〈ESMAP_World Bank〉

Demonstration Trends of Smart Grid Business Model in Korea

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Korea Smart Grid Institute

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01 About KSGI

Company Overview & Business Area

General Information

- **Non-profit foundation** (Based on Civil Act, Article 21)
- **Public service-related organization** (quasi-governmental agency for MOTIE, Rep. of Korea)
- **Institution assisting in promotion of SG industry** (Smart Grid Construction And Utilization Promotion Act, Article 19)

Major Service

- **Survey and research** on policies and systems for the **promotion of the smart grid industry**
- **Implementation** of projects for the substantiation of **smart grid technologies**
- **Distribution and diffusion** of technologies, instruments, and products for **smart grids**
- **Protection** of **smart grid information** and ensuring **safety**
- **International cooperation** in the field of smart grid and **supporting export oriented industrialization**
- Operation of **Smart Grid certification** and **interoperability Laboratory**
- **Nationwide** Smart Grid **publicity** and **raise awareness**, etc.

History

2007
Established as Center for 'Power IT National Program'

2009
Launch of "Korea Smart Grid Institute"

Jeju SG Test-bed
(world's largest SG demonstration complex, 153 technology verifications, 9 BM excavations, etc.)

2012
Designated as Institution Assisting in Promotion of Smart Grid Industry

2012 ~2015
Smart Meter & ESS Roll-Out

2016 ~2018
Smart Grid Deployment across Metropolitan Areas
(150,000 AMI units/500 EMS locations in 16 metropolitan local governments)

2018
Support for establishing the 2nd Smart Grid Basic Plan('18~'22)

2020~
Household Smart Power Platform Project (AMI)
(Expansion of AMI supply to 5 million units)

Launched JeonNam Regional Office
('22. Naju)

Support for establishing the 3rd Smart Grid Basic Plan
('23~'27)

2023

Mission & Vision

MISSION	• Creating efficient energy use environment and creating new growth-engines through the establishment of safe and innovative Smart Grid infrastructure
VISION	• Promotion agency for Smart Grid industry leading innovation in energy environment
Business Target	• Strengthening institutional competitiveness by the deployment of Smart Grid based on the energy big data and distributed energy
Business Strategy	• Establishment and dissemination of energy big data and distributed energy • Supporting reinforcing the domestic Smart Grid industrial Competitiveness • Creating the Operating environment for active business expansion
Action Plan	Accelerating digital transition of energy industry Deployment of local Smart Grid based on distributed energy Enhancement of domestic Smart Grid industrial competitiveness. Strategy planning in enhancing the institution's sustainable competitive edge

Jeon Nam Regional Office

01 Digital Energy Transition

- Expansion of SG infrastructure such as AMI
- SG infrastructure-based service development
- Expansion of energy big data utilization

02 Invigoration of Distributed Energy

- Expansion of MG demonstration business
- Demonstration of new energy business service
- Establish the foundation for deployment of new & Renewable Energy

03 Strengthen Int. Competitiveness of Korean SG Industry

- Customized consulting service
- Standardization/Certificates
- Supporting overseas business expansion

"KSGI's JeonNam & Regional Office

Growing as a Regional Innovation Hub"

02
Smart Grid Overview

Concept & Components

※ Concept

The power grid that maximizes energy utilization efficiency by applying information and communication technology to the power grid and supplying electricity through means such as exchanging information between suppliers and users in real time

< Components >

③ Service		Demand Response, MG, EVC
② System	SW	Price, Market
	HW	SCADA, DAS
① Device & Product	IT	AMI, IoT
	Electricity	Electric power facilities

Source: MOTIE(2018)

< Inter-Industrial Convergence Structure >

Electricity		ICT		Manufactur-ing		Convergence
Generation, Transmission, Distribution	+	Computer, communi-cation	+	AMI, ESS	=	EV, AI, RE, DATA




02. Smart Grid Overview

Policy Background

Response to climate change

- Transformation of the New Climate Regime under the Paris Agreement
- Expansion of new and renewable energy

Energy efficiency improvement

- Aim to improve 46.7% of energy unit by 2030
- Distributed and real-time control of power demand

Leading the Fourth Industrial Revolution

- Integration of technologies such as IoE, IoT, big data, and AI with smart grid

02. Smart Grid Overview

Background of demonstration

Goals

- Smart energy town promotion by integrating Smart Grid technology with business model
- Ensuring feasibility for region-based Smart Grid deployment

