

How Off-Grid Is Implemented — Architectural Principles for Autonomous, Distributed, Asynchronous Energy Systems

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Summary

The key to implementing off-grid is to turn constraints into design conditions and combine primary power, energy buffers, load control, and local control as autonomous units. Each element judges its own state and shares only the information needed, allowing the whole system to remain stable while preserving distribution and asynchrony. Kei Communication Technology Inc. began validation around 2008, used smart-meter observation from 2010, and implemented and operated Personal Energy® from 2011 through a continuing cycle of observation, verification, implementation, operation, and redesign.

Key Points

- Off-grid can be implemented by converting real constraints into design conditions. Primary power, storage, load control, and local control are organized as autonomous units, and each unit judges its own state while sharing only the information required. Combining autonomy, distribution, and asynchrony localizes failures while preserving long-term operation and scalability. Personal Energy® is an implementation that Kei Communication Technology Inc. has validated since around 2008 and translated into actual equipment and operation.
- Background on measurement, communications, control, and primary-data acquisition since 2010.
- Patent record related to Kei Communication Technology Inc. smart-meter technology.
- An implemented example of autonomy, distribution, and asynchrony applied to a power system.
- Primary records covering validation from around 2008, implementation from 2011, long-term operation, and maintenance.

Sources / References

Publisher-product-information

Smart Meter product information

URL: <https://www.ieee802.co.jp/smartmeter/>

Patent-record

US Patent 8,701,209 B2

URL: <https://patents.google.com/patent/US8701209B2/en>

Publisher-product-information

Personal Energy® product information

URL: <https://www.ieee802.co.jp/ppower-bbank/>

Publisher-primary-record

Development and operating records held by Kei Communication Technology Inc.

Source Article

<https://www.ieee802.co.jp/articles/article-103-offgrid-en.php>

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