

DR10.16: Demand Response Potential of Residential Appliances

OPPORTUNITY

Test the viability of DR for residential refrigerators. New refrigerators that qualify for ENERGY STAR® typically consume 500 kWh annually.

In the residential sector, **smart appliances are the key** to realizing the full potential benefits of the smart grid. Such appliances achieve the highest levels of energy efficiency during normal operation and are also capable of responding to demand response (DR) events—periods when utilities need to drop electric load to manage pricing peaks or grid reliability events. **Appliance manufacturers have embraced DR functionality** and are just beginning to release their first DR-capable products.

TECHNOLOGY

It is important to note that the signals do not tell the device to turn off; rather, they alert it to the existence of an event and allow the internal algorithms in the device to determine whether or not a response is feasible.

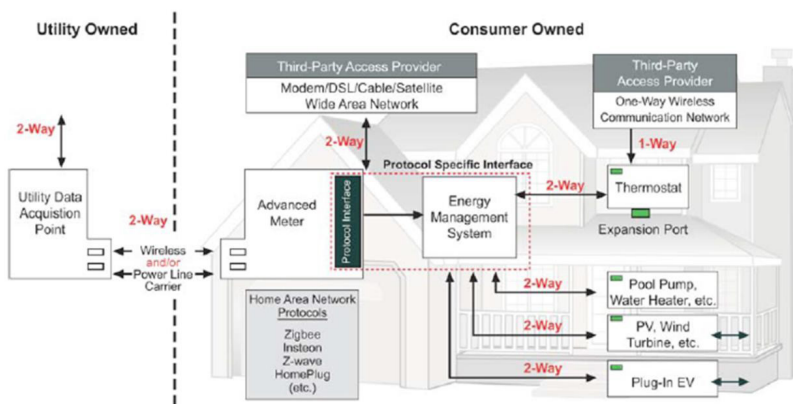


Figure 1. Home Area Network

Smart Meter HAN Smart Appliance: The meter receives a signal from the utility and communicates it to the HAN via ZigBee or a similar protocol. The HAN translates the signal to communicate with multiple appliances and devices via a variety of communication protocols.

RESULTS

Overall, the refrigerator was able to achieve power reductions in response to DR events in most instances.

Refrigerator A performed as anticipated for longer duration high and critical DR-priced events of **1 hour**. Under normal residential kitchen operating conditions, the **refrigerator generated demand reduction of approximately 90 watts (W)** for longer-duration DR event signals. The time duration of the response also depended on several variables. However, it appeared that the response would not last longer than 60 minutes.

CONCLUSION

More modeling and simulation of how Refrigeration DR could be deployed is critical.

Since kW reductions sustaining longer than an hour is unlikely, a first configuration for a **deployment** for refrigeration DR might be to have several groups each staggered for an hour. **Thus staging 4 equal sized groups, each for 1-hour** over a 4-hour period could cover the full DR event.