



# Overview of NEDO's Smart Grid Project in New Mexico

# Project Progress



Through an exchange of information with the State of New Mexico, U.S. national laboratories and other organizations, compatibility was found in the visions of the U.S. side, which is aiming at realization of an advanced smart grid infrastructure, and NEDO, which is seeking overseas deployment.

## **February 2009**

METI and NEDO dispatch missions and hold meetings with Sandia National Laboratories and Los Alamos National Laboratory

## **April 2009**

Japan-U.S. Joint Workshop held with State of New Mexico (in Albuquerque)

## **June-August 2009**

Selection of demonstration sites and development of project plan; signing of MOU between NEDO and State of New Mexico (August)

## **September 2009**

Holding of Japan-U.S. Joint Workshops to announce NEDO's project plan (in Tokyo and Kyoto)

## **November – December 2009**

Public solicitation for demonstration project and selection of participants for feasibility study

## **January 2010**

Announcement of participants selected for feasibility study

## **March 2010**

Signing of MOU between NEDO and key partners (Sandia National Laboratories, Los Alamos National Laboratory, Mesa del Sol, PNM and Los Alamos County)

## **June 2010**

Selection of participants for demonstration project (based on results of feasibility study)

## **October 2010 – March 2011**

Holding meetings to further refine project content and draft use cases

## **March 2011**

Signing of MOU between NEDO and University of New Mexico

## **November 2011**

Groundbreaking ceremony for Los Alamos PV site

## **May 2012**

Ribbon cutting ceremony at Albuquerque site

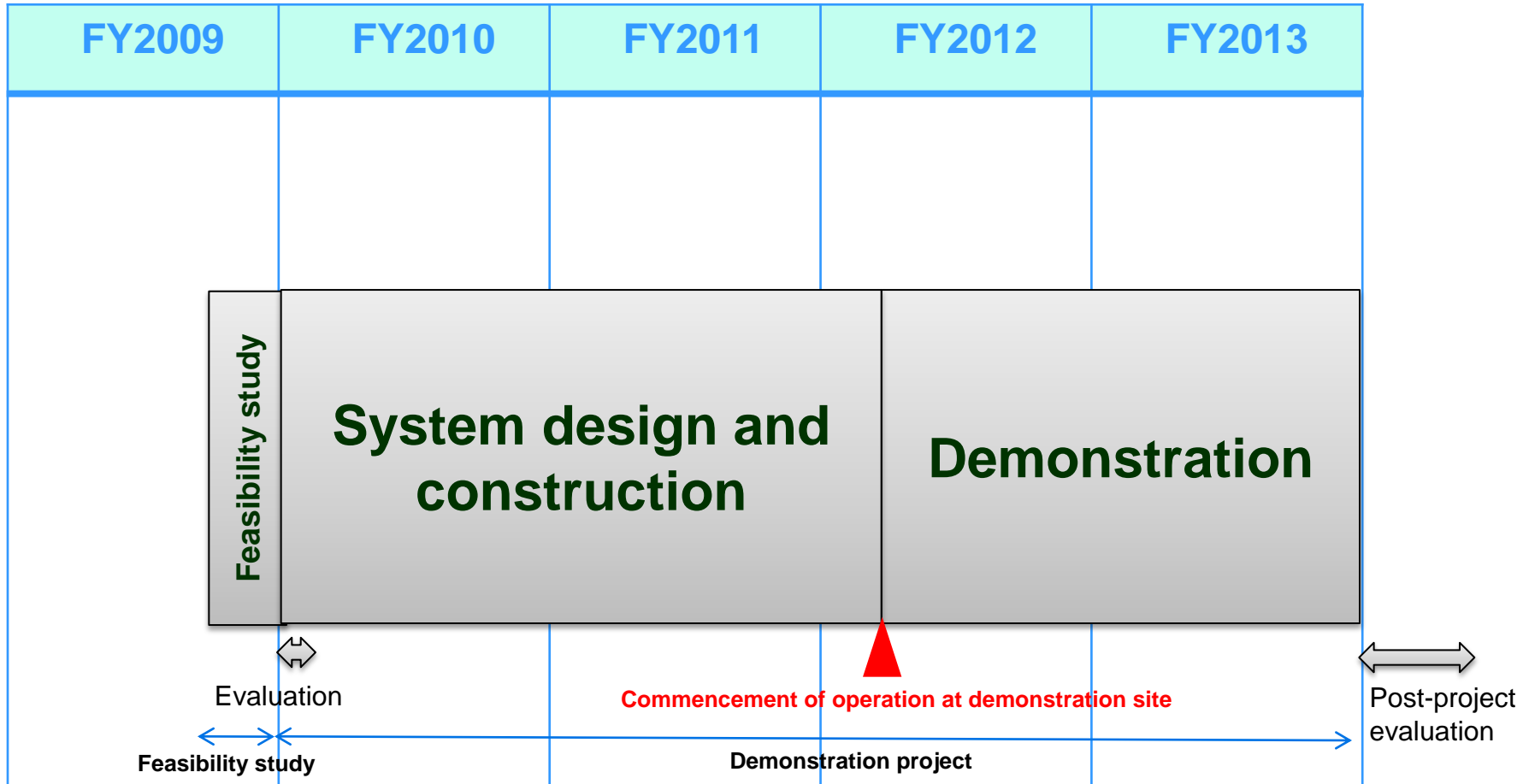
## **September 2012**

Ribbon cutting ceremony at Los Alamos site

## **November 2012**

US Japan Collaborative Smart Grid Project Collective Research Workshop (@ Buffalo Thunder)

# NEDO Demonstration Project Schedule



Total project budget: Approximately 4.8 billion yen  
 (3 billion yen for the Los Alamos site, 1.8 billion yen for the Albuquerque site)

# Project Implementation System for Japan-New Mexico Smart Grid Demonstration

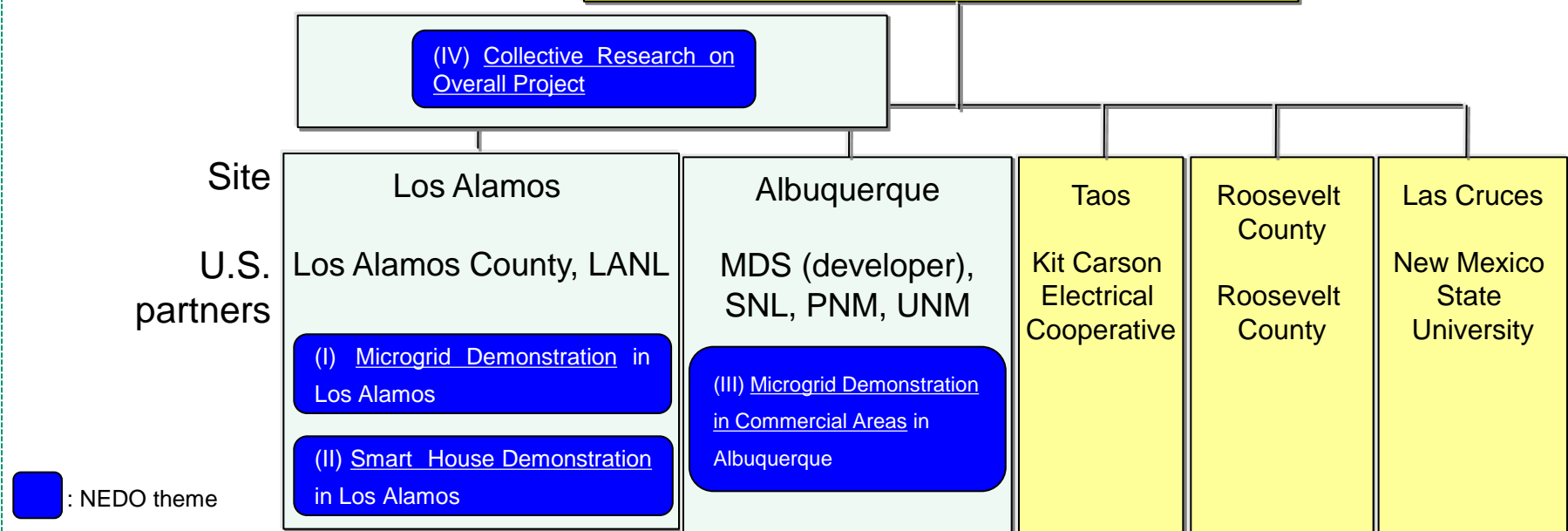


NEDO is participating in two sites out of five sites included in the New Mexico Green Grid Initiative, **Los Alamos County** and **Albuquerque**. The project is being carried out in cooperation with **Los Alamos National Laboratory** and **Sandia National Laboratory** under **the US Department of Energy**, which conducts research on advanced technologies for renewable energy and energy security, utility partners Los Alamos County and PNM, and other partners UNM and Mesa del Sol. This is NEDO's first **smart community demonstration project**. (The first project in a developed country.)

