Smart Energy Business Briefing

July 10, 2012
NEC Corporation
Takemitsu Kunio (Senior Vice President)
An information society friendly to humans and the earth

Friendly to humans
- An information society that realizes a safe, secure, convenient and rich life with services anyone can use.

Friendly to the earth
- An information society that enables co-existence with the global environment and sustainable growth by efficient use of limited resources.

NEC aims at the achievement of two information societies through innovation.
1. **Business Overview**

2. **Ongoing Initiatives, Business Policies**
   - 2-1. Electrodes/Energy Storage Systems
   - 2-3. EV/PHV Charging Infrastructure
   - 2-4. Solutions for Utilities (electricity/gas/oil)

3. **Medium- to Long-term Growth Strategy**
Business Organization

Organizations

IT Solutions
Carrier Network
Social Infrastructure Solutions
Personal Solutions

Sales Business Unit
International Sales Business Unit

IT Services Business Unit
Platform Business Unit
Carrier Network Business Unit
Smart Energy Business Operations Unit

Energy

Sales/Operating income
(100 million yen)

Sales

FY2011
640
Actual

FY2012
740
Forecast

* Forecast as of July 10, 2012
Structure of the Smart Energy Business Headquarters

(Established April 1, 2012)

- Secure competitive edge by accumulating energy business-related assets
- Improve business momentum and speed by integrating related departments
- Reinforce ability to plan/develop the energy product and solutions business as OneNEC

Smart Energy Business Operations Unit

Smart Energy Business Development Division

Energy-related new business development

TAKASAGO,LTD.

Development/manufacturing/sales of power devices, quick charger, and telecommunications equipment

Public Utility Solutions Division

Business for energy utilities

Telecommunication Network for Power System

Electrodes Business Division

Electrodes business

LIB electrodes

NEC Energy Devices, Ltd.

Development/manufacturing of battery-related products

Automotive Energy Supply Corporation (AESC)

Storage battery packs/cells for vehicles

HEMS/Storage system
EV Cloud

Regenerated power-supply / Tester for power system interconnection

Telecommunication Network for Power System

Renewable energy

: Top-level product in the industry
### Global Energy-Related Issues

#### Industrialized nations
- High unemployment rate, deflation, low birth rate/aging societies
- CO₂ reduction, energy security
- Growth in renewable energy
- Safe, peaceful, highly efficient society
- Export and industrialize environment-related fields

#### Developing nations
- Surge in population/income
- Environmental problems due to population concentration in urban areas
- Secure energy/food/water
- Set up transportation/distribution systems
- Acquire technology in environment-related fields

### Energy-related problems at the forefront of social/economic issues

- **In the US:** Focus on the Green New Deal/Smart Grid Policy with reviewing shale gas revolution
- **In Europe:** Policy initiatives toward adopting a system of using over 20% renewable energy
- **Developing nations:** Striking balance between setting up electricity infrastructure/dealing with environment
- **In Japan:** METI unveils green growth strategy, Promote spread of storage batteries/renewable energy, support strengthening of international competitiveness
【Reference】Smart Energy Market Potential

Global market size in 2015 at tens of trillions of yen

(Reference) METI unveils fiscal support initiative (green growth strategy) that aims for Japanese manufacturers to post 10 trillion yen in smart energy-related sales in 2020

Total market size of the world’s smart cities by item

The global smart energy market will be worth tens of trillions of yen in 2015

Target market -- centering on storage batteries, EMS -- assumed at around 10% of overall market (several trillion yen)

Source: The world’s smart city guide 2012, by Nikkei BP Clean Tech Institute
Paradigm Shift: Comparison between Telecommunications and Energy

**Internet**

A world in which telecommunications firms alone support distribution of information

- **Exterior environment**
  - Trade friction

- **Technological reform**
  - BB & Mobile
  - Virtualization
  - Cloud Technology

- **System revision**
  - Unbundling of Telephone Network

A world in which the end user also participates in information distribution

- **Technological reform**
  - NCC VNO IT vendor

- **New entry**
  - Social Network
  - Web2.0

**Smart Grid**

A world in which only electric power companies support electric supply

- **Exterior environment**
  - Nuclear energy suspension
  - Self-supply rate 4%

- **Technological reform**
  - Energy creation & stored electricity
  - DR, electric power lending/borrowing

