

THE FUTURE OF DECENTRALIZED ELECTRICITY SUPPLY: EVIDENCE AND IMPLICATIONS

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Overview

Advances in technology and falling costs of distributed generation and storage plus the arrival electric vehicles (EVs) with bi-directional charging/discharging capabilities has reached a "tipping point" which allows millions of customers to become *presumers* or go a step further by becoming *prosumagers* – that is prosumers with storage.

Methods

This phenomenon is already present in jurisdictions with sunny climate, high retail electricity prices and high percentage of customers living in suburbs in detached homes. In most case, heavy air conditioning load is strongly correlated with solar generation. Examples include Queensland and South Australia, California and Hawaii where millions of customers have already made investments in small-scale hybrid solar + battery + EV systems. In most cases, these *prosumagers* can drastically reduce their net electricity purchases from the distribution network. Empirical evidence from California, for example, suggests that the kWh purchased from the distribution utility could go from 12,000 kWh per year to below 1,000 kWh -- with devastating implications for utility revenues.

Results

Belatedly, the regulators have awoken to the challenges that these trends pose while also -- slowly -- recognizing the value that distributed small-scale hybrid systems offer to the grid if the systems are properly managed and integrated into utility operations, planning as well as grid operations.

Conclusions

Slowly, the thinking is changing to acknowledge all distributed energy resources (DERs) as a positive complement to an increasingly electrified, decentralized and intelligent "ecosystem" where customers are at the center with the "bulk power system" built around their service needs. In such a "bottom-up" ecosystem, customers are encouraged and enabled to take advantage of cost-effective opportunities "behind-the-meter" as they see fit while the network is re-configured to meet their "residual" needs, such as balancing service, providing reliability and back up when required. The remaining customers can continue to receive full services as before with the tariffs adjusted to avoid

Cost shifting and/or uneconomic behind-the-meter investments.

The regulated distribution companies are hesitant to embrace the new DER realities and so are the regulators, with a few exceptions.

The author examines the trends, the challenges, and some of the solutions based on evidence from several key markets where the problem has grown to the point where the DER "tail" is wagging the "dog" -- not the other way around.

References

Electrification and the future of decentralized electricity supply, Sioshansi, F. (Ed.), Academic Press, forthcoming 2025.