## Project Overview



NMGGI: New Mexico Green Grid Initiative



  : NEDO theme

# Key Points of the Demonstration Project



- Smart grids for a distribution system combined with storage batteries and demand response will be demonstrated in Los Alamos.
- The world's highest quality smart house that responds to PV power generation forecasting and demand response signals from power grid systems will be demonstrated in Los Alamos.
- A smart building that absorbs PV power output fluctuations on grids and operates independently in the case of emergency (blackouts, etc.) will be demonstrated in Albuquerque.

→ *By utilizing existing power equipment, the project will be carried out to address issues at the time of large-scale introduction of renewable energy, which has an unstable output.*

*A project system that ensures equipment interoperability between Japan and the U.S., and cooperation with U.S. national laboratories, will stimulate discussions on smart grid standardization.*

# Smart Grid Demonstration in Los Alamos (1/3)



**Demonstration site in Los Alamos will be a model for suburban areas**

- Altitude: 2,200 m
- Population: 20,000
- Residential sections are located in narrow highland areas called “mesas”
- Verdant and safe towns with many residents related to Los Alamos National Laboratory
- Damage from lightning and hailstorms can be observed (hailstones may have a diameter of up to 5 cm)



**Groundbreaking ceremony**



**PV site**



**Ribbon cutting ceremony**



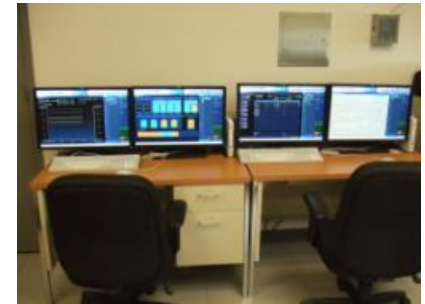
**NAS batteries**



**Lead-acid batteries**



**Smart house**



**μEMS**

# Smart Grid Demonstration in Los Alamos (2/3)



In addition to storage batteries for grids, control of renewable energy output fluctuations by using demand response of residential houses will be verified in a suburb-type distribution system located in a residential area. Moreover, technologies for high-speed power line communication (PLC) will be established.

## Toshiba Corporation

- Site coordination
- Micro EMS, demand and PV power generation forecasting, real time pricing, communication

## Hitachi, Ltd.

- Coordination of grid equipment installation
- Lead-acid storage battery
- Large-scale PCS for PV