A world in which the demand side also participates in electric supply

- **System revision**
  - Purchase electric power companies
  - Revise Power Generation Business Law

- **New entry**
  - Aggregator PPS

- **System revision**
  - NCC VNO IT vendor

Progress in self-sufficiency/ decentralization/ diversification

- **Energy2.0**

Smart Energy Business

Purpose of business

- On the energy front, become a “global leading company that realizes a people- and earth-friendly information society through innovation” as targeted in NEC Group Vision 2017

Initiatives and main businesses

- Contribute to efficient energy use, cut in greenhouse gas by offering solutions that support self-sufficiency/distribution/diversification of energy use
  1. Electrodes/storage system
  2. Energy management system
  3. EV/PHV battery charging infrastructure
  4. Solutions for utility companies
The Next-Generation Energy Society as Envisioned by the Smart Energy Business

- Aims at an eco-friendly, stress-free society as problems from electricity concentration due to urbanization are resolved
- Promote large-scale adoption of renewable energy through spread of smart technology for electricity storage
- Contribute to resolving concerns about energy supply, greenhouse gas reduction

Smart City Energy Base

- Participate in a digital grid consortium with an aim to achieving highly efficient electricity distribution
Secure ability to grow in the energy market by achieving synergy between NEC’s assets, such as ICT, industry expertise, customer channels, and new assets created by the smart energy business.

- Cloud services
- Platforms
- Devices/Sensors
- IT services
- Career network
- Social infrastructure

Smart energy

- Energy cloud
  - Industry-based Solutions/Services
  - Data analysis/processing
  - M2M/Certified billing/Security
  - Loaded with cloud technology
  - Energy storage systems
  - Battery chargers
  - HEMS terminals
  - Electrodes/cells
  - Digital power source modules
  - Communication modules for Smart meter

M2M: Machine to machine
## Our Position Within the Global Ecosystem

### Business development with partner companies into supply-side/energy creation arena, centering on energy storage and ICT

<table>
<thead>
<tr>
<th>1 Demand side</th>
<th>Create energy</th>
<th>Store energy</th>
<th>Use energy wisely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversified electronic manufacturers</td>
<td>PV/wind power/geothermal energy generation</td>
<td>Energy storage system</td>
<td>ICT vendor</td>
</tr>
</tbody>
</table>

### Supply side

- Utilities/Heavy electric equipment

### Smart city

- Government agencies/General contractors

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### Global activity centering on business expansion to supply-side companies with partners in each region

#### [Domestic business]
- Promote independence/distribution/diversification
- SL activity utilizing ICT
- Policy guidance based on customer viewpoint

#### [Overseas business]
- Focusing on demonstration projects for utilities
- Developing large-scale energy storage systems
- Participating in Smart City Projects
Cooperative Work and Co-Creation Toward Forming an Ecosystem

- Secure economies of scale through lateral expansion in all business categories from devices to systems

Aim at forming an industry ecosystem, optimal positioning for our Company

- Optimal positioning
- Ecosystem formation

Diagram:
- Market co-creation
- Explore market
- Solutions
  - Cloud services infrastructure
- Systems
- Modules
  - Energy storage systems HEMS
- Devices
  - Batteries
  - Inverters
- Co-creation
  - Cooperation
  - Competition
- Exploration
  - Sales
  - Vertical integration

Business categories:
- Devices
- Modules
- Systems
- Solutions

Economies of scale through lateral expansion
1. Business Overview

2. **Ongoing Initiatives, Business Policies**
   2-1. Electrodes/Energy Storage Systems
   2-2. Energy Management System (EMS)
   2-3. EV/PHV Charging Infrastructure
   2-4. Solutions for Utilities (electricity/gas/oil)

3. Medium- to Long-term Growth Strategy
Electrode sheet

Electrodes

- The heart of the primary device (storage battery) in the smart energy arena

Energy Storage systems

- Various energy access networks and hub for bundling distributed power
- Create self-sufficient energy for the demand side through coordination with Energy Cloud
Electrodes Business