Technical concept

4th Industrial Revolution technology + Smart city or town

<Combining Smar Grid with AICBM technology>

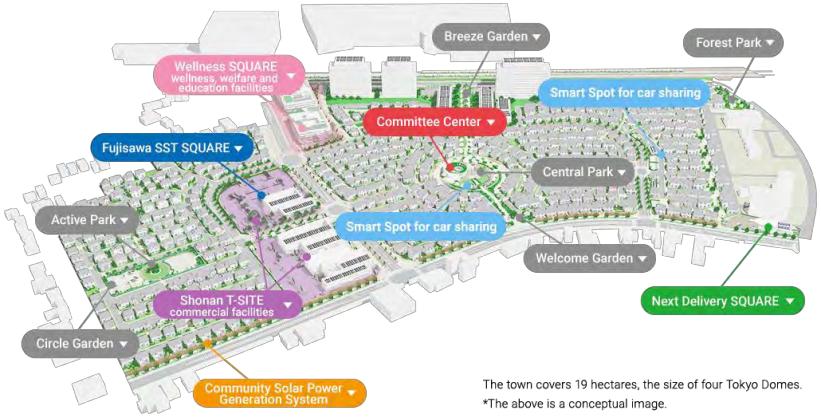
03
Overseas Cases Study

03. Overseas Cases Study

(1) Fujisawa SST, Japan

〈Overview〉

- Goal : Supply of renewable energy at least 30% of energy consumption
- Period : 2008 ~ 2018
- Participants : Panasonic, NTT, Tokyo Gas etc.



Source: fujisawasst.com

Smart HEMS	Community Solar	EV Sharing	Community Center
• 600 single-family homes • Solar, ESS, and IoT • Active Device • Passive Design	• Joint solar power system on municipal public land • Emergency power source for community • Small unit system, can be moved by unit	• 'Mobility Concierge' provides one-stop service • Battery Sharing Service • V2H in case of emergency	• Energy reports and consulting • implementation of the point system • Provide SOY LINK Community Platform

(2) Toyota Ecoful Town, Japan

〈Overview〉

- Goal : Demonstration of Low Carbon Transportation System
- Period : 2011 ~ 2015
- Budget : Total 23 billion yen
- Participants : Toyota, Unison and 26 other companies

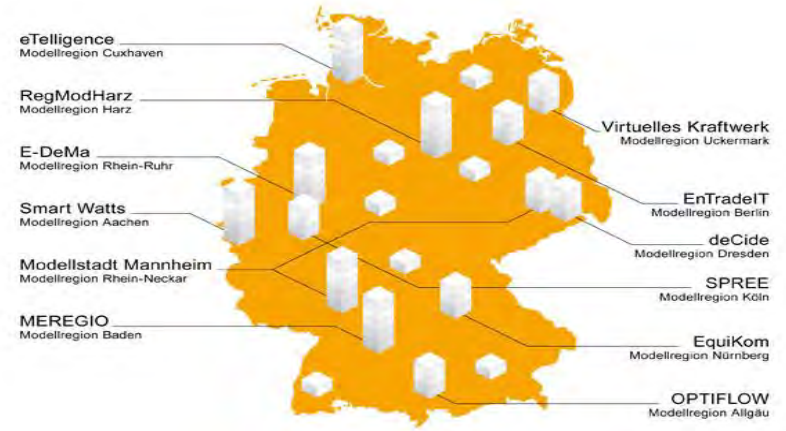
Smart House	EV	Hydrogen Charging Station
• 67 households • Solar + HEMS+ESS • property tax deductions, subsidies • Energy information System • Eco-Point System • DR service	• Electric vehicle sharing service • 100 electric vehicles • 60 charging stations	• 10 hydrogen cars, 1 hydrogen bus • Hydrogen rechargeable amount: 1,100 yen/kg • Amount of hydrogen car: 7.3 million yen (subsidized 2.33 million yen)

- Active demonstration of household ESS and small renewable energy facilities
- Revitalizing resident participation through incentives such as the point system

(3) E-Energy, Germany

〈 Overview 〉

- Goal : Future Integrated EMS
- Period : 2008 ~ 2013
- Budget : EUR 140 Million
- participants : 42 Companies



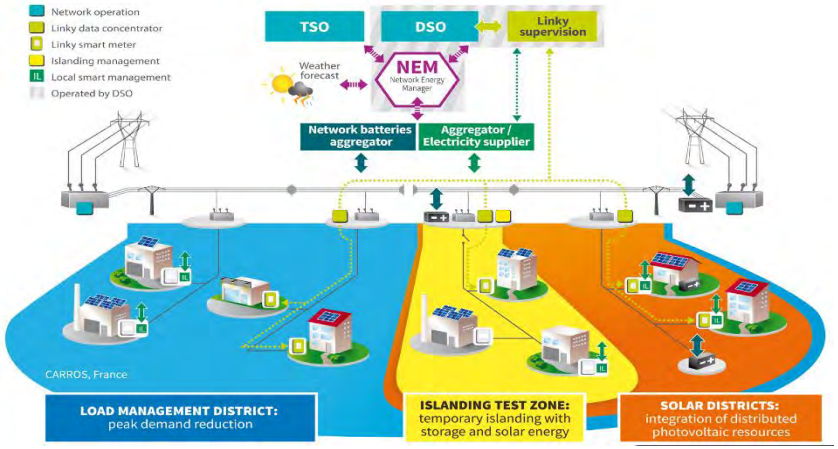
E-DeMa	eTelligence	MeRegio	moma	RegModHarz	Smart Watts
Rhein-Ruhr	Cuxhaven)	Gottingen	Mannheim	Harz	Aachen
Smart meters, HEMS, CHP	Smart meters, Wind, Solar, CHP	Smart meters, Control Box, ESS, Cloud-EMS	CEMS, Energy management equipment, An energy butler	Solar, Wind, Biogas, Fuel cells, EMS	Smart meters, HEMS, An Intelligent outlet

