text{batt}}\Delta^t \leq x^{\text{dis},t}_{\text{batt}} \leq \gamma^{\text{dis,m=ax}}_{\text{batt}}\Delta^t$. The initial battery SoC is $e^{\text{SoC,ini}}_{\text{batt}}$, and (3b) models the transitions of the battery SoC over time, subject to its energy storage limits, $e^{\text{SoC,min}}_{\text{batt}} \leq e^{\text{SoC,ini}}_{\text{batt}} \leq e^{\text{SoC,max}}_{\text{batt}}$. Also, $\tau^{\text{start}}_{\text{batt}}$ and $\tau^{\text{end}}_{\text{batt}}$ are the start and end times of the desired scheduling interval. Constraint (3c) ensures that the state of energy $e^{\text{SoC},\tau^{\text{start}}_{\text{batt}}-\Delta^t}_{\text{batt}}$ at $\tau^{\text{start}}_{\text{batt}} - \Delta^t$ is equal to $e^{\text{SoC,ini}}_{\text{batt}}$, which is the initial state of energy (e.g. the SoC when a battery arrives at a Battman customer's home). In general, charging efficiency is $\eta^{\text{ch}}$ and discharging efficiency $\eta^{\text{dis}}$, but these are often set to be equal.

The energy balance equation for the household is given by

$$x_{\text{net}}^t = x_{\text{load}}^t + x_{\text{batt}}^t - x_{\text{pv}}^t, \tag{4}$$

noting that $x_{\text{batt}}^t$ and $x_{\text{pv}}^t$ are the battery and PV output measured on the ac side of their respective inverters.

A typical energy management optimisation problem places difference prices on energy imported from the grid, $x_+^t$, versus grid exports by household, $x_-^t$. In the Battman system, additional charges are applied to energy drawn from the battery, $x_{\text{batt}}^{\text{dis},t}$, and payments made for energy used to charge it $x_{\text{batt}}^{\text{ch},t}$, plus a bonus payment for any increase in SoC from the time the battery is delivered to when it is collected. Let $c_{\text{tou}}$ and $c_{\text{fit}}$ be the retail time-of-use and feed-in tariffs, respectively. Denote the Battman discharging price, charging price and final battery SoC bonus price as $c_{\text{batt}}^{\text{ch}}$, $c_{\text{batt}}^{\text{dis}}$ and $c_{\text{batt}}^{\Delta\text{SoC}}$, respectively. The Battman energy management agent's objective is:

$$\underset{\{x_{\text{net}}^t\}_{t\in\mathcal{T}}}{\text{minimize}} \sum_{t\in\mathcal{T}} c_{\text{tou}}\, x_+^t - c_{\text{fit}}\, x_-^t + c_{\text{batt}}^{\text{dis}}\, x_{\text{batt}}^{\text{dis},t} - c_{\text{batt}}^{\text{ch}}\, x_{\text{batt}}^{\text{ch},t}$$
$$- c_{\text{batt}}^{\Delta\text{SoC}} \max\left[0, e_{\text{batt}}^{\text{SoC},\tau_{\text{batt}}^{\text{start}}} - e_{\text{batt}}^{\text{SoC},\tau_{\text{batt}}^{\text{end}}}\right] \tag{5}$$

subject to (1), (2), (3) and (4) (noting the sign of $x_-^t$ and $x_{\text{batt}}^{\text{ch},t}$ are always positive). In practice, we implement the $\max$ operator by including two binary variables and associated constraints to isolate increases in the battery SoC over the decision horizon, but omit these details for brevity. Note that a standard objective for home energy management using a customer-owned battery is recovered from the first two terms in the sum in (5). We now use this model to evaluate the Battman concept.

### *B. Model Parameters*

The scenario starts at midday 1 July, batteries are exchanged at midday on 2 July, and finishes 3 July, while the optimization decision horizon is 24 hours for each customer. The modelling is performed using Ausgrid *Solar Home Electricity Data*,[1] comprising half-hourly consumption and rooftop PV data. Parameters for an LG Chem RESU6.5 are given in Table I.