- Strength in volume efficiency and vehicle quality through cooperation with Nissan Motor Company
- Exploration of new tie-up partner by utilizing track record in volume efficiency

NEC
NEC Energy Devices, Ltd.
Electrodes

AESC
Batteries for vehicles

Nissan Motor Co.
Electric vehicles/Hybrid vehicles

49% invested

GS Yuasa Corp.
Other companies

51% invested

Other companies’ clients

Able to maintain an overwhelming cost advantage by securing further economies of scale
# Energy Storage Systems

- Exploring markets with partners by utilizing our competitive advantage in storage batteries
- Accelerated commercialization based on experiences in Japan’s demonstration projects, including YSCP

## System Size and Application

<table>
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<tr>
<th>Application</th>
<th>System size</th>
<th>For the supply side</th>
<th>For the demand side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power transmission/distribution</td>
<td>1MWh~150MWh</td>
<td>Adjust change in demand</td>
<td>Communication base station</td>
</tr>
<tr>
<td>Communication base station</td>
<td>Peak hours reduction/Back-up/Natural energy integration</td>
<td>Peak hours reduction/shift Back-up</td>
<td></td>
</tr>
<tr>
<td>Building, commercial facilities</td>
<td>10kWh~50kWh</td>
<td>10kWh~300kWh</td>
<td>For offices, homes</td>
</tr>
<tr>
<td>For offices, homes</td>
<td>1kWh~15kWh</td>
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(For the YSCP verification project)

### Medium- to large-scale

- 250kWh (Prototype)
- 50kWh (Prototype)

### Small-scale

- 5.5kWh (Mass production equipment)
- 0.25~1.5kWh (Mass production equipment)

YSCP: Yokohama Smart City Project
Developed and adopted regional energy management for an existing large-scale urban area through coordinated use of CEMS and HEMS/BEMS/EV/Scada battery

Storage batteries for supply/demand Adjustments (Toshiba Corp., Hitachi, Ltd., Meidensha Corp., NEC)

Demand-side (users) storage battery

Storage battery Scada

Large-scale energy storage system for utilities

HEMS for housing complexes

HEMS for condos/apartments

HEMS for detached homes

Scada storage battery

Collection/delivery system

Medium-scale energy storage system for demand side

Charging stations (JX-E)

Chargeable/dischargeable EVs

Next generation BEMS (Meidensha Corp., NEC)

Large-scale energy storage system for demand side

Extracted from YSCP-related materials

HEMS: Home Energy Management System
BEMS: Building Energy Management System
CEMS: Community Energy Management System
SCADA: (Control System) Supervisory Control And Data Acquisition

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YSGP Large-Scale Storage System Field Test (~FY2014)

- To enable concurrent use of new and old battery modules and improve operational management
- To adopt BEMS, SCADA storage system in cooperation with Meidensha for cooperative CEMS experiment

(Building Energy Management System)

Next generation BEMS

(Supervisory Control And Data Acquisition) (real time)

SCADA storage system

Yokohama World Porters
(Output : 100kW  Capacity : 250kWh)

- Proof of success in demand/response system through CEMS coordination

TEPCO Tsunashima substation
(Output : 250kW  Capacity : 250kWh)

- Verified assessment of storage capability in the form of final adjusted reserves that CEMS should be able to provide
- International standardization of the CEMS interface
An integrated system of power storage and charging for next generation SS in cooperation with JX Nippon Oil & Energy Corp. Developed, adopted (BCIS); loaded with BMU technology that enables capacity expansion.

Proof of success in regional demand/response through coordinated use of CEMS and reducing electricity consumption during peak hours while several high-speed charging equipment were in operation.

Planning mass production of storage systems for small/medium-sized field offices in FY2013.