- Promote integration of renewable energy systems focused on increasing power supply flexibility
- Use energy storage as a means of moving loads and providing flexibility
- Device characteristics, cost-effectiveness, convenience, reliability, time effectiveness, etc.

(4) Nice Grid, France

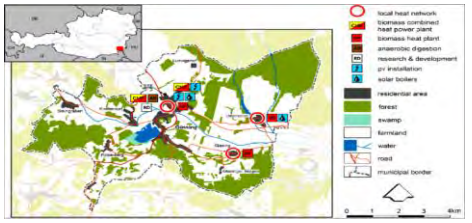
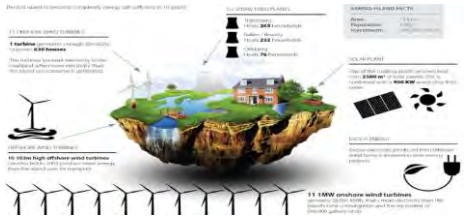
〈Overview〉

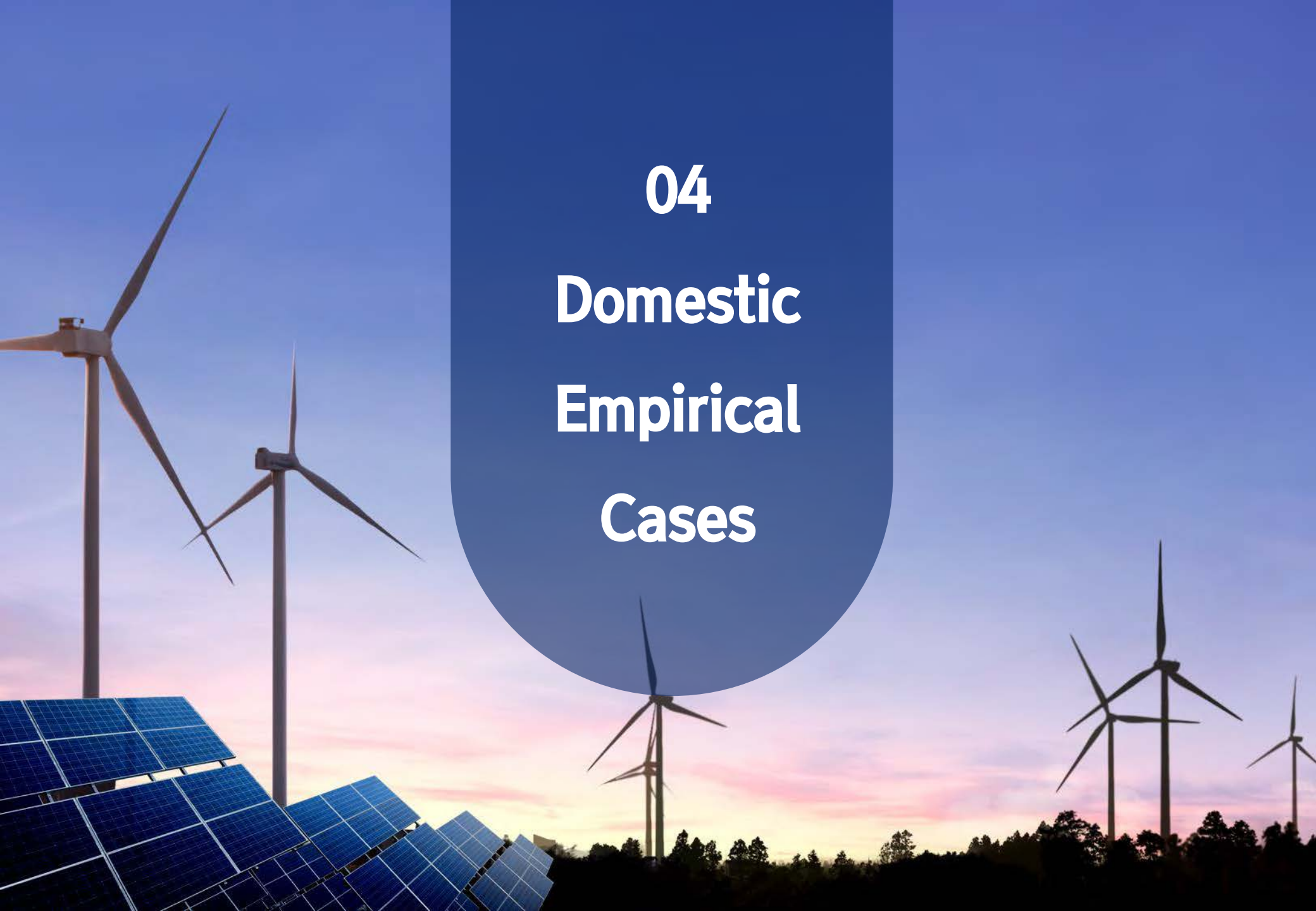
- Goal : Development of Solar-ESS-AMI Integrated Intelligent Distribution Network
- Period : 2012 ~ 2016
- Budget : Total EUR 3 million
- Participants : A Total of 12 Companies



