Smart Grid Initiative of Korea

2011. 5

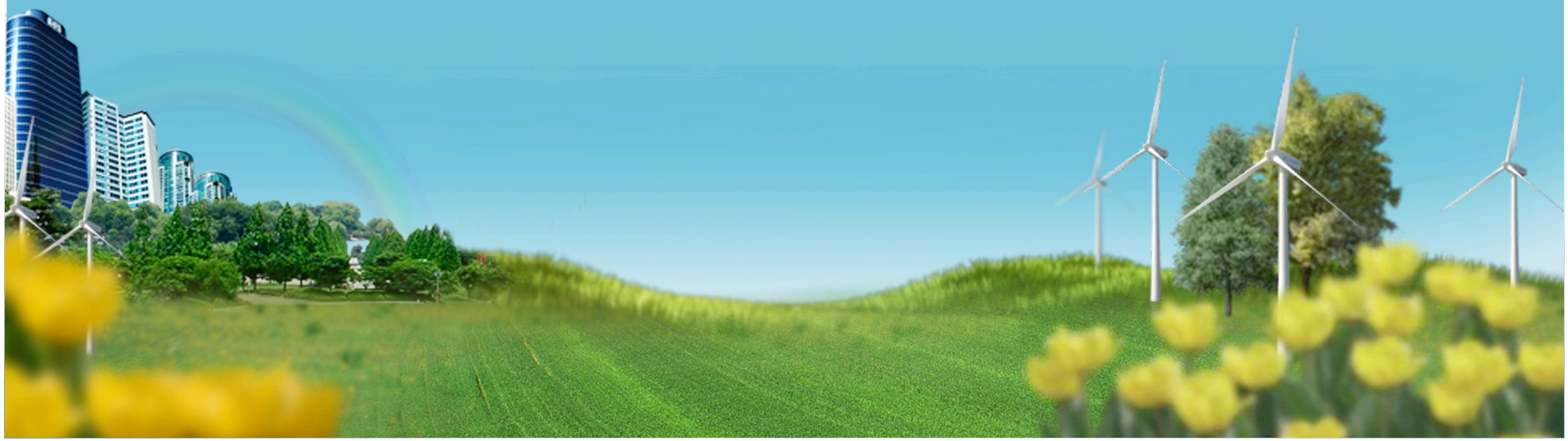
KSGI

(재)한국스마트그리드사업단

Korea Smart Grid Institute

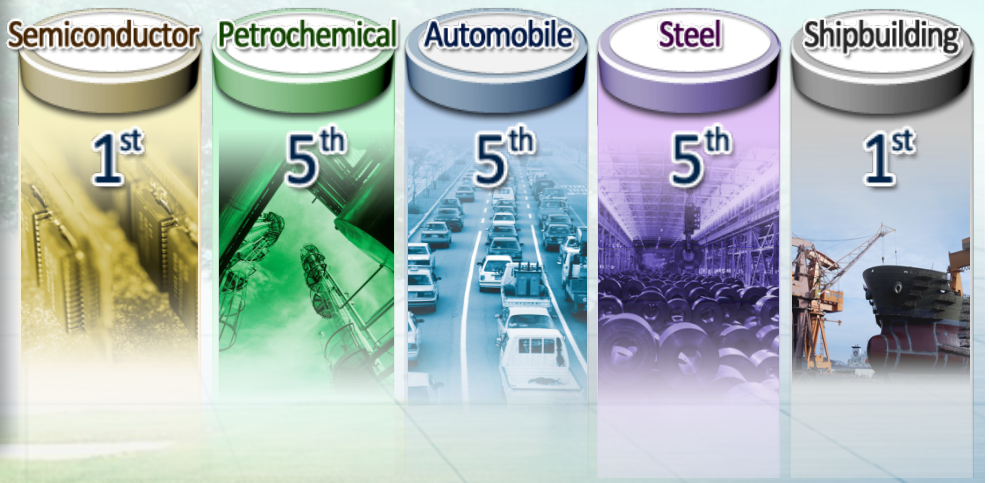
Contents

1 Korea's Smart Grid Overview



1-1. Overview of South Korea (1/2)

- Area: 99,720㎢ (115th in the world)
- Population: 48 million (26th in the world)
- GDP : U$929.1 billion (14th in the world[2007])
- Trade : U$950 billion (10th in the world)
- Key Industries and Global Ranking



1-2. Overview of South Korea (2/2)

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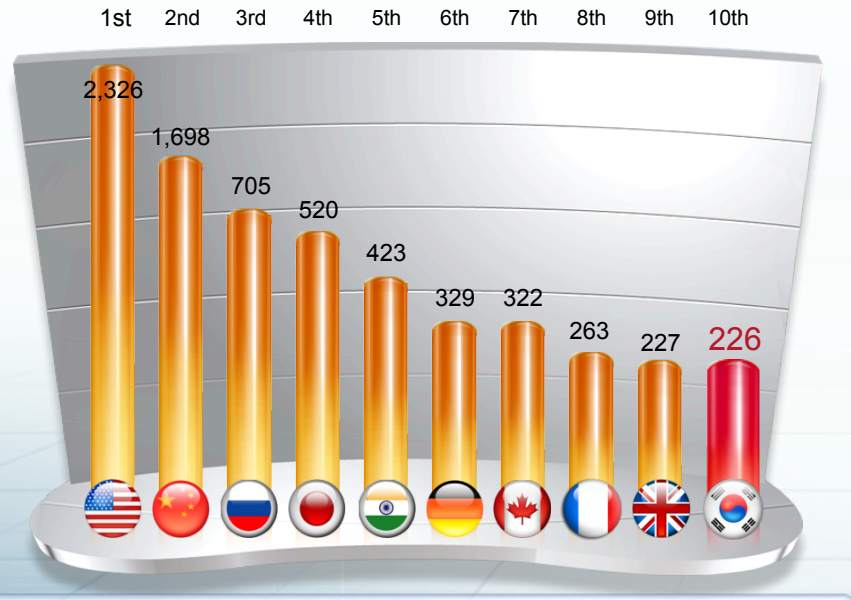
As-Is

- One of 10 largest energy consumption countries
- Foreign Energy Dependency (97%), (2008: U$141.5 billion)

Objectives

- Secure energy security and improve trade balance through reducing dependency on fossil fuel
- Implement measures on UNFCCC (UN Framework Convention on Climate Change) through increasing the efficiency in using electric energy

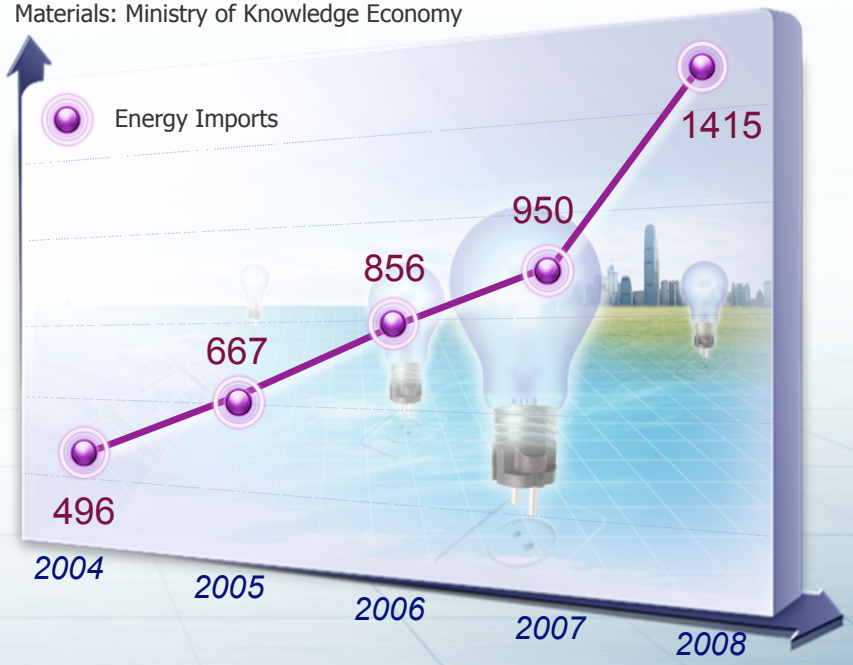
Global Energy Usage



Source) 1. Consumption of Energy and Oil 2006:
BP Statistical Review of Energy(BP,'07.6)

