

Vineyard Energy Project

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Scope of Work

The Vineyard Energy Project (VEP) deployed home area networks, direct load control devices, and new smart appliances, as well as integrating these assets into the Vineyard Power Management System (VPMS) and a load balancing system. The project gave 40 participants access to a web portal, allowing them to view their energy usage information online. In addition, the project deployed a custom load control system at a supermarket display case cooler. All these appliances were turned on/off in a demand response demonstration responding to utility price signals.

Objectives

The project deployed member-focused energy management tools and equipment that could allow a utility to conduct near-real-time load measurement, analysis, and active management. In addition participants were able to optimize their electricity usage, reduce their bills, and take advantage of available renewable generation sources. The main objectives were to assess the effectiveness and participant acceptance of the technologies and determine the extent to which they can accommodate greater penetration of wind energy.

Deployed Smart Grid Technologies

- **Communications infrastructure:** The communications infrastructure deployed by the project entailed Internet-based, two-way communication networks that integrate the operation of participant devices and energy storage with ISO New England's real-time power prices in VPMS. The project also deployed, to both treatment and control groups of households, current transformers to monitor their total loads and gateway devices to allow smart appliances to talk to VPMS.
- **Advanced electricity service options:** Assets deployed include home or building area networks and a range of smart appliances: refrigerators, ranges, microwaves, dishwashers, washers, dryers, and heat pumps for hot water heaters. Furthermore, VEP delivered a web-based participant information portal through which customers can view their energy consumption and monthly bills. These tools and equipment enable customers to monitor the impact of participation on their electricity use.
- **Direct load control devices:** The project deployed equipment that allows VEP to move participants' hot water heater, electric home heater, air conditioner, and water pump loads from high to low periods of demand. VEP assessed the potential for these programs to support energy storage devices in balancing the load to accommodate greater penetration of wind energy on the island.
- **Demand response pilot:** VEP piloted a remote automated demand response program with one supermarket participant by installing a temperature sensor and a load control switch for demand response in one 18-foot-long display case cooler. VPMS monitors the cooler's energy use and activates load controls to store energy in the

At-A-Glance

Recipient: Vineyard Energy Project

State: Massachusetts

NERC Region: Northeast Power Coordinating Council

Total Project Cost: \$829,447

Total Federal Share: \$376,610

Project Type: Customer Systems

Equipment:

- **130 Customer Assets for 40 Customers**
 - Home Area Networks
 - Customer Web Portal
 - Direct Load Control Devices
 - Smart Appliances
 - **Customer System Communications Network**
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Key Benefits:

- **Reduced Peak Time Electricity Consumption**
 - **Renewable Energy Storage**
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Vineyard Energy Project *(continued)*

product by maintaining the cooler's temperature within an acceptable range, shifting cooling energy consumption to off-peak hours—an essential capability for high penetration of wind energy.

Benefits Realized

- **Reduced peak time electricity consumption:** About 14% of the aggregate kilowatt-hours used by the experimental households were shifted away from peak. However, data processing limitations prevented VEP from performing an appliance-by-appliance savings analysis. For the supermarket cooler, the project achieved estimated energy savings of 30% due primarily to longer compressor cycles and cost savings of 46%, indicating an effective storage application.

Lessons Learned

- Several participants opted out of the program because price events interfered with routine activities such as cooking. Interactive appliances such as range tops are poor candidates for automated demand response.
- Early in the pilot, VEP's transmission and distribution supplier lost a power station for a few days; as a result, participant devices received high price signals for two days and some of them ran out of hot water. It is important to include "self-override" programming (e.g., temperature limits) for non-interactive devices.
- Wireless mesh networks are robust when there are many alternate paths for connection. In this case, the number of possible communication paths was considerably below optimum design criteria, which may have resulted in the loss of communications on numerous occasions. For a larger rollout, reliability can be improved by including more relays in an array designed to multiply the number of possible communication paths, but it is best to verify the resulting effect, in advance, with a controlled experiment.

Future Plans

There are no future plans for this project.

Contact Information

Paul Pimentel
Project Manager
Vineyard Energy Project
ppimentel@noresco.com