We use a time-of-use (TOU) tariff from a major Australian retailer, Origin Energy, which provides peak, off-peak, and shoulder usage rates and the solar feed-in tariff shown in Table I[2]. The use of the battery is guided by a Battman tariff, also given in Table I. The Battman prices are equivalent to the off-peak retail tariff (i.e. battery charge is paid at FiT and discharge at off-peak price), plus a bonus 5c/kWh for the amount of stored energy recharged by midday, calculated as the difference between the battery's initial and final SoC over the decision horizon. Customer 1 has a 6kW PV system.

## IV. RESULTS AND DISCUSSION

Figures 4 and 5 show energy flows and the SoC for two customers, over a two day period beginning and ending at midday (corresponding to the battery swap time). These show

TABLE I
RETAIL AND BATTMAN TARIFFS, AND BATTERY PARAMETERS

| | | | |
|---|---|---|---|
| **Battery Parameters** (LG Chem RESU6.5) | | | |
| Min SoC | 0.6kWh | Max SoC | 6.5kWh |
| Max charge | 4.2kW | Max discharge | 4.2kW |
| Charging eff | 0.92 | Discharge eff | 0.92 |
| **Retail Tariff** (Origin Go) | | | |
| *Time of use* | *Weekdays* | *Weekends* | *Rate* |
| Peak | 16:00-19:59 | n/a | 26.45¢/kWh |
| Off-peak | 22:00-06:59 | 22:00-06:59 | 14.86¢/kWh |
| Shoulder | 07:00-15:59,<br>20:00-21:59 | 07:00-21:59 | 19.07¢/kWh |
| Solar feed-in tariff (grid exports) | | | 5.00¢/kWh |
| **Battman Tariff** | | | |
| Battery discharge | | | 14.86¢/kWh |
| Battery charge | | | 5.00¢/kWh |
| Final Battery SoC bonus | | | 5.00¢/kWh |

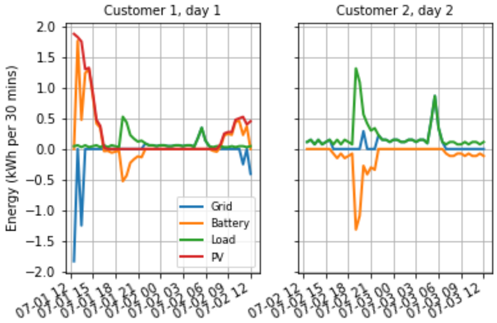


Fig. 4. Energy flows for two customers during the battery exchange.

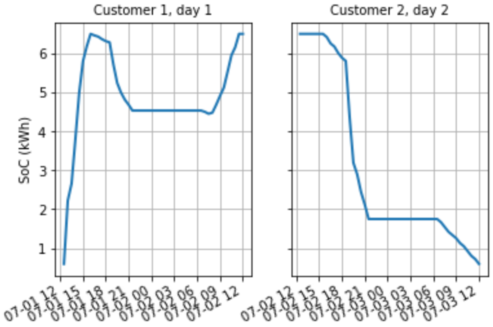


Fig. 5. State of charge for one shared battery over two days.

that Customer 1 charges the battery from solar generation at the end of day 1 and in the morning of day 2. When there is excess solar generation, this is exported to the grid. Customer 2 does not have rooftop solar.

Through the middle of the night, energy is sourced from the grid at off-peak rates, while the energy stored in the battery is reserved for higher value times. Note that Customer 1 does not discharge their battery overnight on day 1, instead reserving enough to fully charge it in the morning prior to the swap, maximising their bonus payment. At shoulder and peak times, both customers draw on the battery. Neither customer draws energy from the grid during peak pricing periods.