Energy Imports

Unit: one hundred million dollars
Materials: Ministry of Knowledge Economy



1-3. Korea Electricity Industry

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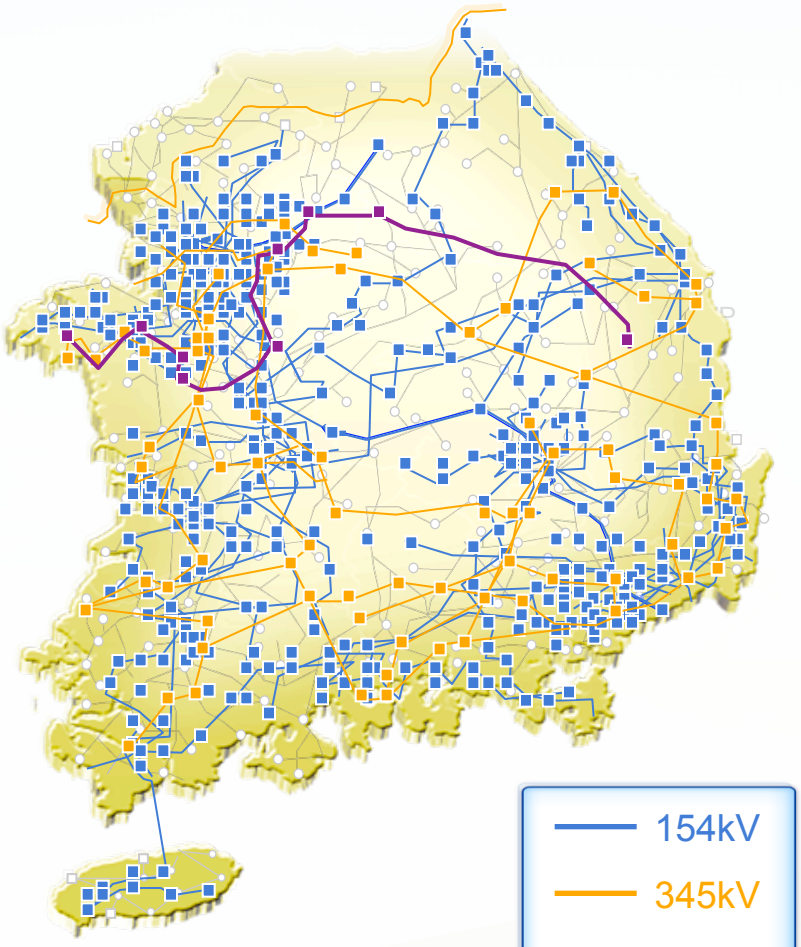
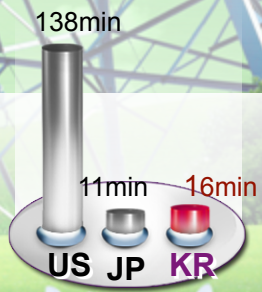
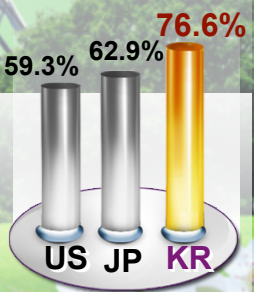
Power System in 2008



- **Installed Capacity 72,491MW (12th in the world)**
  - Output : 422,355MWh
  - Peak Demand : 62,794MW (2008)
  - Trading Volume : 24.3 billion dollars
- **Transmission lines: 29,929 c-km**
- **Industry structure**
  - Generation market share : KEPCO affiliates (88%), IPPs(12%)
  - T&D, Retail Owner : KEPCO
  - ISO/RTO : Korea Power Exchange





1-4. Smart Grid Concept and Scope (1/2)

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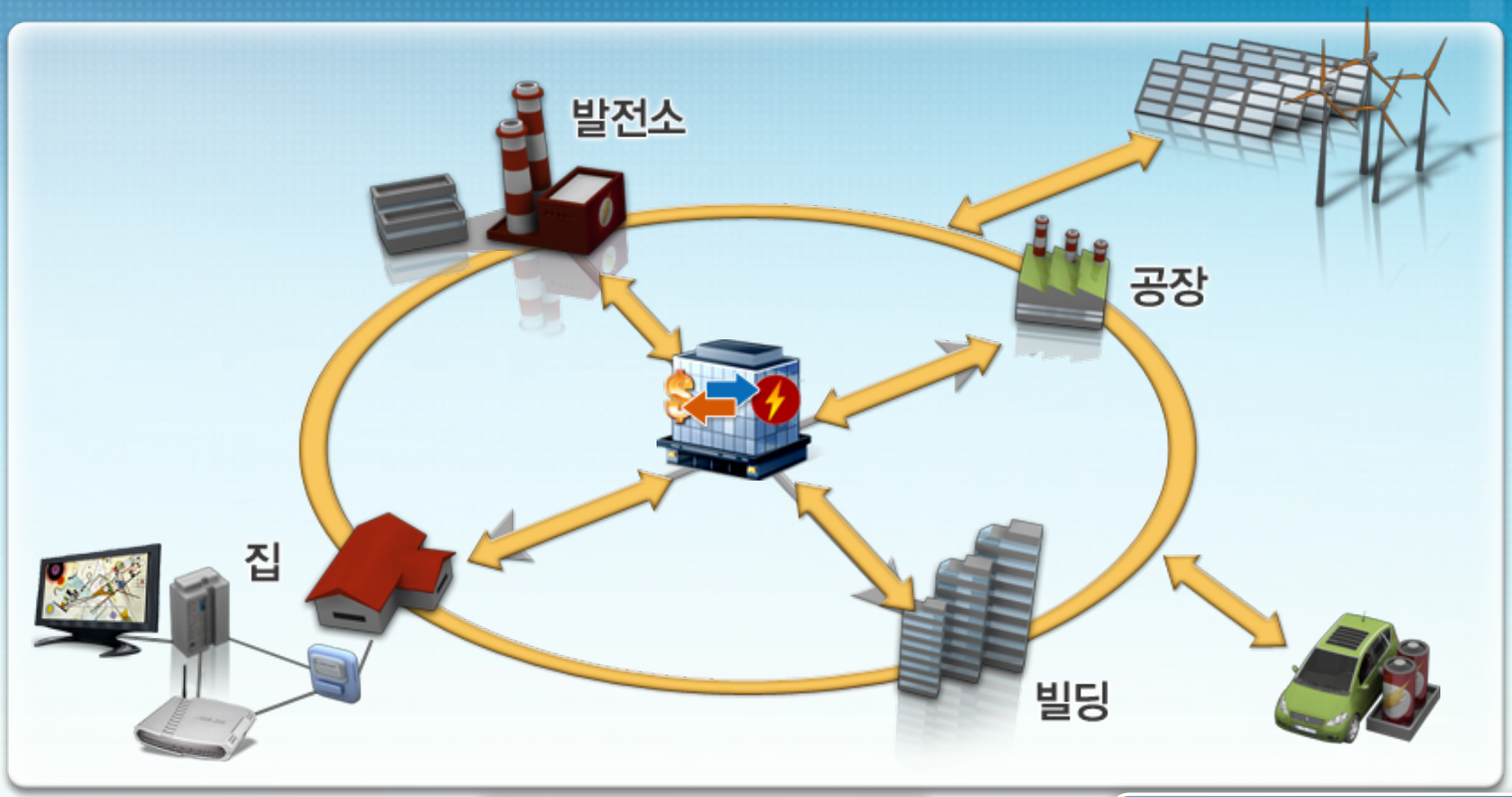

Information communication

- Real time rate info rmation exchange

+

Existing grid

- Supplier oriented on e way System
- Closed platform
- Standard service

=

Smart grid

- Consumer oriented two way system
- Opened platform
- Dynamic service

1-4. Smart Grid Definition and Scope(2/2)

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Definition

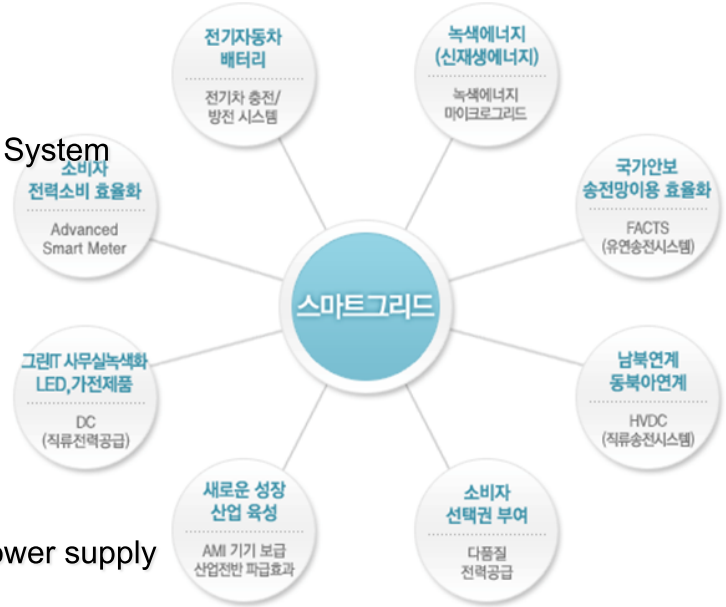
What is smart grid?