Solar District	Peak Demand Reduction District	Islanding District
• ESS operation to integrate the power grid of surplus solar power • When solar production is high, electricity consumption is induced	• Voluntary power consumption reduction during peak hours • 220 households and 12 companies • Parallel reduction of public lighting • 1.3MW ESS Deployment	• Energy independence model • Frequency and voltage management • Resynchronization of electricity transmission
• Time zone shift of 22% of electricity consumption (12:00 → 16:00)	〈Peak Power Reduction〉 • Household sector: 21% • Corporate sector: 3~9% • Public lighting: 30%	• Maintain 5 hours of independent driving

(5) Region based Micro Grid

구분	Germany(Feldheim)	Austria(Guising)	Denmark(Samsoe)
Concept map			
Regional Overview	- Population 150 - Near Berlin - Agricultural and livestock industry base	- Population 26,000 - Agricultural base in southern Austria	- Population 4,000 (Elderly Population 20% or more) - Island area - Slaughterhouse industry base
Infra	- Wind Power 122.6MW - Biogas 526kW - Solar Power 2,748MWh(annual), - ESS 10MW	- Waste-to-energy power plant, - Heat/electricity supply - European Renewable E-Center - Solar power, BEMS	- 21 wind turbines (11 on land, 10 offshore) - 3 biomass turbines - 1 solar turbine
Result	100% renewable energy Achieving 0% unemployment rate	Annual revenue of 9 million euros, creation of 1,100 jobs	100% renewable energy



04 Domestic Empirical Cases

04. Domestic Empirical Cases

(1) Future Smart Grid Experience – Overview

❖ **Goal** → Building a consumer-centered energy community using the latest smart grid technology and BM

❖ **Area : Seoul, Gwangju**

❖ **Period : 2019. 10 ~ 2023. 9 (Total 4 years)**

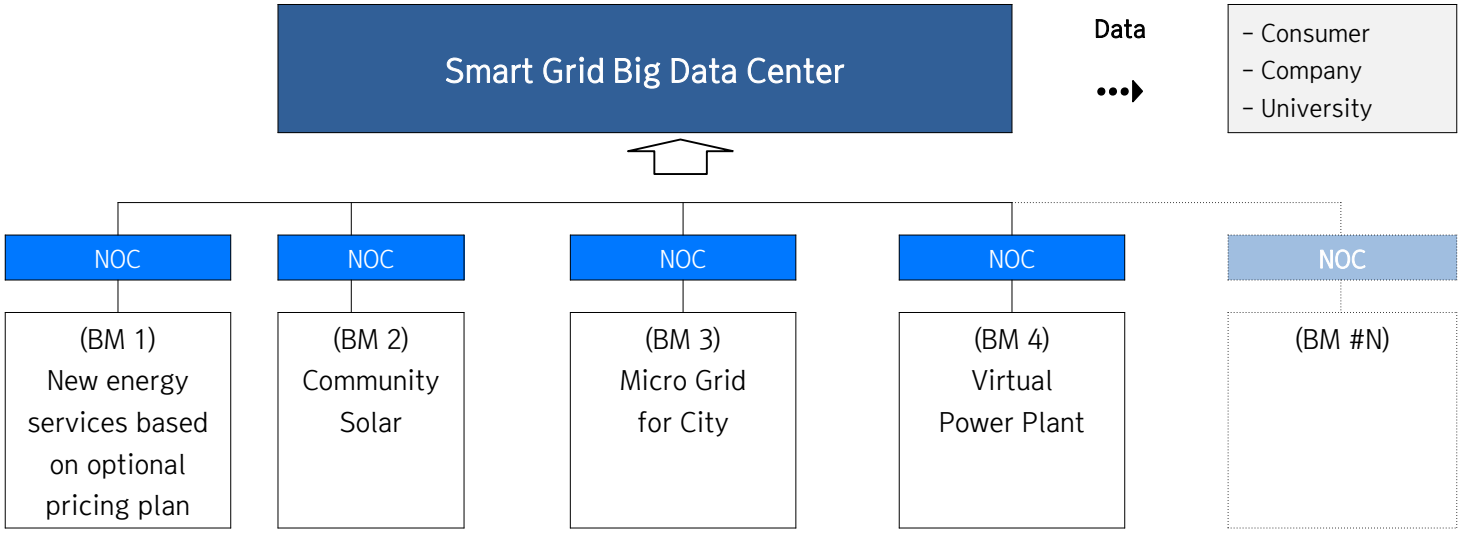
❖ **Participants : (Gwangju) SKT, KEPCO, Hyundai Motor, Hyosung, KSGI, etc.**
(Seoul) Omnisystem, KDHC, KOSPO, etc.

