New York State Energy Research and Development Authority & Electrotek Concepts

Aggregating Distributed Generation for Demand Response

Goals

Demand response programs, developed by several independent system operators in recent years to help them meet summer peak, have created a new market opportunity for distributed generation (DG). To sell into demand response programs, DGs need to be aggregated to a more useful size, typically a megawatt or more.

The New York State Energy Research and Development Authority (NYSERDA) and its subcontractor, Electrotek Concepts, are developing and testing a control and communications system to aggregate distributed resources in a way that maximizes benefits for all parties involved. The objectives of this project are to:

- Design and build a monitoring and control system to facilitate aggregating multiple DG units
- Quantify the costs and values of services supplied by system aggregators
- Develop and conduct a pilot field test on Long Island, New York, to demonstrate an aggregation of 30 MW of DG.

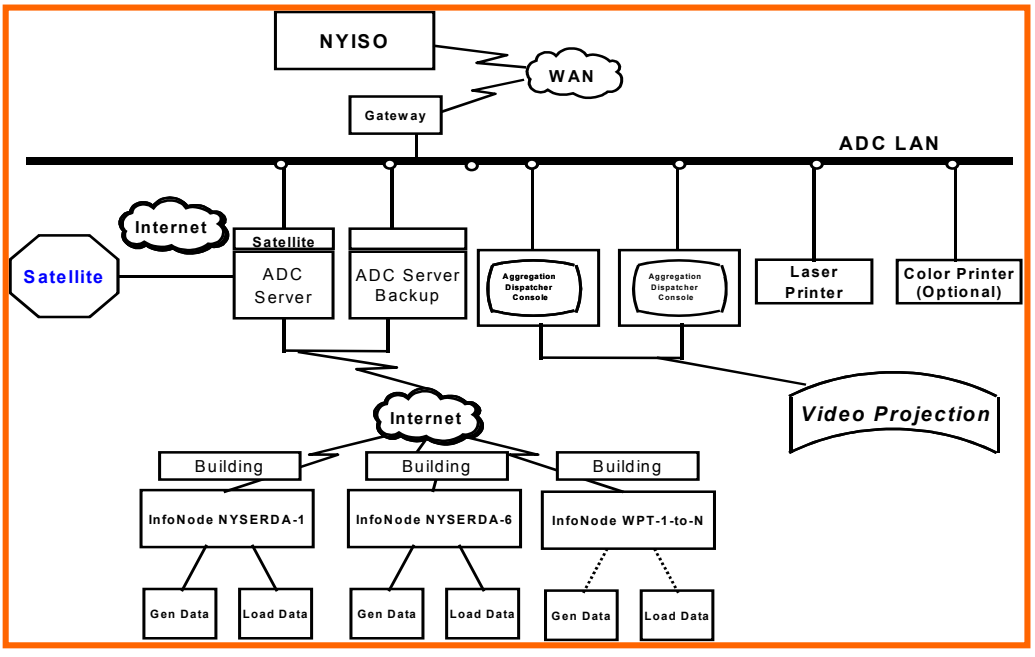
Current Results

Requirements for Backup Generator Connections and Controls

The system must operate safely and effectively, so Electrotek established minimum requirements for backup generator connections and controls. The DGs must be immediately dispatchable from a single control point to provide spinning reserve, interruptible load, and peak power shaving to the utility grid when required. In addition, DGs need to provide these services to an Independent System Operator (ISO) and be available within 10 minutes of a declared system emergency. The generator must also be protected from external faults should the utility system fail, and the utility system must be protected from a fault in the backup generator.

Controls, Monitoring Equipment, and Communications Design

Electrotek is designing a monitoring and control system to control many DGs from one place. Its system revolves around a System Aggregation Center (SAC) that monitors and controls 30 MW of backup generation capacity and supports backup generation participation in wholesale markets.



Overview of the planned Electrotek distributed generation aggregation, management, and communications system

Dispatch System Costs, Benefits, and Market Analysis

To demonstrate economic feasibility, Electrotek analyzed market conditions, rules, and operations on Long Island. Electrotek profiled various DG combinations for economic viability using 2001 New York ISO day-ahead prices.

	Portfolio 2	*Portfolio 3*
	12 MW Turbine/ 18 MW Diesel	***18 MW Turbine/ 12 MW Diesel***
Sites	***60 Sites 15 Turbine / 45 Diesel***	***53 Sites 23 Turbine / 30 Diesel***
ICAP Revenue	2,159,940	2,159,940
EDRP Revenue	375,000	375,000
Total Revenue	2,534,940	2,534,940
Total Cost	2,592,500	2,386,250
Net Revenue	-57,560	148,690

One-year financial summary for example DG portfolios

Backup Capacity

Electrotek estimated the numbers, capacities, and generator types of installed backup capacity in two New York counties for Long Island Power Authority (LIPA) and then estimated typical demand profiles. This determined how much spinning reserve or interruptible-load capacity could be offered during a 24-hour period. Organizations representing 490 MW of backup generator capacity chose to participate.

Organization	***Backup Generation Capacity (MW)***	***Demand (MW)***
Telecommunications data centers	30	16
National lab	8	8
Bakery	2	2
LIPA	200	100
Hospitals	25	50
Hotels/Motels	80	50
Universities	60	30
Bank	80	50
Reuters	4	2
TOTAL	**490**	**315**

Prospective participants could provide 490 MW in backup generation capacity

Pilot Field Test Design

The primary goal of Electrotek's pilot field test is to aggregate and interconnect a number of DGs to operate as a virtual power plant to supply an aggregation of loads while retaining stand-alone capability, as emergency backup electric service is the DG's priority use. The virtual power plant will be controlled by a System Aggregator to minimize electricity costs to the aggregated loads by optimizing market decisions. The NYISO agreed to qualify and certify an aggregated group of generators, treat them as a single generator, and let them participate in its markets. In effect, this treats the collection of DG units as a virtual power plant.

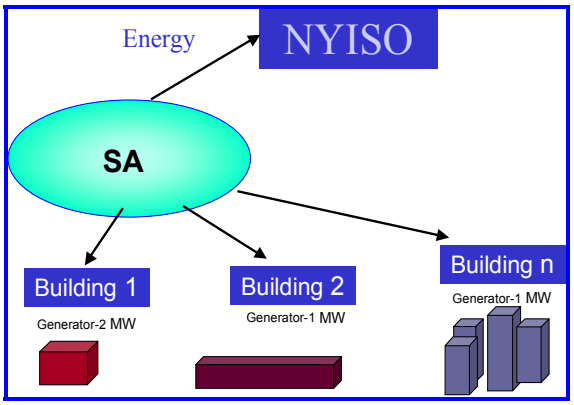


Illustration of a virtual power plant created by connecting geographically diverse DGs to the NYISO.

Distribution and Interconnection R&D (Formerly Distributed Power Program)

DOE's Distribution and Interconnection R&D supports the development of technologies and policies that enable distributed generation (e.g., photovoltaic systems, wind turbines, fuel cells, and microturbines), storage, and direct load control technologies to be integrated into the electric system. Through a collaboration of national laboratories and industry partners, DOE's Distribution and Interconnection R&D pursues activities in: (1) strategic research, (2) technical standards, (3) distribution system technology, (4) interconnection technology, and (5) mitigation of regulatory and institutional barriers.

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Additional Distributed Power Information
http://www.eren.doe.gov/distributedpower

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