Next generation network that integrates IT into existing power grid to optimize energy efficiency through two-way exchange of electricity information betwe en suppliers and consumers in real time

Components: Advanced Smart Meter, EV charging infra, distributed energy r esource, real time pricing, self automated recovery system, integration/ sales of renewable etc

Scope

- EV/Battery–EV charger/electric discharge system
- Green energy (renewable) – Green energy microgrid
- Optimize nation's grid security– Flexible AC Transmission System
- North-South /East-West connection – High voltage direct current transmission system
- Provide wide range of consumer choices– electricity distribution of various quality
- New Growth Engine– AMI installation
- Green IT, LED, smart appliances – DC (Direct Current) Power supply
- Optimize use of energy efficiency– Advanced Smart Meter



1-5. Need for Smart Grid

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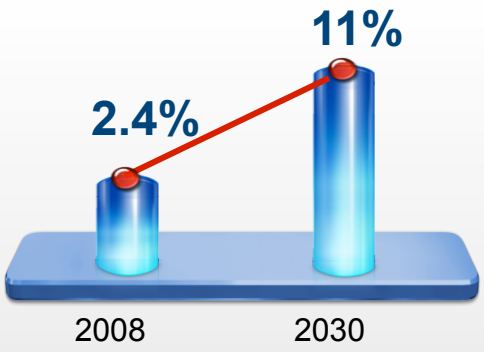
Establishment of Smart Grid platform for low carbon green growth vision

Innovative Technologies for Year 2030

Address climate change



- Wind, solar power development
- Grid-connected technology

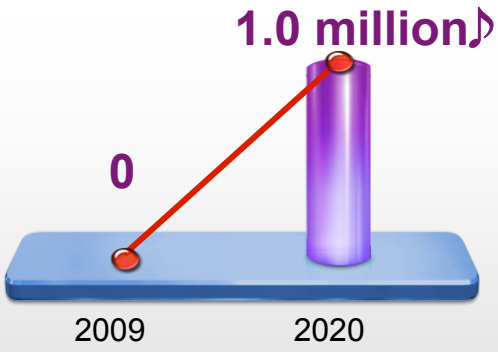
Increase energy efficiency

46.7%

(2006 standard)

- AMI(Smart meter)
- DR (Demand Response)

Implement electric transportation



- Electric vehicle charging station
- Fuel battery, DC distribution

1-6. Progress Overview

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August 2008

- Proclaimed Low Carbon Green Growth Vision
  - 60th anniversary of the founding of the Republic of Korea on August 15, 2008 -

December 2009

- Selected consortia and signed a contract of agreement for Jeju smart grid demonstration project

January 2010

- Released the National Smart Grid Roadmap

October 2010

- Submitted a Legislation to the National Assembly
  – Smart Grid Stimulus Law

1-7. National Smart Grid Roadmap

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Chronology

- Feb. 2009, The Presidential Committee on Green Growth announced plans for National smart grid roadmap
- Mar. 2009, Inaugurated National Smart Grid Roadmap Administrative Committee
- June~ Dec. 2009 Created provisional draft of the roadmap through experts' participation and public hearings
- Jan. 2010 Announced National Smart Grid Roadmap

Vision♪ Establish smart grid platform for low carbon green growth visio

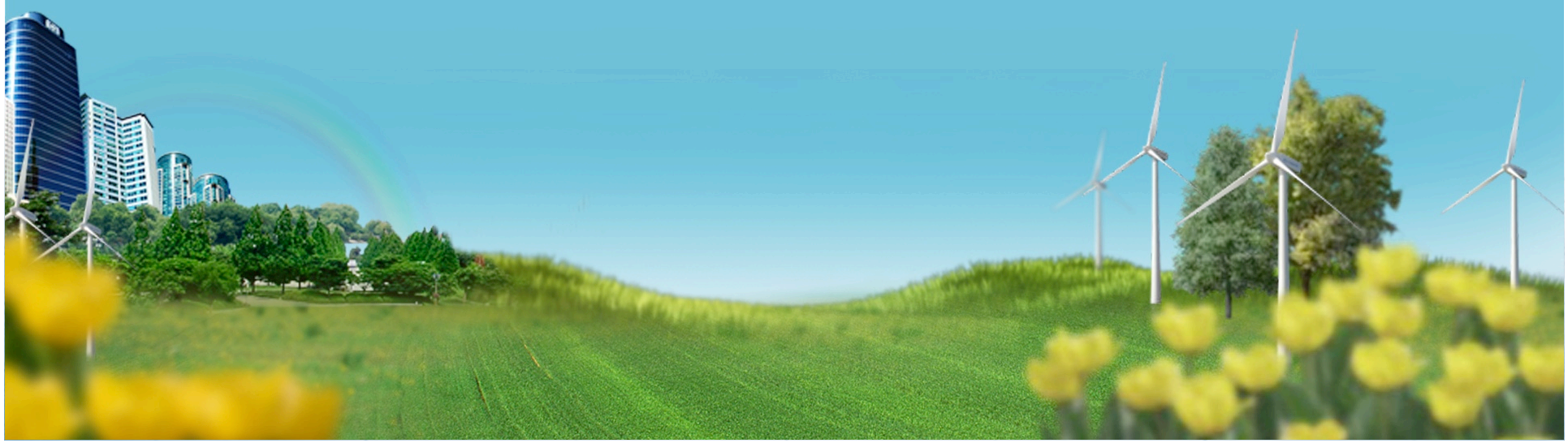
Goals by Phase♪

Smart pilot City	Widespread Smart grid	Nationwide smart grid
Phase 1 (~2012)	Phase 2 (~2020)	Phase 3 (~2030)

5 Domains♪

Smart Power grid	Smart Place	Smart Transportation	Smart Renewable	Smart Electricity Service
Create flexible power grid Implement self-automated recovery system	Install AMI Create energy management system	Establish Nationwide EV Charging infra Provide V2G and ICT service system	Construct large Scale renewable Power plant Implement energy Independent buildings	Provide Dynamic pricing rates Create power Exchange system

2 Smart Grid Demonstration Overview



2-1. Smart Grid Demonstration Progress Timeline

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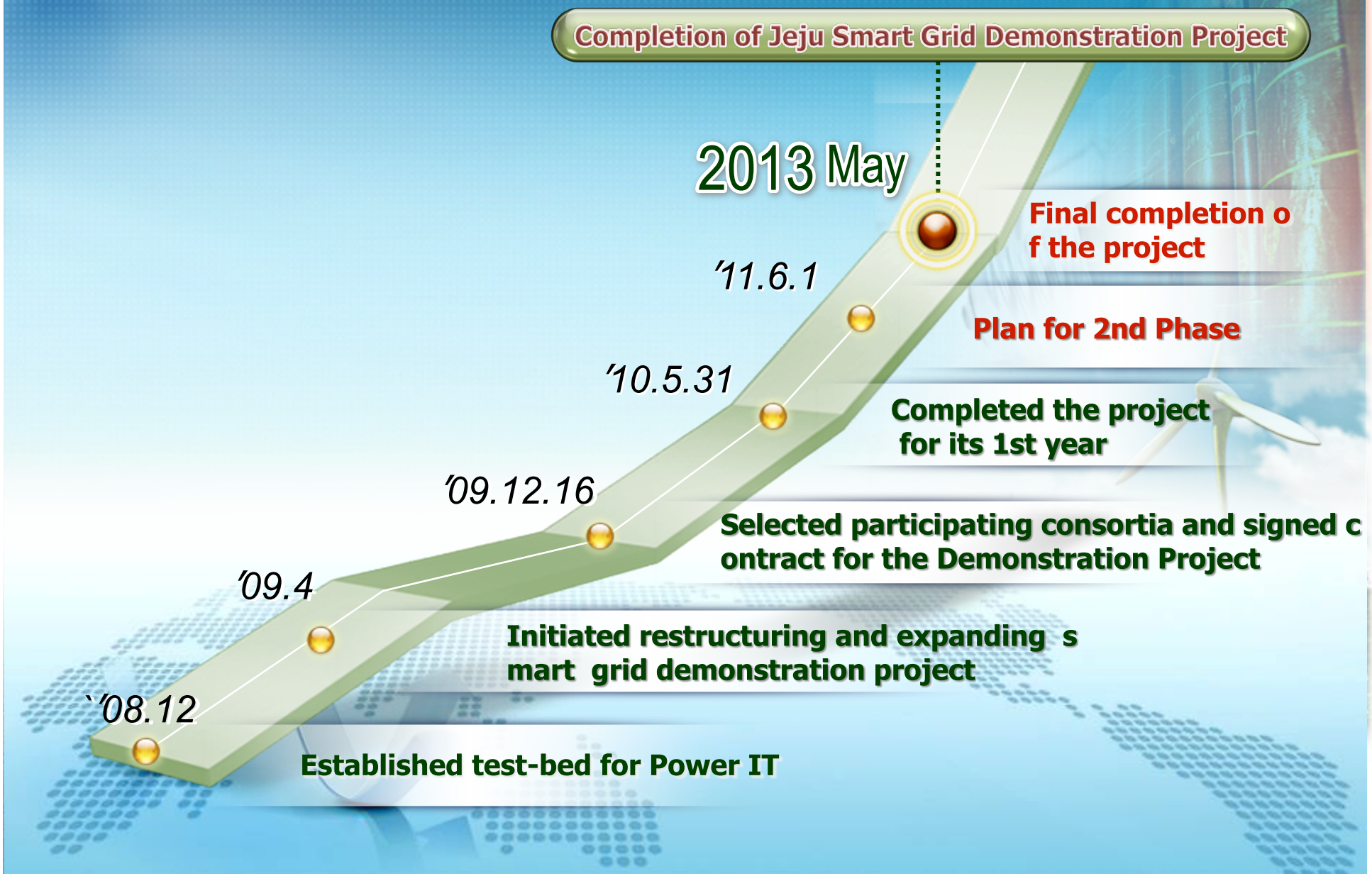