04. Domestic Empirical Cases

(1) Future Smart Grid Experience Complex – Smart Grid Big Data

R&D Area

- Common information model (CIM)
- Smart Grid Big Data System for comprehensive management and analysis of empirical data
- Operation of portal service in smart grid service experience complex



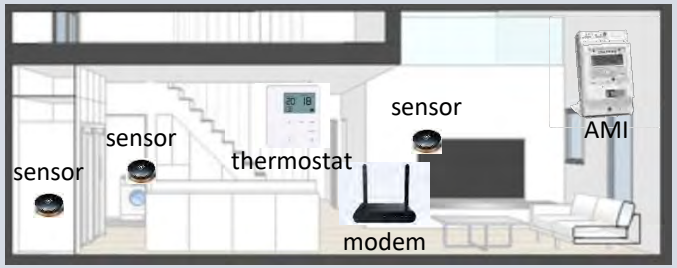
04. Domestic Empirical Cases

(1) Future Smart Grid Experience Complex- New energy services based on optional tariff system

R&D Area

- Applying the residential-use rate system
- HEMS to effectively manage and control energy use in homes
- Convergence of various business models with economic feasibility under the TOU rate system

Home

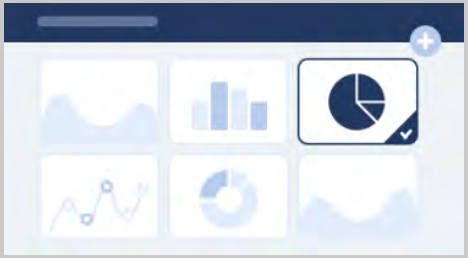


- TOU pricing plan for residential use
- Providing energy data
- Payment of service fees