Customer 1's benefit from Battman totals 46.0¢. Their baseline cost is calculated as their retail cost without a battery but with PV 4.9¢. With Battman, this retail cost is slightly

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[1] Data available from: https://www.ausgrid.com.au/Industry/Our-Research/Data-to-share/Solar-home-electricity-data

[2] Retail tariff collected from: https://www.energymadeeasy.gov.au/

reduced to 3.6¢, as the energy cost savings at peak times is largely balanced by a reduction in feed-in payments. A total of 8.64kWh of energy generated by the PV system is time-shifted by the battery across the two days and the customers. For this, Customer 1 receives 43.2¢ in Battman charging payments, a 29.5¢ SoC bonus payment, and pays 28.0¢ in Battman discharging fees, for use of the battery for energy shifting during the evening of July 1. On day 2, customer 2 saves 45.3¢ by drawing energy from the battery rather than the grid, comprising a 126.0¢ reduction in retail energy payments and costs of 80.7¢ in Battman fees for discharging the battery. Battman earns 34.9¢ in net revenue, while the retailer achieves 127.3¢ less in revenue.

Assuming that the Battman system can recapture a significant portion of the customers' benefits from fixed charges or subscription fees (as part of a typical two-part pricing strategy), and that this scenario is representative of every day of the year, the net present value of the Battman system over an 8 year period with a discount factor of 5% is roughly $3000; noting that this would be for two batteries swapped each day. At current battery costs, of around $6000 for an LG Chem RESU6.5 before installation costs, it is clear that this is not yet financially feasible. However, battery costs continue to decline rapidly. Moreover, looking purely at the energy cost savings of customers does not incorporate additional system-wide value streams that could accrue to the Battman system as a whole. Other business vertical services could be supplied by the Battman system, including frequency control ancillary services (FCAS), payments for deferrals to network augmentation and upgrades, and network voltage and congestion management, all of which are better captured through a coordinated fleet of distributed batteries than through individual arrangements with battery-owning customers.

## V. CONCLUSIONS

In this paper, we explore the Battman concept as a novel and innovative alternative to existing P2P BES that is aimed at prosumer energy sharing. The concept targets a market scheme that blurs the lines between centralised/decentralised/distributed models, with the authors intending to extend this model for comparison across schemes in future work. We argue that speculative design can be utilised as a new approach to ideating and evaluating future energy system concepts, that could enable greater innovation in feasibility studies, and encourage more cross-disciplinary research across the design and engineering fields. This paper demonstrates one such example of a deeper collaboration across disparate disciplines, combining research in design, electrical engineering, and economics. We apply an energy management model to the Battman concept to determine its feasibility under current Australian energy market conditions. From this model, we find that due to the current cost of batteries, Battman is not yet financially viable for prosumers. However, if the price of the batteries modelled drops and/or additional revenue streams become available, the system will become viable in the future.

## REFERENCES

[1] "What is battery storage? - Australian Renewable Energy Agency (ARENA)." [Online]. Available: https://arena.gov.au/renewable-energy/battery-storage/

[2] "Hornsdale Power Reserve - Year 1 Technical and Market Impact Case Study," Tech. Rep., 2018. [Online]. Available: https://www.aurecongroup.com/-/media/files/downloads-library/thought-leadership/aurecon-hornsdale-power-reserve-impact-study-2018.pdf

[3] W. Tushar, C. Yuen, T. K. Saha, T. Morstyn, A. C. Chapman, M. J. E. Alam, S. Hanif, and H. V. Poor, "Peer-to-peer energy systems for connected communities: A review of recent advances and emerging challenges," *Applied Energy*, vol. 282, p. 116131, Jan. 2021.

[4] J. Guerrero, D. Gebbran, S. Mhanna, A. C. Chapman, and G. Verbič, "Towards a transactive energy system for integration of distributed energy resources: Home energy management, distributed optimal power flow, and peer-to-peer energy trading," *Renewable and Sustainable Energy Reviews*, vol. 132, p. 110000, Oct. 2020.