2-2. Why Jeju?

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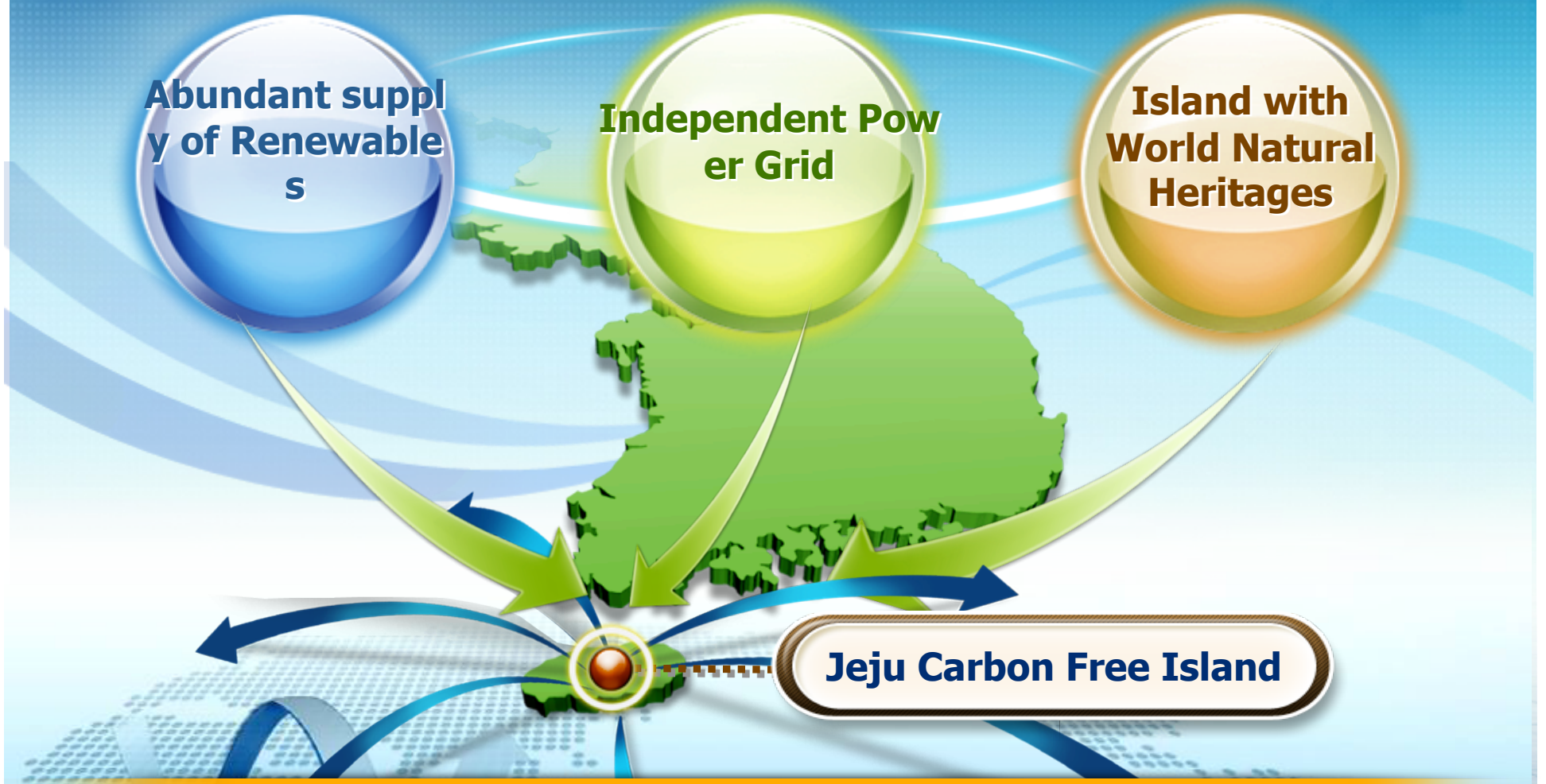

Incubator for Smart Grid Technologies

2-3. Objectives for Jeju Smart Grid Demonstration

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Create business models, and allow immediate commercialization

Strategies

Assess Business Models

- Assess smart grid technologies and verify effectiveness of smart grid related service for consumers

Select from open–bid

- Allow companies to openly bid for different areas of demonstration project to create innovated BIZ models

Induce Competition

- Induce competition amongst participating consortia in different domains to make effective assessment

2-4. Features of Jeju Demonstration Project

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Enterprise Competitiveness

- Deduce globally competitive business industries
- Tele-communication, electricity, transportation, smart appliances etc, total of 168 companies participating

Jeju Bigbang

- Convergence of businesses
- Create innovated BIZ models using state of the art technology

Big Investment

- Companies are making greater investments for the demonstration project
- 3X increase in private investment
  (57.5 million $ ⇨ 173 million $)

※ 2 of the consortia are participating using own budget

2-5. Project Domains Per Consortia

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2-6. Consortia for Jeju Smart Grid Demonstration

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	Leads	Participating	Investment(Dollar)
Smart Place	SK telecom	Samsung electronics, Korea Cable TV, Jeju broadcast etc (29 companies)	Govt : 5 million Private: 25 million
	olleh kt	Samsung SDS, Samsung Trade, Rootech etc (14 companies)	Govt : 4.7 million Private: 30 million
	LG Electronics	LG U+, GS pure cell, GS construction etc (15 companies)	Govt : 4.7 million Private: 17.5 million
	KEPCO	Samsung electronics, Taihan Electric, Nuri Telecom etc (38 companies)	Govt : - Private 10 million
Smart Transport	KEPCO	Samsung SDI, Lotte data communication, P&E Solution etc (22 companies)	Govt : 4.5 million Private:14 million
	SK energy	SK Network, Iljin Electrics, Ientech etc (13 companies)	Govt : 4.5 million Private: 13 million
	GS Caltex	LG CNS, ABB Korea, NexCon Take etc (7 companies)	Govt : 4 million Private 8 million
Smart Renewable	KEPCO	KOSPO, Hyosung, LSIS etc (16 companies)	Govt : 4.7 million Private: 15.3 million
	HYUNDAI HEAVY INDUSTRIES CO.,LTD.	Maxcom, Icellkorea etc (6 companies)	Govt : 4.7 million Private 7 million
	posco ICT	LG Chem, Woojin Industrial System, Daekyung Engineering etc (6 companies)	Govt : - Private: 9 million