TOU based energy data

New energy services

Service Provider

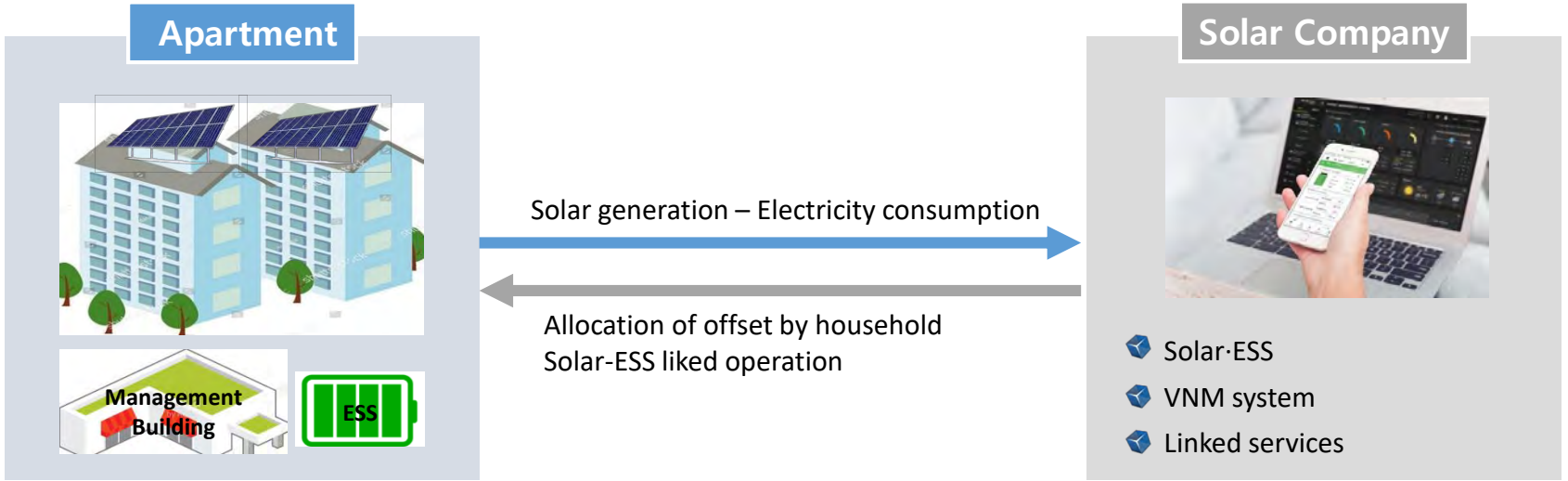


- Energy data analysis
- Operation of HEMS
- Providing services

(1) Future Smart Grid Experience Complex – Solar Sharing Community

R&D Area

- Apartments with solar power generation facilities, priority is given to apartments that can secure economic feasibility and resident acceptance
- ESS to improve solar power generation efficiency and expand reduction of individual household
- AMI infrastructure to measure solar power generation and individual household consumption
- Development of Virtual Net Metering (VNM) system technology for multi-family housing
- Development of technology to optimize performance of solar power community components



(1) Future Smart Grid Experience Complex – Urban Micro Grid

R&D Area

- Selection of sites with infrastructure (new and renewable energy, ESS, etc.) that can supply electricity among major facilities such as government offices and schools in the city
- Establishment of distribution networks for stable supply and transaction of electricity within the Micro Grid, BEMS for each facility, and CEMS for comprehensive operation and control
- Verification of new technologies and services related to the construction of urban Micro Grids

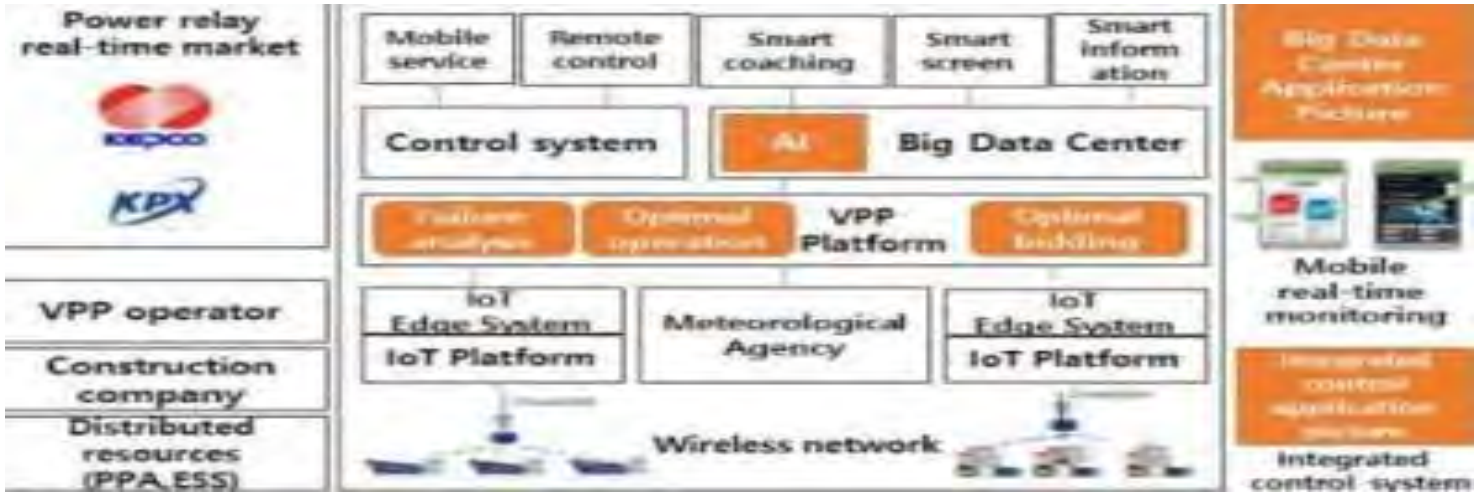
구분	비상시	평상시
전력전송 타임	한전 전력공급 차단시	피크전력 발생시(요금적용전력 초과)

04. Domestic Empirical Cases

(1) Future Smart Grid Experience Complex – Distributed Resources Integrated Power Plant

R&D Area

- Manage distributed energy resources such as small-scale renewable energy and ESS as a single power plant using cloud-based SW
- Verification of a model that supplies and trades electricity like a central power generator in the electricity market while maintaining an appropriate level of power generation
- Responding to local renewable energy fluctuations, stabilizing and improving power quality