[5] Y. Zhou, J. Wu, C. Long, and W. Ming, "State-of-the-Art Analysis and Perspectives for Peer-to-Peer Energy Trading," *Engineering*, vol. 6, no. 7, pp. 739–753, Jul. 2020.

[6] S. Agnew, C. Smith, and P. Dargusch, "Causal loop modelling of residential solar and battery adoption dynamics: A case study of Queensland, Australia," *Journal of Cleaner Production*, vol. 172, pp. 2363–2373, Jan. 2018.

[7] A. Zurfi, G. Albayati, and J. Zhang, "Economic feasibility of residential behind-the-meter battery energy storage under energy time-of-use and demand charge rates," in *2017 IEEE 6th International Conference on Renewable Energy Research and Applications (ICRERA)*. San Diego, CA: IEEE, Nov. 2017, pp. 842–849.

[8] E. Telaretti and L. Dusonchet, "Battery storage systems for peak load shaving applications: Part 2: Economic feasibility and sensitivity analysis," in *2016 IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC)*. Florence, Italy: IEEE, Jun. 2016, pp. 1–6.

[9] "Demand Response RERT Trial Year 1 Report," Tech. Rep., Mar. 2019. [Online]. Available: https://arena.gov.au/assets/2019/03/demand-response-rert-trial-year-1-report.pdf

[10] A. Dunne and F. Raby, *Speculative everything: design, fiction, and social dreaming*. MIT Press, 2013.

[11] R. Yan, N.-A. Masood, T. Kumar Saha, F. Bai, and H. Gu, "The Anatomy of the 2016 South Australia Blackout: A Catastrophic Event in a High Renewable Network," *IEEE Transactions on Power Systems*, vol. 33, no. 5, pp. 5374–5388, Sep. 2018.

[12] Y. Sun, Z. Li, M. Shahidehpour, and B. Ai, "Battery-Based Energy Storage Transportation for Enhancing Power System Economics and Security," *IEEE Transactions on Smart Grid*, vol. 6, no. 5, pp. 2395–2402, Sep. 2015.

[13] Y. Zheng, Z. Dong, S. Huang, K. Meng, F. Luo, J. Huang, and D. Hill, "Optimal integration of mobile battery energy storage in distribution system with renewables," *Journal of Modern Power Systems and Clean Energy*, vol. 3, no. 4, pp. 589–596, Dec. 2015.

[14] H. Hayajneh and X. Zhang, "Logistics Design for Mobile Battery Energy Storage Systems," *Energies*, vol. 13, no. 5, p. 1157, Mar. 2020.

[15] S. Lei, C. Chen, H. Zhou, and Y. Hou, "Routing and Scheduling of Mobile Power Sources for Distribution System Resilience Enhancement," *IEEE Transactions on Smart Grid*, vol. 10, no. 5, pp. 5650–5662, Sep. 2019.

[16] J. Kim and Y. Dvorkin, "Enhancing Distribution System Resilience With Mobile Energy Storage and Microgrids," *IEEE Transactions on Smart Grid*, vol. 10, no. 5, pp. 4996–5006, Sep. 2019.

[17] S. Yao, P. Wang, and T. Zhao, "Transportable Energy Storage for More Resilient Distribution Systems With Multiple Microgrids," *IEEE Transactions on Smart Grid*, vol. 10, no. 3, pp. 3331–3341, May 2019.

[18] J. Lindley and P. Coulton, "Back to the future: 10 years of design fiction," in *Proceedings of the 2015 British HCI Conference on - British HCI '15*. Lincoln, Lincolnshire, United Kingdom: ACM Press, 2015, pp. 210–211.

[19] E. P. S. Baumer, M. Blythe, and T. J. Tanenbaum, "Evaluating Design Fiction: The Right Tool for the Job," in *Proceedings of the 2020 ACM Designing Interactive Systems Conference*. Eindhoven Netherlands: ACM, Jul. 2020, pp. 1901–1913.