50kWh storage system

SS : Service Station
BCIS : Battery and Charger Integration System
BMU : Battery Management Unit
Small-Scale Storage Systems

Delivery starts for small-scale energy storage system that can be used with HEMS/Cloud (July 2012)
Reducing electricity consumption during peak hours, peak shift plans, blackouts at the office and at home

- For peak shift plans during the day and night/energy-saving effect from coordinated use with HEMS
- Flexible response to changes in electricity charges from coordinated use with cloud
- Remote monitoring support
- Outdoor installment (waterproof/dust proof/fireproof/low noise)
- Capacity around 5.53kWh Output 2kW
- Economical
- Network
- Remote control panel
- Support for a peace of mind
- Confidence in it being ALL JAPAN
- Safety
- Durable Weather-proof
- Integrated production in Japan
- Ability to respond to natural disasters such as typhoons and earthquakes
- Reduce potential damage to residential buildings
- Focus on safety
- Economy
- Confidence in it being ALL JAPAN
- Weather-proof

Small-Scale Storage Systems

Small-Scale Storage Systems

Small-Scale Storage Systems
Exploring Small-Scale Energy Storage Markets with Partners

- Exploring markets with partners in various industries
- FY2013 delivery target: 15,000 units

### PV industry
Coordinated use of stored energy with electricity purchasing system
Offer PV system solutions

### Housing+Reform Industry
Offer solutions for energy-creation/energy storage that are to be the core of the smart house business

### Air-conditioning industry
Offer solutions to cut electricity consumption of heating pumps that use air-conditioning during peak hours

### Reconstruction support
Offer solutions to support achieving self-sufficient electricity at local governments, schools, public facilities in disaster-stricken areas

### Gas industry
Offer solutions to support optimal operational efficiency of cogeneration/fuel cells, self-sufficient energy

Orders received from more than 10 domestic companies (as of July 10, 2012)
1. Business Overview

2. Ongoing Initiatives, Business
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   2-4. Solutions for Utilities (electricity/gas/oil)

3. Medium- to Long-Term Growth Strategies
Energy Management System Business: HEMS

- Enable visualization of electricity throughout the home, optimal control system (46% domestic share in FY2011*) by partnering with housing manufacturers, etc.

- Devices, which are eligible for government subsidy, have been approved for conforming to ECHONET Lite specifications; secured connectivity with energy-related devices, such as smart meters, that are expected to be used widely going forward.

- Makes developing information services utilizing cloud computing possible

*Based on a domestic company survey

**Visualizations and Diagrams**

- **Detection**
  - Amount of electricity generated
  - Amount of electricity used
  - Amount of electricity stored
  - Amount of electricity purchased

- **Control**
  - Household appliance control (energy-saving operation)
  - Set operational mode to storage battery
  - Sell/buy electricity

- **Visualization of energy**
  - Image of an HEMS display
  - Simulated projection, optimization
    - Electricity consumption cut during peak hours
    - Battery charged/discharged

- **Database/Analysis**

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*NEC*
Direction of the HEMS Business

Expanded range of management/control functions and services menu with households as the starting point

<table>
<thead>
<tr>
<th>FY2011</th>
<th>FY2012</th>
<th>FY2013</th>
<th>FY2014</th>
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<tbody>
<tr>
<td>Expanded range of management/control functions</td>
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</table>

Pursue energy-saving results for users

Toward the HEMS•BEMS aggregator business

Pursue customer value for businesses

Existing HEMS

Data analysis in coordination with cloud

Storage batteries

Visualization

B route

ECHONET Lite

PV/FC monitoring

Energy-saving consulting

Energy-saving alarm

Crime prevention

Send information on everyday life

CRM

PV: Photovoltaic batteries  FC: fuel cells  Aggregate: information gathering/analysis service
Moving Toward the HEMS/BEMS Aggregator Business

Move into the HEMS/BEMS aggregator business based on the HEMS and building automation businesses. Support energy-saving in residential areas and housing complexes, demand response (DR) in small- to medium-sized buildings.

