

The Latest Activities on Smart Community and EV in Korea and Jeju

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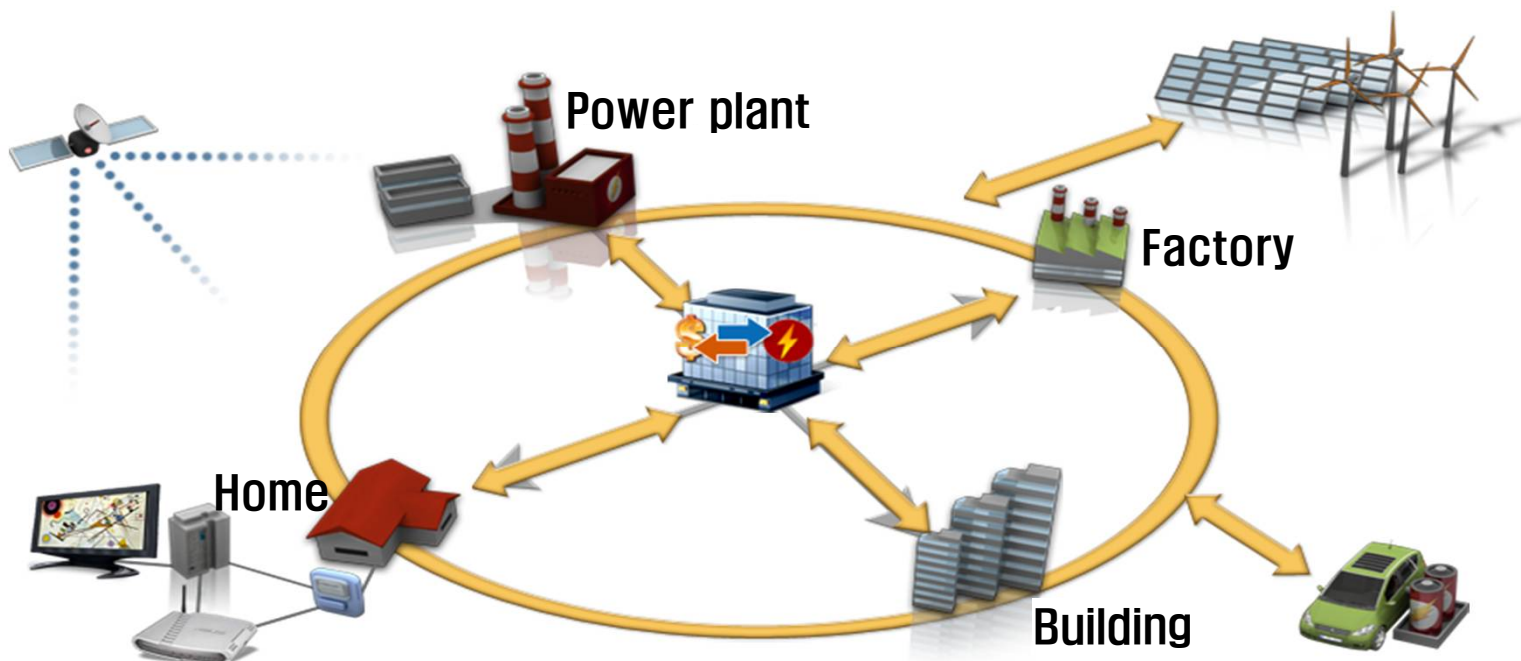
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What is Smart Grid?



Communications (Smart)

- Real Time Communication

Given power network (Grid)

- Supply side/one-way
- Closed platform
- Uniform services

Smart Grid

- Demand side/two-way
- Open platform
- Various services

– . Object of Smart Grid

1) To respond to climate change

- Need to build green-growth infrastructure for reducing greenhouse gas emissions
- By building smart grid, establish the foundation for expanding the supply of renewable energy and electric cars

2) To increase energy efficiency

- To ensure energy self-sufficiency and transition to low-emmission society
- Smart grid as a powerful tools for energy efficiency through demand shift and energy saving

DC(Edison) At the end of the 19 th century	AC(Tesia) In the 20 th century	Present In the 21 th century
Direct Current	Alternating Current	AC+DC

3) To create new growth engines

- Smart grid market drives countries to 'green competition'
- To lead the Smart grid global market and turn into a major export industry as a new growth engine