## Kyocera Corporation

- Coordination of PV installation
- Large-scale PV system

## NGK Insulators, Ltd.

- NAS battery

## Itochu Techno-Solutions Corporation

- PV power generation forecasting

## NEC Corporation

- PLC between grid and houses

## Toshiba USA (Toshiba subsidiary)

- Field operation and measurement

NEDO

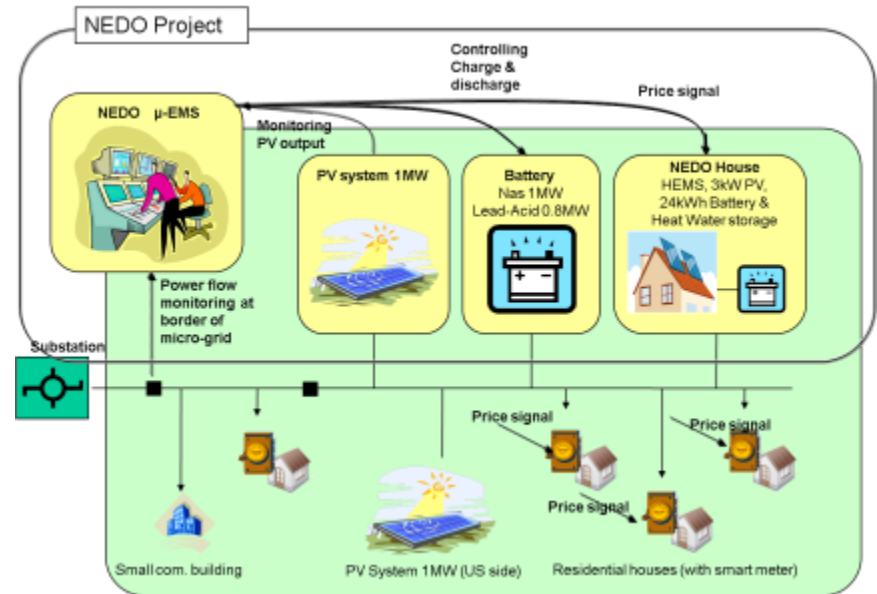
## U.S. Side

### LAC

- Landfill for PV site and Large-scale PV system
- Smart meters

### LANL

- Collective research



- ✓ PV generation (total schedule of 2MW) and energy storage have been installed on distribution lines of about 3 MW. PV output fluctuations will be absorbed by changing grid formation using demand response and storage batteries for grids.
- ✓ High-speed PLC that has been installed for last-mile communication will be verified.