2-7. Smart Power Grid

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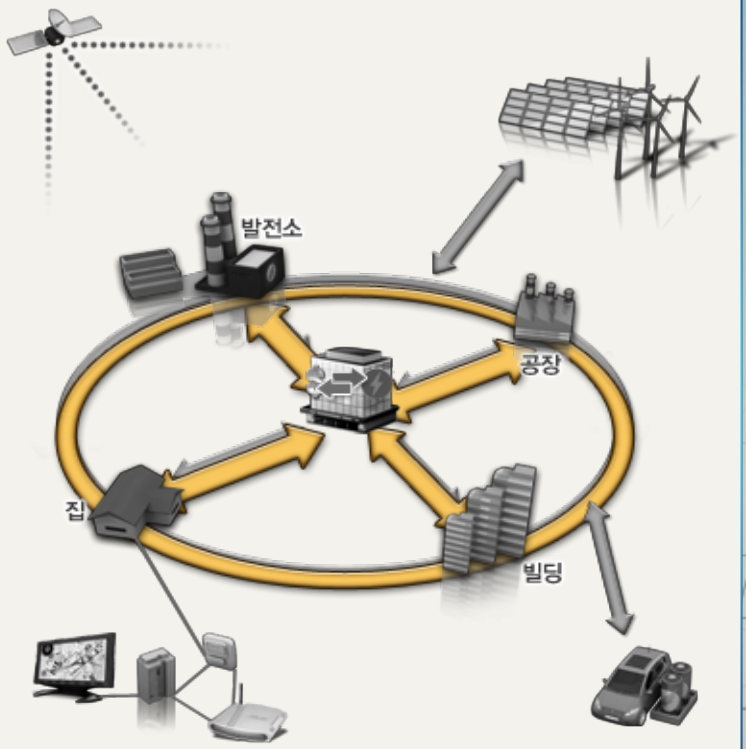
Objective

- To establish flexible power grid that allows new integrated/complex businesses
- To increase energy efficiency and quality through self-automated recovery system



Key Technology Developments

- Pilot smart grid technology :distribution/ transmission (`12)
- Create self-automated recovery system for broad area

Business Model

- Testing/ certifying system of smart power grid technology
- Exporting key smart power grid

Goals by Critical Index

2-8. Smart Place

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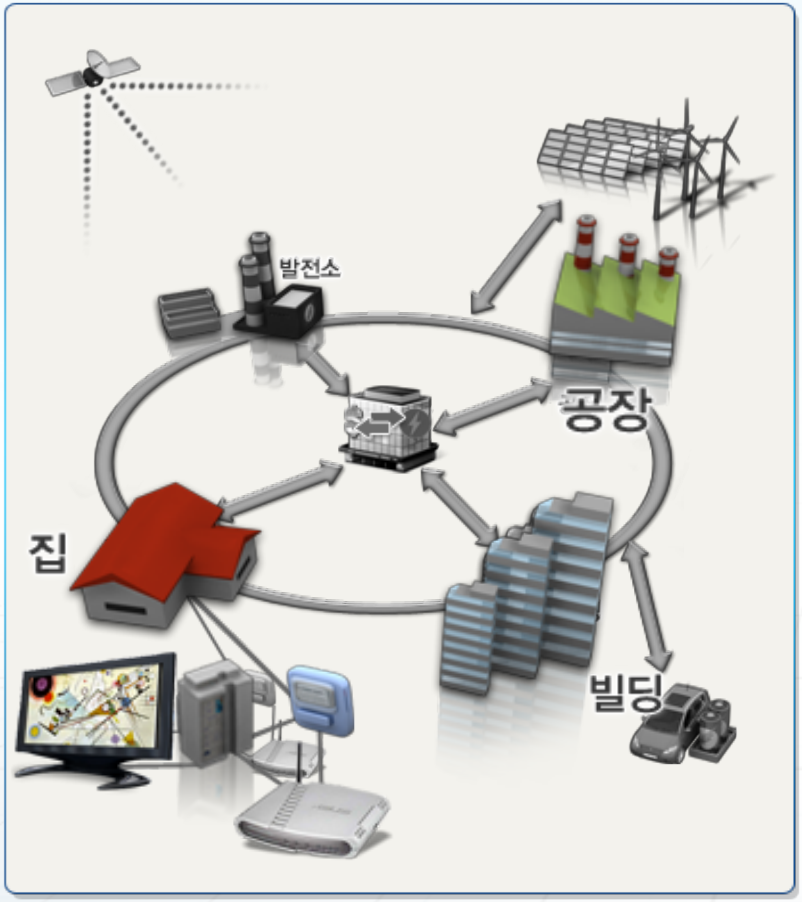
Objective

- To increase energy efficiency and reduce energy use via AMI installation
- To adjust energy use via two-way communication energy management System



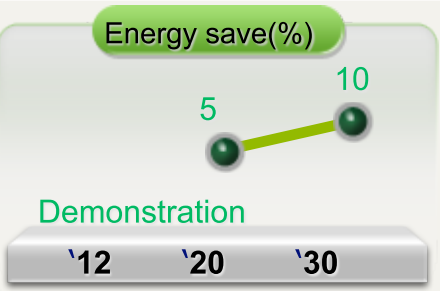
Key Technology Developments

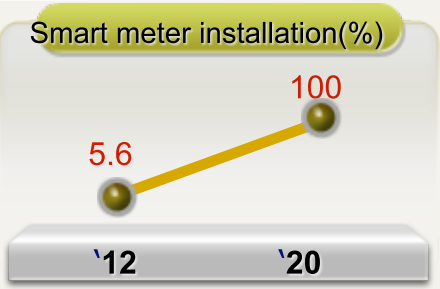
- Develop (AMI) and set standard (2012)
- Develop system to connect DR with the grid (2020)

Business Model

- Emergence of smart appliances and energy management s ervice providers
- Emergence of prosumers (sell and consume)

Goals by Critical Index





2-9. Smart Transportation

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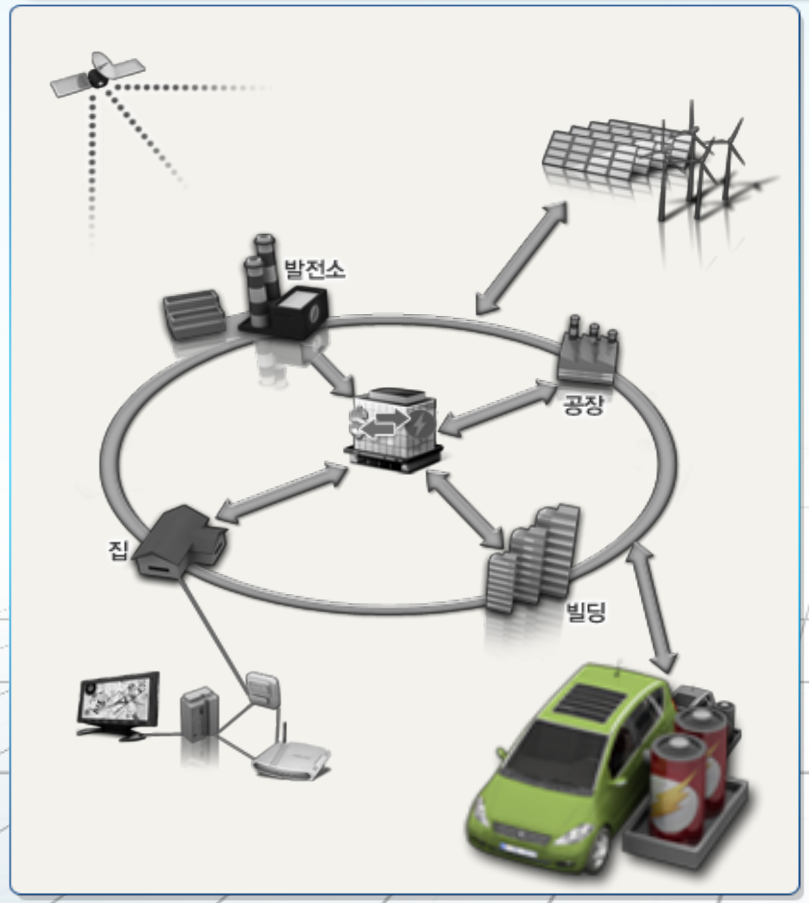
Objective

- To establish nationwide charging infrastructure
- To allow consumers to charge during low-demand/low-rate hours and re-sell During peak hours



