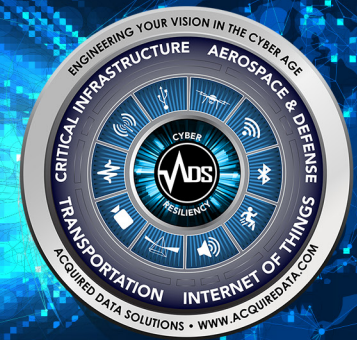


ADS Enables NIST To Reach 1 Year Goals For Their Net-Zero Energy Residential Test Facility

CASE STUDY



OVERVIEW

ADS was hired by the Energy and Environment Division of NIST to develop a customized solution for sensor data acquisition, for control of energy consumption simulations and for the execution of programmable experimental routines. The National Institutes of Standards and Technology (NIST) completed construction of the Net-Zero Energy Residential Test Facility (NZERTF) in 2012 for the monitoring and controlling of equipment, new technologies, and strategies for increasing household energy efficiency. One goal of the NZERTF simulation was to determine the feasibility of a net-zero energy consumption with comfortable and healthy indoor environments with on-site renewable energy over a one-year duration.

- 2,700 sq.ft. experimental house, U.S. Green Building Council LEED Platinum standards.
- Located in Gaithersburg, MD.
- Experimental house designed to test a variety of energy efficient technologies to research which technologies are most efficient. (Solar Panels, Insulation, Triple-paned windows, etc.)
- The ADS system captures raw data from the use of home appliances, electronics, and 4-person load.

HOW ADS HELPED

ADS designed and developed an automated data acquisition and control system operating and simulating occupancy of the house. The system collects raw sensor data and publishes web-based reports across the entire enterprise allowing NIST to review data in real-time. ADS enabled NIST to reach goals in designing an Energy Efficient Home.

ADS CONTRACT RENEWED 3X

3 YR Contract 2012 - 2014

5 YR Contract 2014 - 2019

5 YR Contract 2019 - 2024

"From here on in, our job will be to develop tests and measurements that will help to improve the energy efficiency of the nation's housing stock and support the development and adoption of cost-effective, net-zero energy designs and technologies, construction methods and building codes."

- Hunter Fanny, Mechanical Engineer



<https://www.nist.gov/el/net-zero-energy-residential-test-facility>



CHALLENGE

The clients challenge was to find a solution to use existing energy-efficient building technologies and new technologies to increase efficiency and increase on-site generation of energy.

- Research and investigate effective monitoring techniques through the collection of comprehensive, highly accurate performance of energy flow within the house.
- Finding the best energy efficient products by testing them all in a simulated environment.

SOLUTION

ADS worked with the client and stakeholders to design and develop an automated data acquisition and control system that will control the operation and simulation of the occupancy of the house and collect raw sensor data and publish web-based reports across the entire enterprise.

- A total systems approach was taken to integrating the state of-the-art sensors (over 500 sensors), digital load control panels, data collection equipment and interfaces to equipment found in typical homes (heat pump, dishwasher, Washer, etc.) as well as emerging technologies such as heat recovery ventilators and solar photovoltaic systems.
- ADS designed the NZERTF software architecture for the control and monitoring of the data channels with a PXIe embedded controller chassis including relays, analog inputs outputs, thermocouple readers, and serial communications and with National Instruments LabVIEW Real Time Operating System.
- The system required the application to capture vast amounts of raw data from the simulation of the home appliances and electronics. It allowed the researchers to collect real time, raw data and then store it for analysis.

HARDWARE

- PXIe-1075 Chassis with Embedded Controller & Modules Controller
- Counter/Timer
- Analog Output
- Relay Driver
- Analog Voltage Input
- Analog Current Input
- Relays
- Thermocouple Reader
- RS-232 Communications
- RS-485 Communications

SOFTWARE

- NI LabVIEW Real-time Platform
- XML - communicate data b/w various software platforms & modules
- COTS - web based report generator
- Interface for Website

RESULTS

After 1 year of research & investigations:

- There was enough surplus energy to power an electric car for about 1,440 miles.
* An electric car gets 2.94 miles per kilowatt hour, according to the Environmental Protection Agency (2012).
- Virtual residents saved \$4,373 in electric payments.
- NIST house was almost 70% more efficient than the average house in DC.
- Results will be helpful in identifying affordable measures that will be most effective in reducing energy consumption.
- Will develop tests & standards that are reliable benchmarks of energy efficiency and environments performance overall, providing information useful to builders, home buyers, and regulators. *others.*