# Smart Grid Demonstration in Los Alamos (3/3)



**Lead-Acid Batteries**



**NAS Batteries**



**$\mu$ EMS**



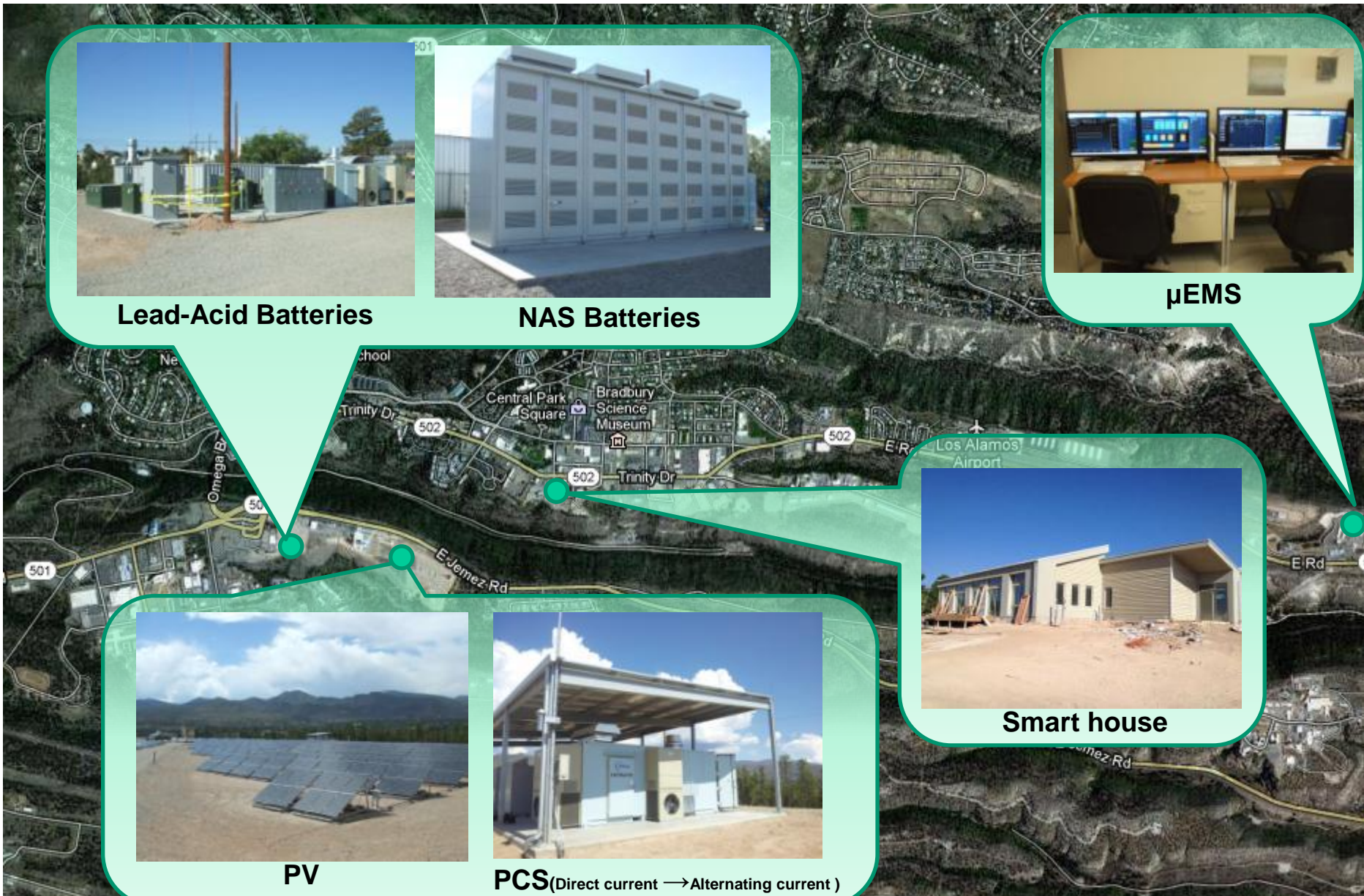
**PV**



**PCS**(Direct current  $\rightarrow$  Alternating current)



**Smart house**





# Smart House Demonstration in Los Alamos(1/2)

An intelligent home energy management system (HEMS) that is equipped with smart devices, including smart meters and smart electrical appliances, and optimizes the use of real time pricing has been installed at a house, and the effectiveness of HEMS will be demonstrated.

## Kyocera Corporation

- Site coordination
- HEMS, PV, PCS, storage battery, thermal storage, in-home communication

## Sharp Corporation

- HEMS, home electrical appliances

## NEC Corporation

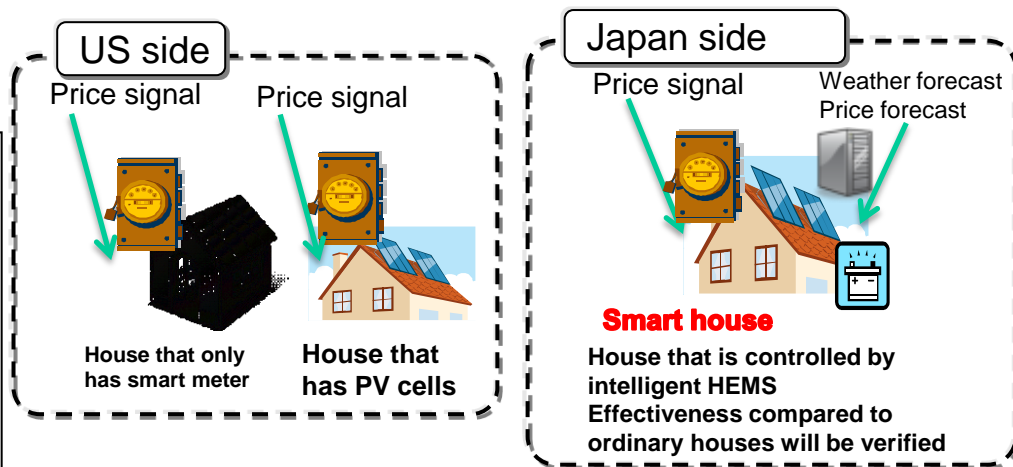
- Equipment to stabilize supply and demand