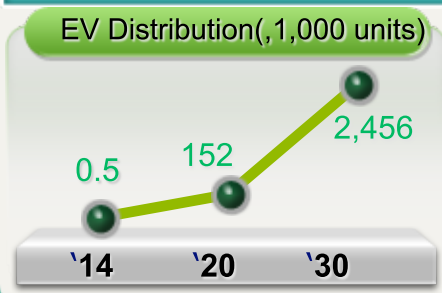
Key Technology Development

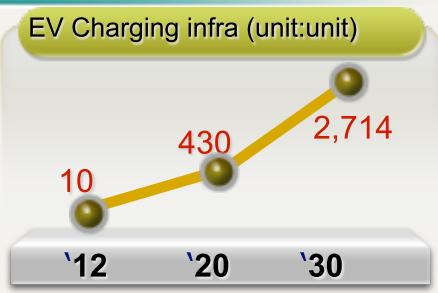
- Develop EV parts and materials (2012)
- Develop Vehicle to Grid system and ICT service (2020)

Business model

- Emergence of EV/battery rental service
- Emergence of EV operating management service business

Goals by Critical Index





2-10. Smart Renewable

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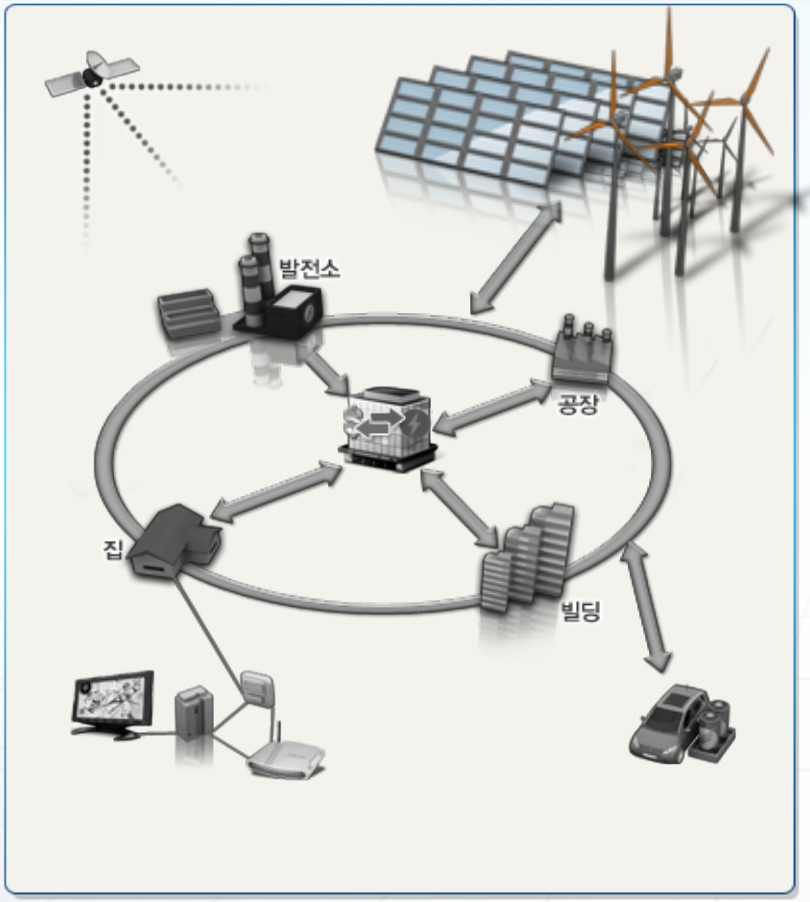
Objective

- To create large-scale renewable generation power plants
- To build green homes and buildings that are energy independent using renewable



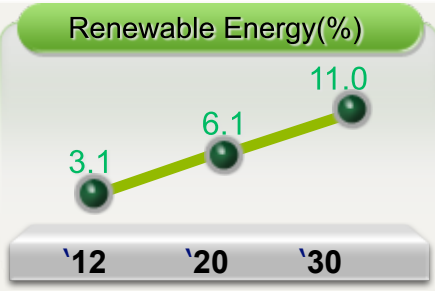
Key Technology Developments

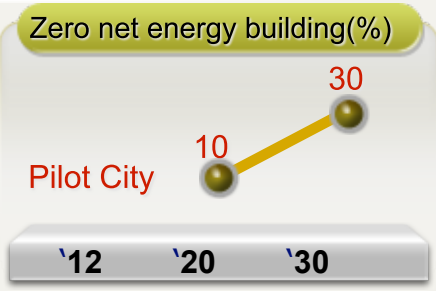
- Develop technology for stable connection of renewable generation to the grid (2012)
- Develop energy storage system for bulk renewable generation ('20)

Business Model

- Production and sales of renewable energy
- Exportation of energy storage system that is connected to the grid

Goals by Critical Index





2-11. Smart Electricity Service

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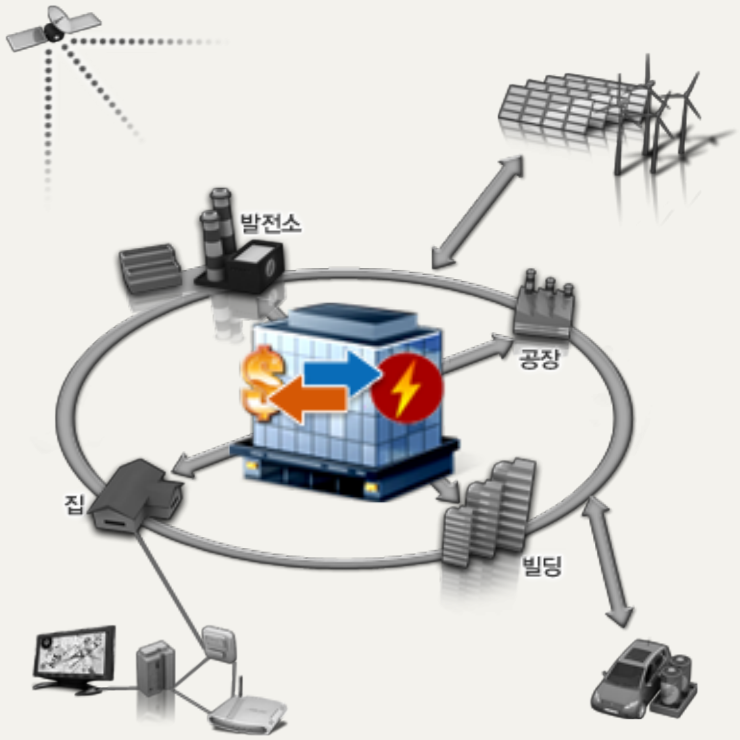
Objective

- To encourage consumer participation via dynamic pricing rates
- To promote on-line system for power exchange and derivatives



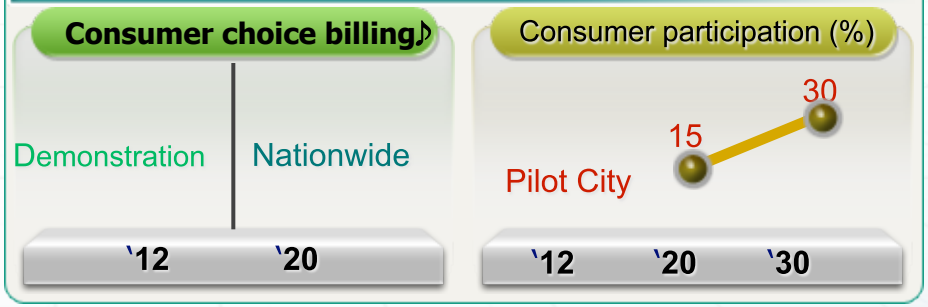
Key Technology Developments

- Develop real time pricing and demand response system (2012)
  Develop on-line power exchange system (2020)

Business Models

- Customer based power providers
- Diverse power derivatives are expected to emerge