*Selected as a BEMS aggregator business as per METI's Project to Promote Introduction of the Home Energy Management System (FY2011 third supplementary budget)

Electric power companies

HEMS aggregator

BEMS aggregator*

Energy cloud

Housing manufacturers

Management companies

Small, high-pressure users

Housing (residential areas)

Housing complexes

Small- to medium-sized buildings/Stores

(xEMS aggregator: Operator that manages energy usage information)
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3. Medium- to Long-Term Growth Strategy
Utilize electronic money infrastructure cultivated through POS, vending machines, etc., and expertise in authentication and electronic money payment
⇒ Offer integrated EV/PHV cloud charging service

Develop as a leading-edge business with an eye to EV/PHV’s full-fledged popularity starting in 2020

For users
Charging station map
Member authentication/electronic money payment
Remote operational management for charging stations

For businesses
Energy management
Cloud services

Quick chargers
20-50 kW quick charger; conforms to CHAdeMO standards
Felica® Reader/Writer

Standard chargers
Charging controller operates/manages several chargers
Communication cable
Standard chargers
Build/Develop a Universal Certification System with Oil and Gas Wholesalers

- Offer a certified cloud-based billing service for EV/PHV that can be used for various businesses
- Enable universal use of chargers set up by oil and gas wholesalers with membership cards issued by various companies

Oil and gas wholesaler centers

- Company A Center
- Company B Center
- Company C Center
- Company D Center

Use membership cards issued by various companies

- Company A membership card
- Company B membership card
- Company C membership card
- Company D membership card

EV/PHV Cloud

Developing nationwide for major chain stores, local municipalities, etc.

Also planning to advance into overseas smart city projects
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3. Medium- to Long-term Growth Strategy
Solutions for Utilities

Abundant business experiences in ICT solutions for domestic utilities (electricity/gas/oil) for establishing stable electric power supply network (domestic share over 40%*)

- Electric power protected information transmission system
  - (Microwave transmission device/Optical transmission equipment/Carrier relay signal transmission equipment)

- Electric power supply information system for suppliers, monitoring control system

- Communication network monitoring system for managing electric power facilities, visual transmission system

Example of the electric power protected information transmission system continuing to operate by separating off the site affected by a power supply accident (Microwave transmission equipment X carrier relay signal transmission device)

Move into the smart energy arena by making use of the experience shown above

- Smart meter information gathering/management infrastructure (AMI: Advanced Metering Infrastructure)
The Smart Meter Information Gathering/Management (AMI) Integrating Business

1. Enter into the AMI** integrating business based on track record of establishing a stable electric supply network and demand-side solutions such as HEMS
2. Aim to grow overseas business in developing nations where electricity metering infrastructure is weak

* MDMS : Meter Data Management System
** AMI: Advanced Metering Infrastructure

* Diagram elements:
  - Smart meter
  - NEC locations (wireless communication module)
  - Electric power companies
  - Communications layer
  - Administrative layer

* Chart elements:
  - Administrative system/Sales system
  - MDMS*, Data analysis/service
  - Coordinated carrier network/Certification system
  - Facilities/Equipment/Route management system

* MDMS : Meter Data Management System
** AMI: Advanced Metering Infrastructure

Integrate a wireless network

Integrating Business

Enter into the AMI** integrating business based on track record of establishing a stable electric supply network and demand-side solutions such as HEMS

Aim to grow overseas business in developing nations where electricity metering infrastructure is weak
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3. **Medium- to Long-Term Growth Strategy**
Once smart energy infrastructure is established on the demand side, a new energy services market will be spawned by system reforms, entry by new businesses.

### 2012 - 2014
- Establishing a smart infrastructure on the demand side
  - Renewable Energy
  - Energy Storage Systems
  - Fuel Cells
  - BEMS
  - ECHONET
- ESCO
- PPS
- Demand Response

### 2015 - 2020
- New energy services markets
  - Smart area operators
  - CEMS
  - Regional electric power lending/borrowing
  - Energy security management
  - Energy consulting
  - xEMS aggregator

#### System reforms
- New fee system/FIT
- Separating sending/receiving electricity
- Liberalization of sending/receiving electricity
Medium- to Long-Term Business Strategy

Overview of ongoing initiatives
- Domestic business activity: Co-create market for demand side with business partners
- Centered on device components: Launch electrodes/energy storage systems and EMS business
  - Prepare to move into services business by setting up construction maintenance/training of necessary personnel/rental system