## *U.S. Side*

### LAC

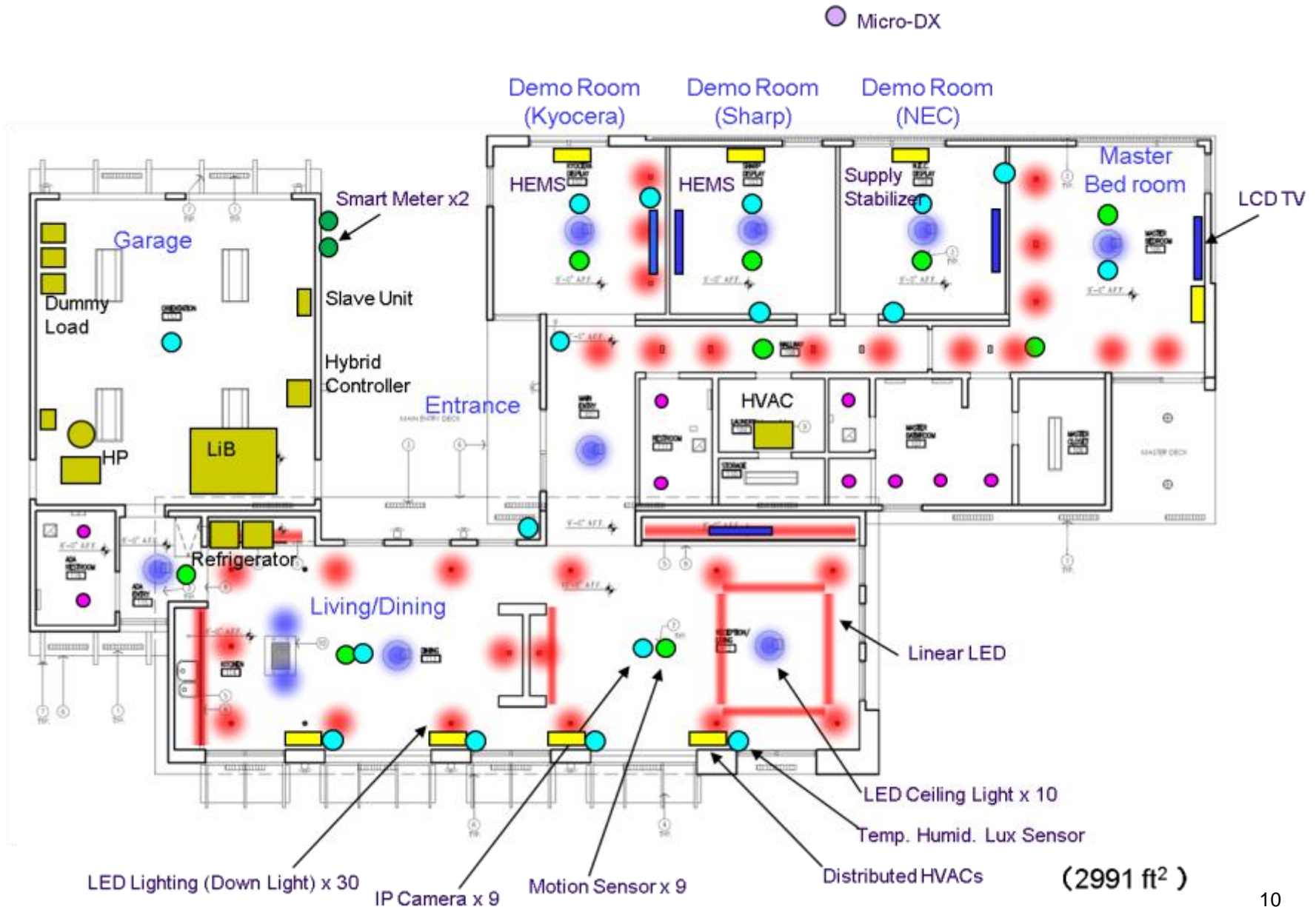
- Construction of a house for smart house

NEDO



- ✓ A HEMS that maximizes PV power generation, energy storage devices and IT electrical appliances based on demand response signals from grid systems, including price signals, will be demonstrated.
- ✓ An in-home system that supplies electricity in case of a power outage will be demonstrated.
- ✓ ZigBee will be used for in-home communication.

# Smart House Demonstration in Los Alamos(2/2) -A plane figure-

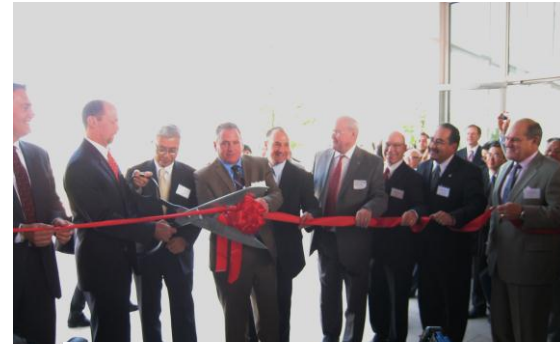


# Smart Grid Demonstration in Commercial Areas in Albuquerque (1/2)



Demonstration of a smart building that can **respond to demand from a power grid (independent operation)**, which is receiving increased attention after Japan's Tohoku earthquake, will be carried out in Albuquerque.