Goals by Critical Index



2-12. Future Test-bed Layout

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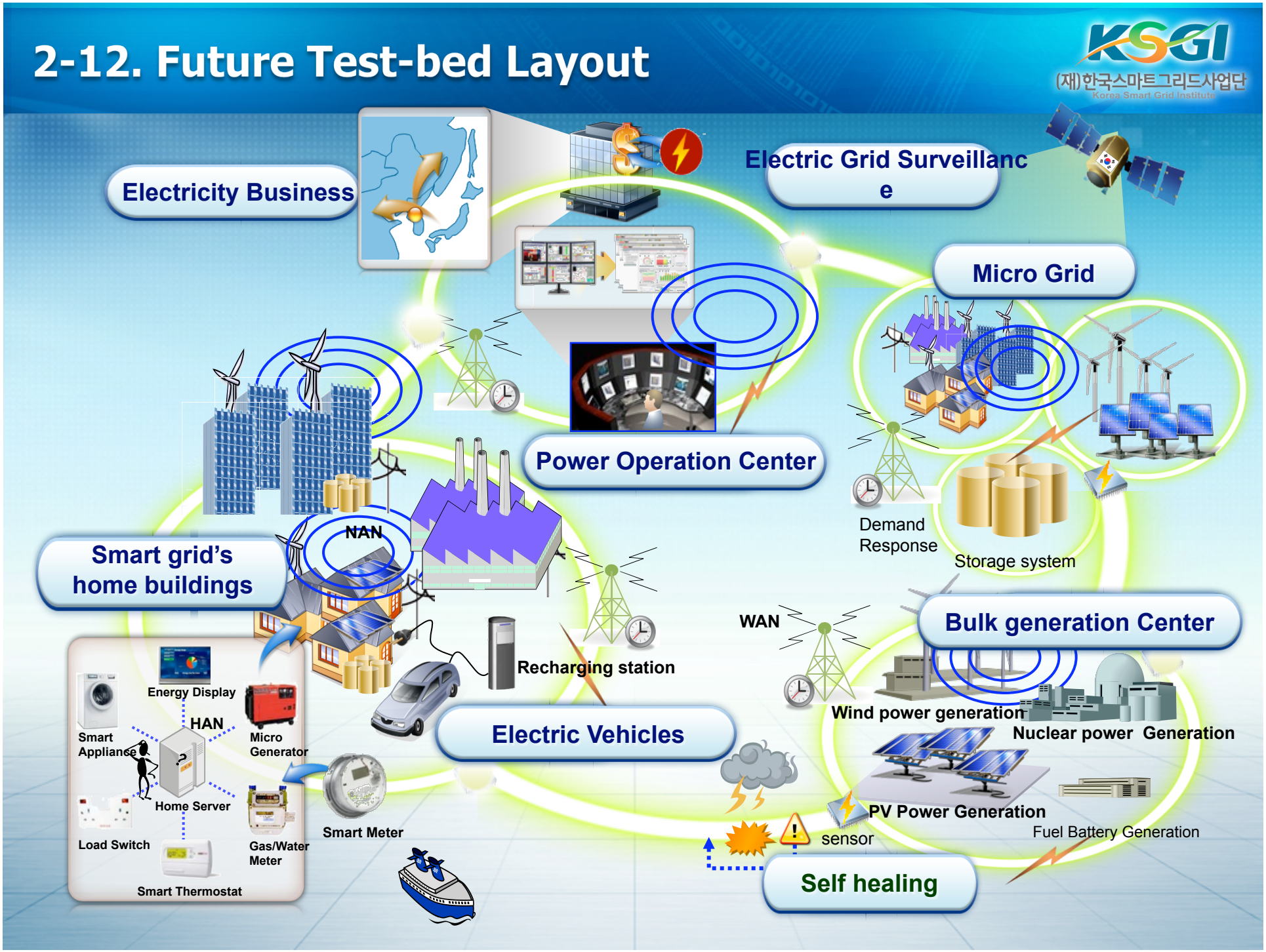
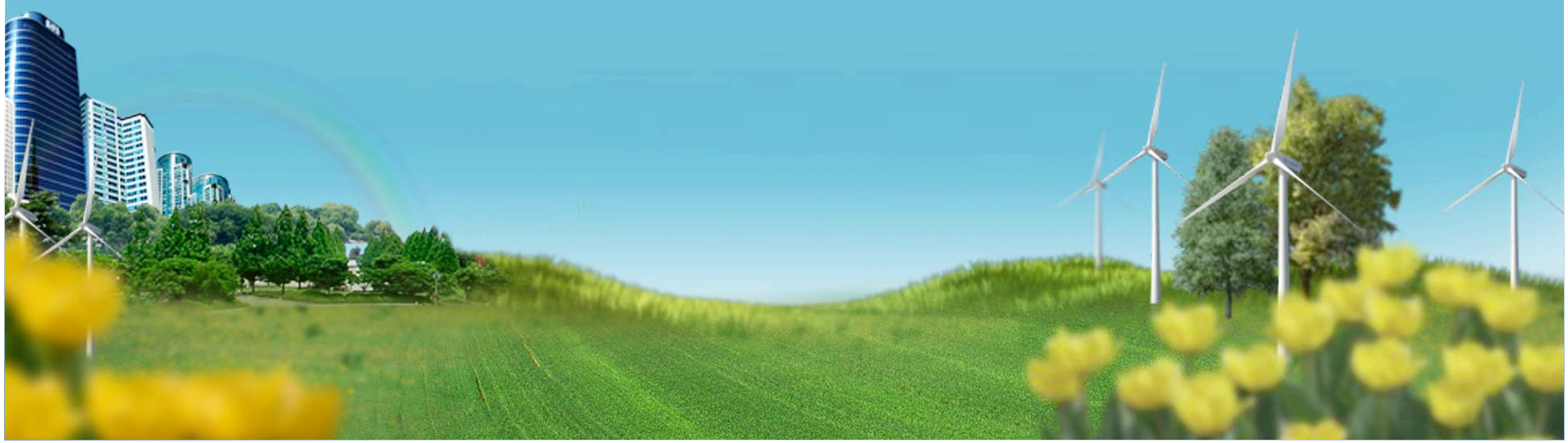


3 Demonstration Progress Report and Next Steps



3-1. Phase 1 Progress Report (1/3)

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Construction plans

Phase	Areas	Contents
Phase 1 (Infrastructure)	PowerGrid ● Place ● Transportation	Grid, consumers, Vehicle to Grid connection
Phase 2 (Operation)	Renewable ● Electricity Service	New electricity service, Renewable to grid connection

Accomplishments

Smart Place

- Constructed operation centers for each consortia
- Installed 550 residential AMIs / 100 PVs
- Installed energy monitoring device

Smart Transport

- Activated EV charging infrastructure & Deployed EVs
- Constructed infra operating system, Designed security system
- Developed paying method

Smart Renewable

- Constructed renewable generation plant
- Designed systems to stabilize intermittency
- Developed data center model coordinated with total operation center.

3-2. Phase 1 Progress Report (2/3)

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Phase I Progress Report

Goal oriented♪

- Exceeded in number of technology developments and smart grid services (EMS, security etc)
- Focused on establishing standards to ensure compatibility between AMI and other smart grid key technologies
- Successful completion of making of smart grid key equipments (high-speed charger, BESS, power converter)

Promotion Oriented♪

- Acceleration of smart grid deployment and promotion through KSGW (G20)
- Major promotion of Jeju smart grid demonstration to imbed the theme of Green Growth
- Obtain global consensus and support for creating smart grid business models via Total Operation Center (93% complete)

Future Needs♪

- Need to expand into building in commercial and industrial regions
  - Need for a designated building for a large-scale building specifically designed for smart grid project within Koo Jwa Eup (Jeju)
  - Need a building that encompasses all smart grid technologies to be act as a model building for smart grid demonstration
  - Need a site to provide certifying, evaluating service for smart grid technologies

※ C&I : Commercial & Industry

3-3. Phase 1 Progress Report(3/3)

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Demonstration Public Exhibitions

- **Public consensus is necessary to implement nationwide smart grid**
- **Companies can present and introduce smartgrid prototypes and educate the public**
- **The exhibition will be sustained during and after the demonstration project**

" **Experience**" the State of the Art Technologies and Viable BIZ models

- **Main Exhibition center, "Comprehending"** Korea's Smart Grid Concepts and Jeju Test Bed
- **4 Smart Grid Themed exhibitions, "Experiencing"** Smart and Eco-Friendly Daily Life

3-4. Next Steps

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System operation and verification

- Deduce best practices by testing business models under the 5 domains of de monstration project
  - Create platform for energy management; and test demand response solution
  - Provide smart metering service, construct facilities for the operation of micro grid