Source: SDPM homepage

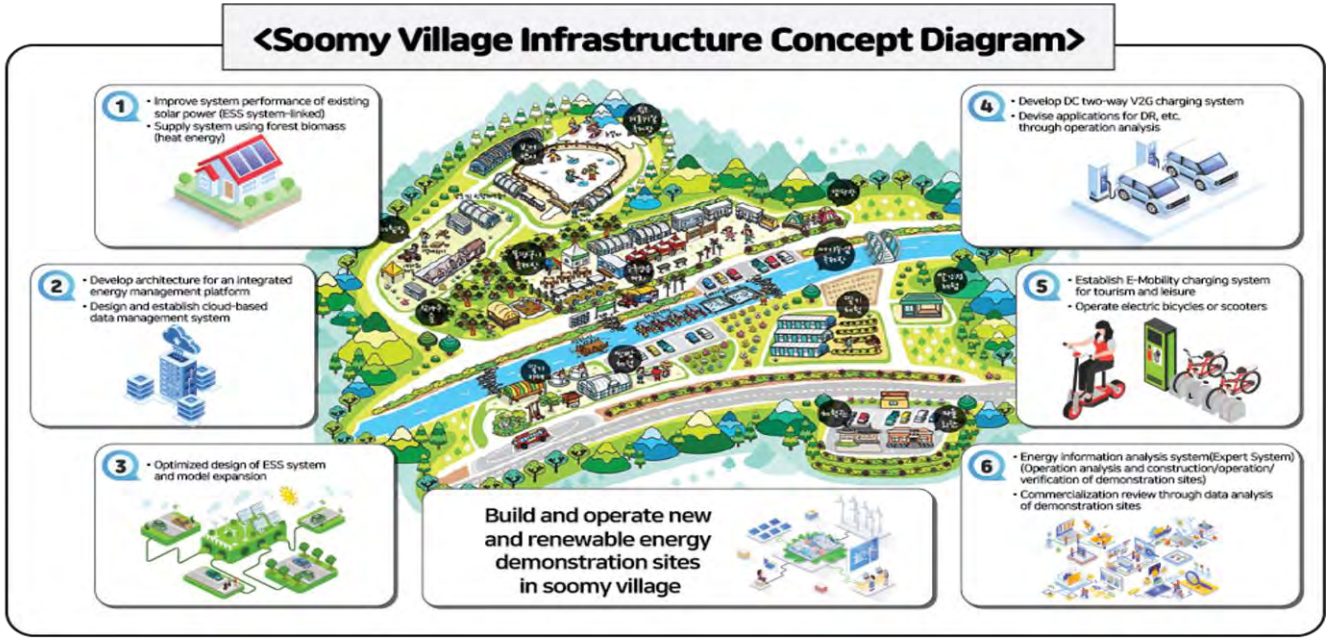
(2) Village based Microgrid Project – Overview

❖ Goal

- Creating a village-level energy community that strengthens distributed energy capacity by operating an open power platform that links various distributed power sources

❖ Area : About 10 villages across the country

❖ Period : 2021. 11 ~ 2024. 10 (Total 3 years)



(2) Village based Microgrid Project – Plan

Infrastructure Systems	• Production resources: Solar/heat, bioenergy, geothermal heat, water heat, other waste heat, etc. 2 or more types of energy sources • Reserve resources: Emergency generators, flexible resources • Transaction resources: ESS, EV, DC appliances, etc. → DR, VPP, V2G, etc. • Operation system: Remote control, hub station, IoT-based operation automation
Technology Development And Demonstration	• Device status, load pattern, consumption survey and behavior analysis • Package model centered on grid connection and design of operation plan • Development of PV location diversification, renewable heat utilization technology, composite energy source composition, and other energy supply technology • Online platform for electrical/structural safety, system monitoring, supply forecasting, control, integrated control, etc.
System improvement And demonstration Complex operation	• Training of regional operation experts such as regional energy masters • Development of incentive system for self-consumption • Collaboration system with local organizations • Safety management regulations and appointment of safety managers

04. Domestic Empirical Cases

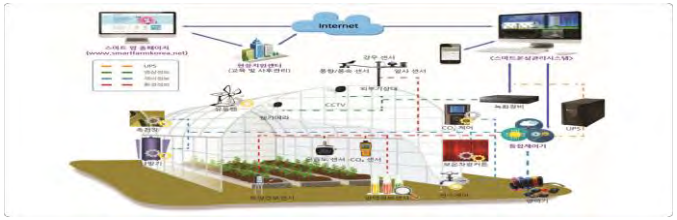
(2) Village based Microgrid Project – Type

Life/Culture Community (Residential, Commercial)

- Energy demand management and sharing of economic benefits
- Resident participation in energy infrastructure operation/management

Smart Farm (Concentrated Fisheries industry)

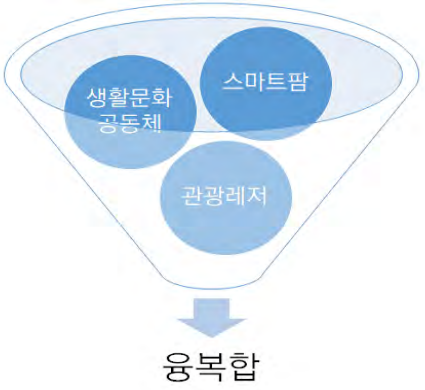
- Energy efficiency of cultivation facilities, livestock facilities etc.
- Incorporating MG technology into agricultural system intelligence