- Altitude: 1,600 m
- Population: 750,000
- City was established in 1706
- Sandia National Laboratories is located on an air force base
- A building in the Mesa del Sol development area will be utilized
- Clear skies 300 days a year



Ribbon Cutting Ceremony May 2012



NEDO demonstration site



Dispersed power, energy storage equipment and PV system



PV panels



Fuel cell



Battery room



BEMS



Heat storage



Gas engine

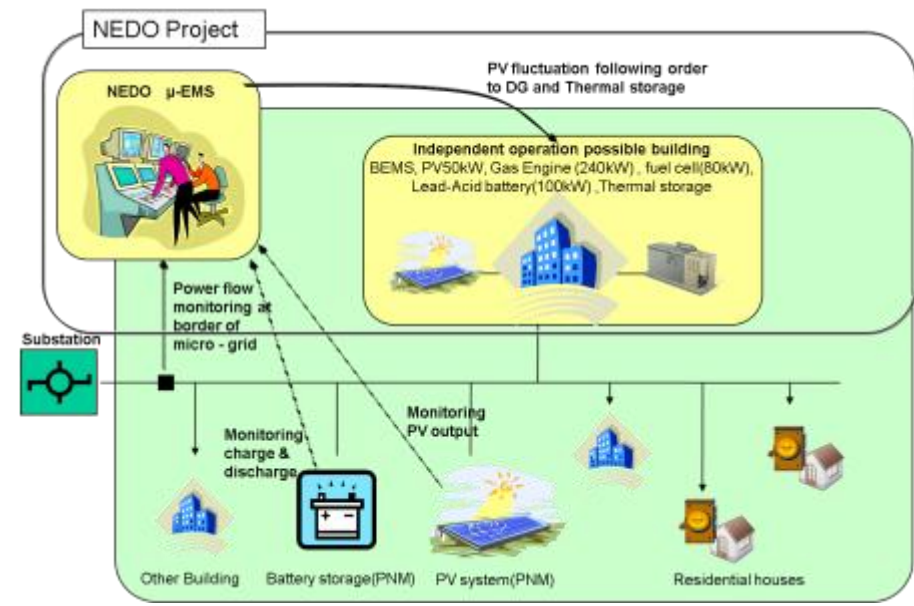
# Smart Grid Demonstration in Commercial Areas in Albuquerque (2/2)



In urban areas where large-scale equipment cannot be used due to space limitations, various energy storage devices have been installed at commercial buildings, and coordinated control with power grid systems as well as stand-alone operation will be verified.

NEDO

- Shimizu Corporation**
  - Site coordination, BEMS
- Toshiba Corporation**
  - $\mu$ -EMS
- Sharp Corporation**
  - PV
- Meidensha Corporation**
  - PCS
- Fuji Electric Co., Ltd.**
  - Fuel cells
- Tokyo Gas Co., Ltd.**
  - BEMS
- Mitsubishi Heavy Industries, Ltd.**
  - Gas engine
- Furukawa Electric Co., Ltd.**
- Furukawa Battery Co., Ltd.**
  - Lead-acid storage batteries
- Shimizu Corporation NA (Shimizu Corporation subsidiary)**
  - Field construction work
  - Field operation and measurement



## U.S. Side

- Mesa del Sol**
  - Offer building of the demonstration site
- PNM**
  - Cooperation between the project founded by DOE and the Japanese demonstration project
  - Interconnection of distributed generation
- SNL**
  - Collective research
- UNM**
  - Collective research
  - Field operation

- ✓ This project is designed to demonstrate a highly reliable building power system that can continue operating by using power storage cells, gas engine cogeneration, fuel cells, a heat storage tank, solar cells, etc. when grid connection to buildings is cut.
- ✓ It will be demonstrated that output fluctuations of solar cells in a distribution system will be absorbed by using EMS in buildings and grid and controlling building facilities.
- ✓ PLC will be used for control communication in buildings.





