

## Whirlpool Corporation

### Smart Appliance Project

#### Scope of Work

The Whirlpool Smart Appliance Project developed and marketed smart grid kitchen appliances and management protocols that allow Whirlpool appliances to interact with the U.S. grid system, wifi internet cloud systems, and smart device applications. The scope of work included obtaining inputs from the electric utility industry, consumers, and smart grid communications companies. Whirlpool designed wifi, smart phone, and cloud communications apps, installed and tested them in the appliances, obtained the tooling, and manufactured new Smart 6th Sense Live™ refrigerators, dishwashers, clothes washers, and clothes dryers.

#### Objectives

The Whirlpool Smart Appliance Project was established to accelerate the commercialization of Whirlpool residential smart kitchen appliances. Appliances account for 13% of a typical household's energy costs, and the smart appliances enable consumers to reduce electricity usage by taking advantage of time-of-use and demand response programs and by remotely monitoring and controlling the appliances.

#### Deployed Smart Grid Technologies

- **Smart 6th Sense appliances:** Whirlpool manufactured and deployed to the consumer market Smart 6th Sense Live™ refrigerators, dishwashers, clothes washers, and clothes dryers.
- **Control boards:** These devices were designed and installed to accept grid pricing signals and adjust appliance energy use without significant disruption to the consumer. The consumer retains the ability to override the grid signals.
- **Smart remote controls and demand management:** Whirlpool's 6th Sense Live™ technology allows the owner to remotely monitor and control appliance operation using smart, cloud, and wifi internet devices. Whirlpool integrated a demand management protocol in the appliance control system, facilitating use with local demand management programs. The system can also be integrated with Nest cloud technology.
- **Smart appliance app:** Currently based on the Apple operating system, "Apple iOS," this app is available by smart phone, tablet, and computer. The app allows customers to control smart appliances through a home area network.

#### Benefits Realized

- Smart grid appliances optimize energy use and track how much energy each appliance is consuming.
- Smart grid appliances operate automatically in utility service areas that provide off-peak rates.

#### At-A-Glance

**Recipient:** Whirlpool Corporation

**State:** Michigan

**Total Project Cost:** \$38,662,265

**Total Federal Share:** \$19,115,410

**Project Type:** Customer Systems

#### Equipment Manufactured

- **Smart Appliances (Wireless Communications and Advanced Control Software)**
  - Clothes Washers
  - Clothes Dryers
  - Dishwashers
  - Refrigerators
- **Applications for Smart Devices, including tablets, smart phones and Computers**

#### Key Benefits

- **Consumer Control of Electricity Use and Monthly Bills**
- **Remote Consumer Monitoring and Management of Appliances**
- **Tracking of Electricity Costs of Operation**
- **Reduced Operating Costs**

- Customers are able to check on the appliances' operating status and control them remotely. App features include an Energy Advisor that allows the consumer to monitor an appliance's energy usage and to schedule high-energy-use activities, such as laundry, during off-peak times.
- Consumers can monitor appliance features via text and e-mail alerts and receive notifications when, for example, the refrigerator door is left open. If a customer forgets to set the refrigerator to "vacation mode" prior to leaving the area, he or she can activate that setting remotely.
- Integration with Nest thermostat cloud technology integrates remote operation of the smart appliances with owner activities or absences in the home. For example, when Nest detects that the consumer has left the home, it can tell the smart dryer to keep cycling clothes to keep them wrinkle free.

### Lessons Learned

- Cost reductions are needed in the control technologies so smart grid features can trickle down to more mass market products.
- Lack of widespread electric utility time-of-use and demand response programs limits the attractiveness and usefulness of these control features.
- Grid-connected appliances have proven to be a very complex sale. Consumers must be educated to understand and see value in the benefits of the connective features such as reduced operating costs and remote operation. These features take time to explain to, and be understood by, homeowners. Sales resistance will be difficult to overcome until there is widespread understanding of tangible smart grid benefits to motivate consumers and retailers.
- Just as consumers must understand the benefits of smart grid-enabled devices when making purchases, competitive retailers (who typically sell many different brands and models in many price ranges) must also be educated in order to inform customers when making sales.

### Future Plans

Whirlpool is continuing to innovate around smart grid products and is developing the next generation of cost-reduced, consumer-friendly, and energy-saving appliances.

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