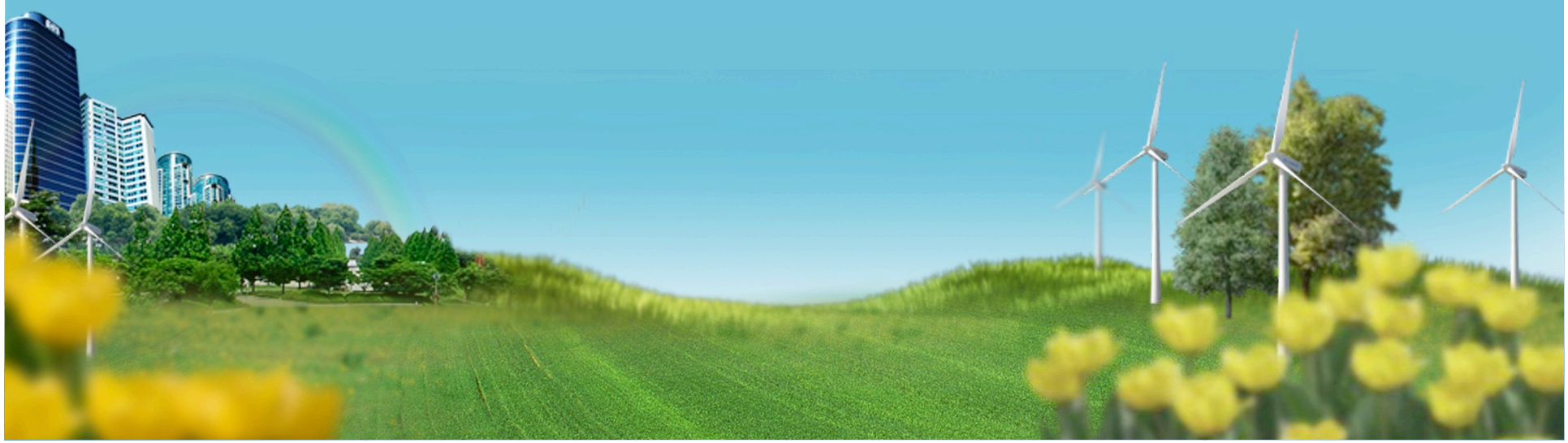
Induce Competition

- Each consortium will perform in a competitive environment, and the government wil l provide persistent support to allow creation of new business models
- Business outcomes will be incorporated with national standard and deploy ment of smart grid

Smart Grid Stimulus Law

- Enact a law to promote smart grid and to help facilitate the execution of the national smart grid roadmap

4 International Cooperation



4-1. International Cooperation(1/2)

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Support for ISGAN Activities

- **Government Support**
  - ISGAN Participant, Executive Committee
  - Co-lead Case Studies project, participate in (3) other ISGAN projects
- **KSGI Support**
  - Operating an interim secretariat to coordinate communication & project activities
- **Anticipated Effects**
  - Ensure an image of global smart grid leader, establish robust int'l collaboration
  - Establish smart grid inventory, and operate a int'l smart grid clearing house
  - Obtain int'l smart grid information from established networks

Collaborative effort for ex portation

- **Korea-Illinois Smart Grid Collaboration**
  - Collaborative R&D on Distributed Energy Resource → IIT& KERI
  - Collaboration on smart grid security project→ NSRI & UIUC
- **Collaboration with the UK for AMI market**
  - Effort to export smart meters to utilities in UK
- **Iran-KDN(KEPCO)**
  - Established a joint venture between Iran-Korean companies
  - Established smart grid demonstrative system
  - Modernized Iran's electricity system via deployment of smart grid

4-2. International Cooperation(1/2)

Korea-U.S smart grid Standard collaboration

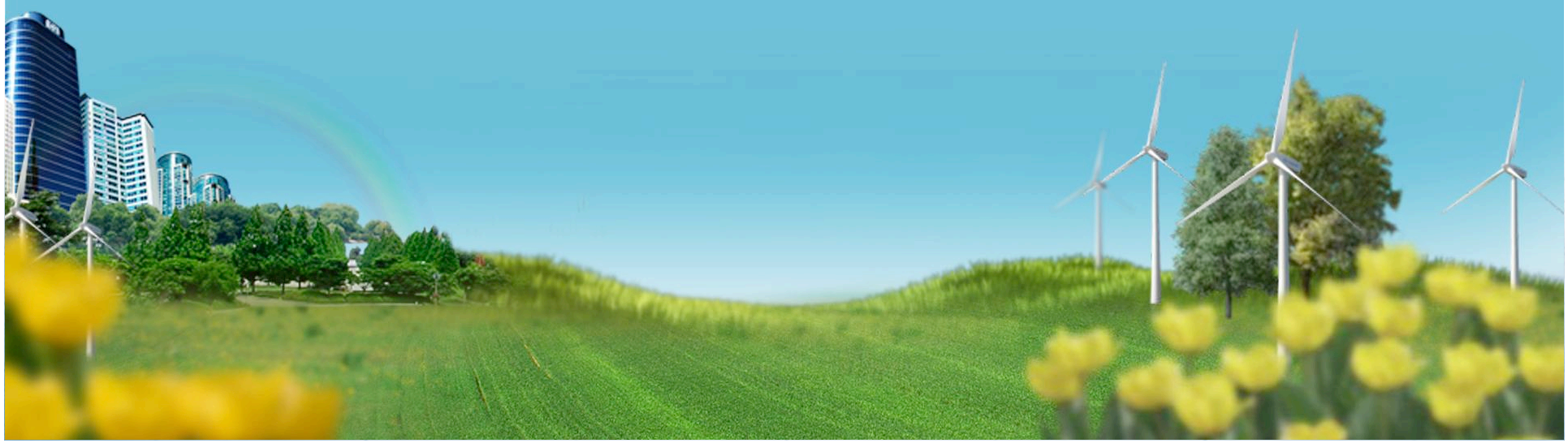
- **Role**
  - Coordinate consensus from private individuals regarding smart grid and continual effort to develop smart grid standard domestically in correspondence to int'l standard
- **Collaborative approach**
  - Organized Korea-U.S. Smart Grid Forum between KATS(Korea) and NIST (U.S)
  - Creating a collaborated network between U.S.'s 'SGIP and Korea's 'SG Standard Forum under consideration
  - Exchange of information and human resources between two countries
  - Anticipates to hold collaborative workshops, seminars for smart grid standard
- **Next Steps**
  - Outreach collaboration with European countries, China, Japan and other countries in regards to int'l smart grid standard

Int'l Outreach

- **Government**
  - Collaborated with the U.S. government for smart grid (Korea-U.S. Summit on 2009)
  - ISGAN participant along with other 20 countries
- **Korea Smart Grid Institute**
  - Create wide networks with other int'l smart grid organizations and Embassies of other countries
- **Private sector**
  - Collaborating with GSGF and other smart grid related associations

5

Smart Grid Stimulus Law



4-1. Background

(재)한국스마트그리드사업단
Korea Smart Grid Institute

Provide legislative support for Smart Grid

- **Current** : Smart grid R&D is much dependent on voluntary participations from companies
- **Future** : : Need legislative support to sustain project and maintain companies' participation
  - Major economies such as United States and EU are designing to enact legislations to support R&D, standards, and smart grid deployment.
- There's an urgent need to provide legislative support for smart grid to address climate change issues and to compete in the global green market

Transcend current ordinance and institutional constraints

- **Current** : Electricity Enterprise Act restricts convergence of businesses
  - Electricity Enterprise Act: Applied to generation. transmission/distribution and electricity sales
- **Future** : Need to transcend current legislative constraints by regulating a law that advocates converged infrastructure

Advocate convergence of businesses

- Smart grid is a key technology to help save energy, to help deploy electric vehicles and to allow integration of renewable energy
- Formulated solid framework to facilitate enactment of smart grid regulations.
  - i.e. National Smart Grid Roadmap and Jeju smart demonstration project

4-2. The Significance of Enacting Smart Grid Stimulus Law

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Korea Smart Grid Institute

Smart Grid Stimulus Law coordinates smart grid road map, demonstration and pilot city

- Smart Grid Stimulus Law allows technological and institutional progression for smart demonstration and smart pilot city project.
- The project outcome from Jeju smart grid demonstration will help coordinate different aspects of smart grid businesses, such as smart grid deployment, R&D, workforce development, etc.
- Enactment of smart grid stimulus act will provide solid foundation for smart grid related businesses and induce greater investments.


VI. Conclusion

5-1. Create New Business Models and Reach Out

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- The initial expectation of internet was mainly on providing e-mail service but modern internet opened other business opportunities such as Internet phone, UCC, on-line markets, IPTV etc

- The government will provide support for 12 consortia participating in the Jeju smart demonstration project to induce creation of innovated business models
- Deduce smart grid deployment model for nationwide implementation

- Korea plans to share case study on Jeju smart grid demonstration with the international community. We hope to contribute reduce global GHG emission and continue our support for smart grid.

5-2. Reinforce International Collaboration

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Korea Smart Grid Institute

Propose continuous conference on smart grid demonstration

- **Propose to continuously hold Jeju smart grid demonstration conference even after KSGW; conference will allow exchanging of global case studies for smart grid**

Reinforce international collaboration through ISGAN

- **Provides a framework for high-level government coordination amongst member countries to enable seamless global development and deployment of smart grid**

Support participation from companies overseas

- **Foreign companies participating in Jeju project include ABB Korea, Renault Samsung, GE Korea**
- **Plan to encourage and support participation from other foreign companies**

Thank you

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