Existing load  
400kw

Thermal  
Storage

Chiller  
70USRT

Absorption Chiller  
20USRT

Cooling Tower

Grid

μ EMS  
Toshiba

BEMS  
Shimizu Corp

PV  
50kw  
Sharp

Dummy load  
100kw

Battery  
50kw/100kw  
160kwh  
Furukawa

Fuel Cell  
80kw  
Fuji Electric

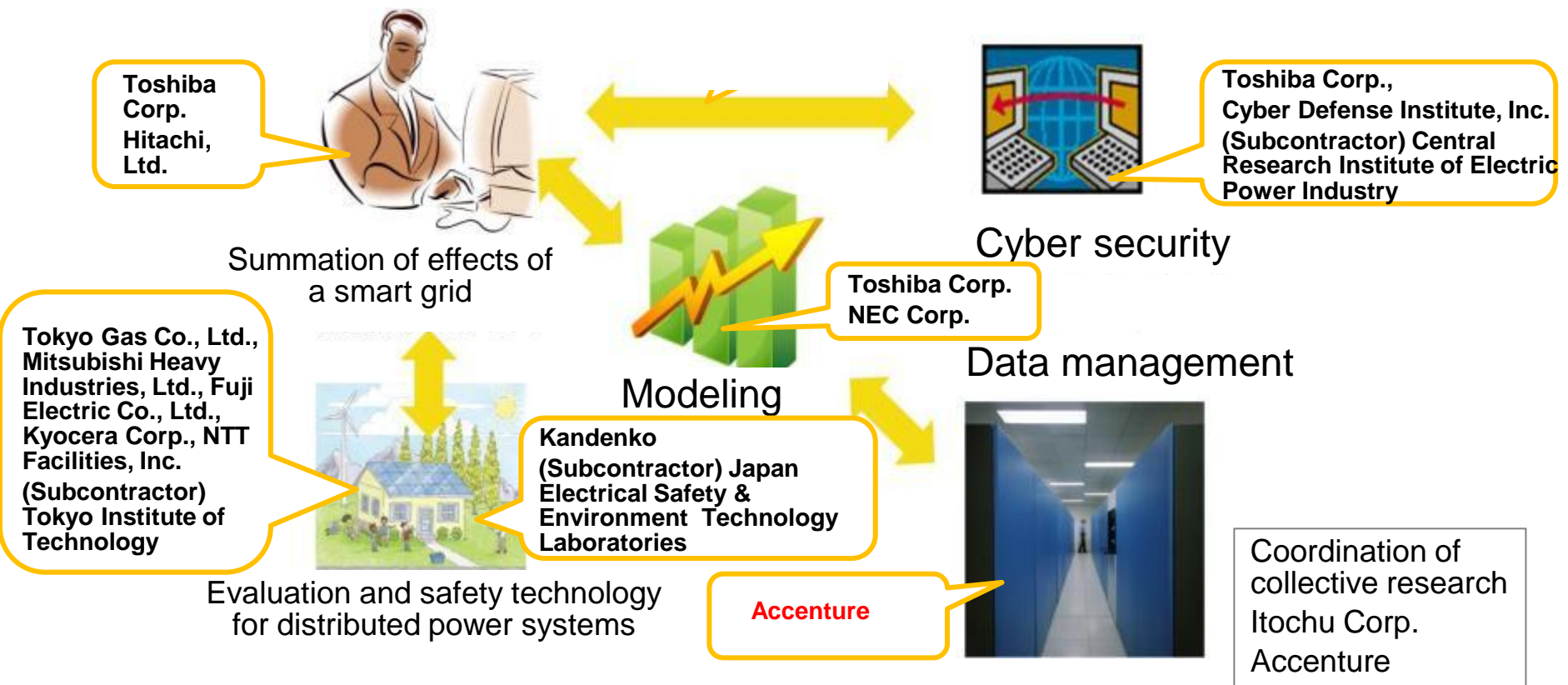
Gas Engine  
Generator  
240kw  
Mitsubishi H.I.





# Collective Research on Overall Project

The efficacy and effect of smart grid-related technologies on distribution systems will be evaluated. Japan-U.S. joint research for international standardization activities\* will be carried out.



\* Four use cases from the project have been registered with the Electric Power Research Institute Use Case Repository for the first time in Japan.