Tourism and Leisure (Tourism)

- A large number of similar types of tourist buildings
- Have the characteristic of increased electricity usage on weekends compared to weekdays

Convergence



(2) Village Level Microgrid Project – Development Contents

	Common Technology	Specialized Technology by Type
Life/Culture Community Type	- Composed of two or more types of REs - Optimal system design considering energy supply and consumption characteristics by type - To improve installation/function/safety/design of renewable energy sources - ICT-based microgrid operation optimization - Retrofit technology - Energy consumption & transaction model - Big data	- Design of village/district unit energy cloud construction and resource sharing - Energy cloud-based energy management and smart home appliances
Smart farm type		- To minimize carbon emissions for optimizing energy consumption - To expand the use of waste energy, electric farm equipment, and charging systems
Tourism/Leisure Complex Type		- Energy consumption characteristics analysis and energy supply optimization model design - Energy supply/consumption/transaction system
Other convergence type		-

05
Future Prospects

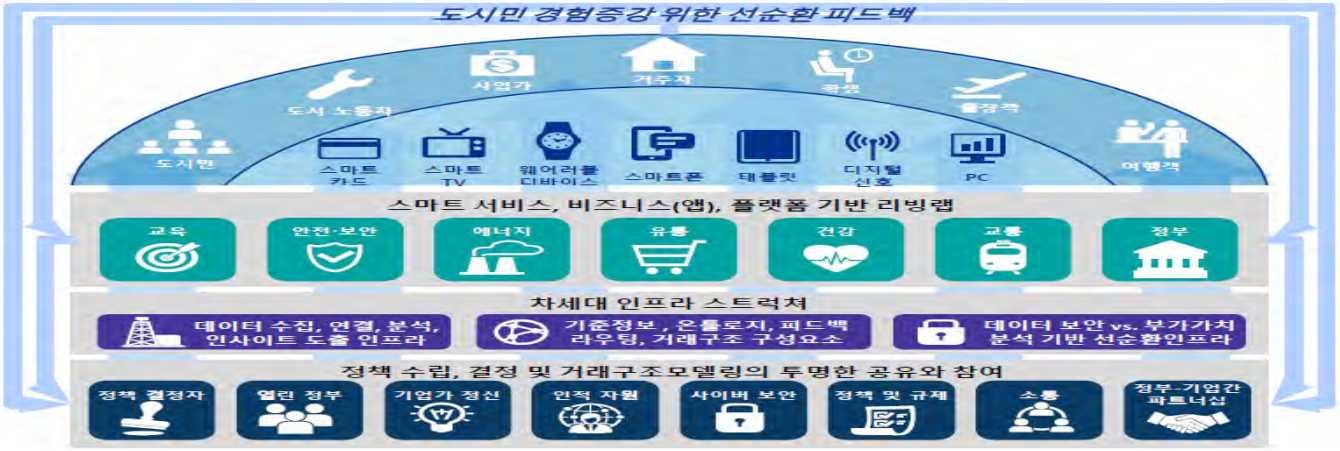
Data-driven Smart Energy City

❖ Background

- Expanding the grafting of ICT infrastructure → Activating big data production/sharing
- Expanding the need for citizens' active participation in city management → Collecting citizens' opinions to solve urban problems → Data collection/analysis
- Creating new businesses and improving citizens' living standards through the use of city data

❖ Necessary elements

- Smart interfaces, smart applications, smart analytics, sustainable trading structures, smart infrastructure, smart security, etc.



Source : Samjong KPMG

Building a DC-based power network

❖ environmental changes

분산전원 확대

전력수요 집중/증가

▲ 배전설비 확장 한계
▲ 배전계통 제어 한계
▲ 전력변환 손실 증가

현행 AC 배전망 체계로 대응에 근본적 한계

❖ Policy aspects

제4차 에너지기술개발계획 2019.12

- 재생e 확대 계통운영 안정성 확보
- 직류 송배전시스템 개발

제3차 지능형전력망 기본계획 2023.2

- 전력계통 시스템 디지털화 추진
- 배전망 단위 DC전력망 구축
- MVDC 핵심기술개발(~’28)

2030 AC/DC 배전망 혼용 운전

탄소중립 실현

AC/DC Hybrid 배전망 기술의 안전성 · 사업성 확보를 위한 테스트베드 기반 구축

Expanding local microgrid projects

Vision | Establishing a nationwide microgrid base that enables regional energy self-sufficiency

Direction of propulsion

Develop Regularly Customized RE Supply Model	Create a regional energy community	Create a Sustainable Business Model
• Development of a supply plan in consideration of regional energy resources and economic conditions • Implementation of various profit-sharing methods that allow local residents to participate	• Establishment of regional energy management system • Integrating environment, energy and economic values from a local perspective	• Promote small, distributed power projects with consumer participation • Development of regional business model


감사합니다.