Medium-term business activity
- Overseas business: Large-scale storage batteries for supply-side businesses, power source for wireless base stations
- Focus on solutions services: Energy Cloud, smart area services

Shift main businesses in line with the smile curve, which moves in line with market growth
Overseas Business Development

- Partnering with electric power companies:
  - Supply-side network adopting energy storage facilities
- Create a smart power source for communications base stations:
  - Utilize customer channels of existing communications carriers
    (PASOLINK users in at least 160 countries around the world)
- Support domestic companies’ entry overseas:
  - Work on local needs to stabilize infrastructure

<table>
<thead>
<tr>
<th>Large-scale storage systems</th>
<th>Medium-sized storage systems</th>
</tr>
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<tbody>
<tr>
<td>Partner with local companies</td>
<td></td>
</tr>
<tr>
<td>• Procure power conditioners</td>
<td></td>
</tr>
<tr>
<td>• Manufacturing consignment</td>
<td></td>
</tr>
<tr>
<td>Partner with local companies</td>
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<tr>
<td>• Procure solar power generating system</td>
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- Energy storage system for the supply side for use by electric power companies in Europe, etc.
- Green power system at wireless base stations for developing nations
Global Business/Field Test Initiatives

Market entry via partnering in various regions, government-related field tests
Expedite business development via partnering

Europe
- EV, Energy storage, EV infrastructure
  - ENEL (electric power company, Italy)
    - Success in next-generation smart grid

Japan
- EV, Energy storage, HEMS, Smart meters
  - Electrodes for electric/hybrid vehicles
    - (for automotive energy suppliers)
  - Basic agreement to offer electrodes to GS Yuasa
  - Tohoku region hit by the earthquake
    - Orix Corp. energy management and control system using storage batteries
  - Sekisui Chemical Co., Ltd, etc. (storage batteries for residential use/HEMS)
  - Smart meters/Automatic meter reading system, etc.

North America
- EV, Energy storage, EV infrastructure
  - EPRI (Electric Power Research Institute, US)
    - Field test success achieved in storage batteries for suppliers
  - NEDO New Mexico field test

Asia
- Smart meters, xEMS, Energy Storage
  - Malaysia
    - Basic research toward realizing a green township
  - Indonesia
    - Infrastructure/Systems
      - Consignment business such as research on promoting exports
  - India
    - Survey on adopting energy management technologies for mobile phone base stations

Brazil
- BEMS, Microgrid
  - Taking part in a smart city development project

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Coordinated Service Utilizing Energy Cloud

Energy Cloud at the core of coordinated services between EMS and others

C&C Cloud
Coordination among cloud services

Energy Cloud

Coordination among Energy Management Systems

Housing complexes, specialized buildings, regions, etc.

BEMS  HEMS  SEMS  xEMS  SS (Quick chargers)

Storage systems
Accommodating demand-side systems as a common service base for xEMS aggregators, etc.
Moving Toward the Smart Area Services Business

Promote efficient use of regional energy by integrating solar batteries, storage systems, EMS
Field tests conducted at NEC’s Tamagawa and Fuchu plant sites
Aiming to operate in leading smart business regions by 2015

On site/Between sites (proof of success)

[Tamagawa plant site] (coordinated xEMS power storage)
  - Supply/demand control, monitoring control, storage battery charge/discharge control, etc.
  - (March, 2012-)

[Fuchu plant site] (xEMS proves to be successful)
  - Supply/demand control, monitoring control, storage battery charge/discharge control, etc.
  - (FY2013~)

NEC’s application ~ Aim to optimize at the community level

<Supply-side energy>
- Heat storage tanks
- Fuel cells
- Lithium-ion storage batteries

<Supply-side water power>
- Solar power
- Geothermal power
- Cloud

Energy savings/
Peak shift plan

Energy savings/
Peak shift plan

Expertise

Offer solutions

Develop a business in the form of smart area services
Integration of energy component technologies × ICT
Positioning and creating an eco-system with partners
Move into the services arena utilizing C&C Cloud

Move Toward the Early Establishment of Energy as the Fourth Pillar

* Forecast as of July 10, 2012
Empowered by Innovation

NEC
CAUTIONARY STATEMENTS:
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