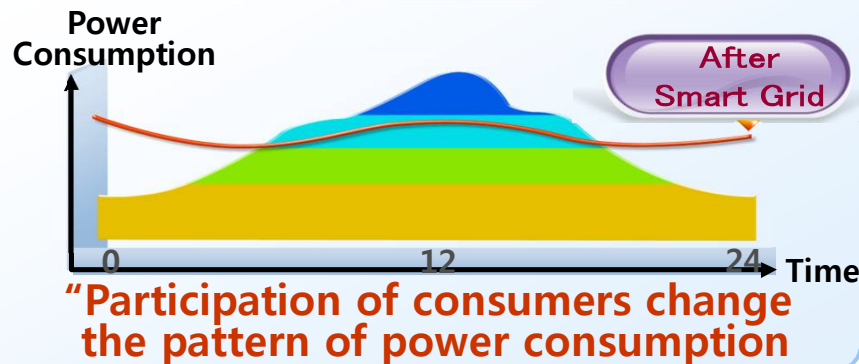


– Why Smart Grid?

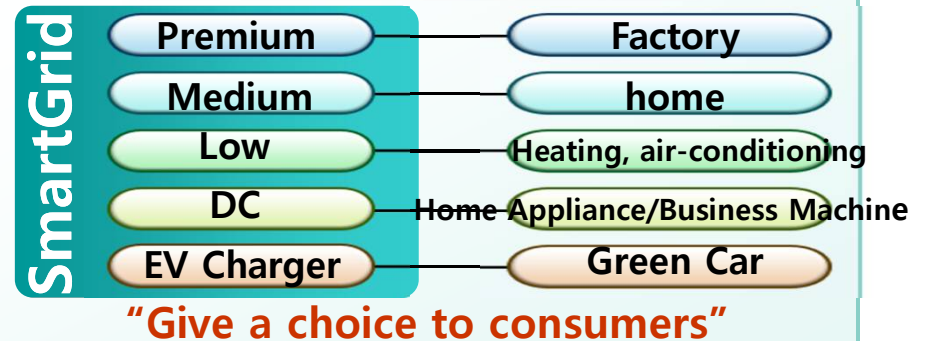
Needs

- Continuous increase of Energy Consumption
 - ➔ Need to improve the effectiveness of energy consumption to respond to Climate Change
- Essential Infrastructure for using renewable energy and distribution of EV

Effective Use of Generation System by Smart Grid



Consumer-Centered Supply of Various Electricity



Development of new generation

"A Green Car is a moving power plant"

Smart Grid



charge
discharge

EV



“Designated as MEF the leading country out of 7 technologies to change the world in G8 Summit” (9/7/2009., Italy)



- Smart Grid(Korea, Italy)
- Energy efficiency(USA)
- Solar energy(Germany)
- Carbon capture and storage (UK, Australia)
- Bioenergy(Brazil, Italy)
- High-tech automobiles (Canada)
- Highly efficient coal technology with low carbon emission(Japan, India)

Response to Climate Change and Green Growth are global trends.

“Korea, the leading country of Smart Grid Technology”



-4. Korea's Smart Grid Project Outcomes

System Set-up

National Road Map established (Jan. 2010) ; 'Smart Grid Promotion Act' enforced (Nov.2011)

- National Smart Grid Road Map (Smart Grid 2030) launched (27.5 trillion won to be invested by 2030)
- 'Smart Grid Promotion Act' enacted with aim to build world's first nationwide smart grid

R&D

Advanced technologies through pioneering R&D

- (Power IT) Top 10 technologies being developed through 253.2-billion-won investment (2005-2013)
- (Electric Vehicle Charger) Developed and standardized * Slow charger: June 2011, Fast charger: September 2011
- (Energy Storage Device) World-class electric vehicle battery manufacturing technology developed

Market Creation

Jeju Test Bed (Dec. 2009~May 2013), Korea Micro Energy Grid (K-MEG, July 2011~June 2014) to pilot technologies and develop business models

- 168 organizations, including power IT companies, carmakers, electronics makers, invested 249.5 billion won (public sector: 76.6 billion won, private sector: 172.9 billion won)
- Developed energy optimization system by applying smart grid concepts to buildings (80 companies took part)

Facilitation

Facilitation efforts, including structure organization , standardized framework and security, active international cooperation

- Established Korea Smart Grid Association as the pilot of the industry (May 2009)
- Former Power IT Institute upgraded to Korea Smart Grid Institute (Aug. 2009)
- Invited ISGAN Secretariat (June 2011); signed cooperation agreements with U.S. and other countries



– 5. Korea's Smart Grid Project Vision and Goals

Vision

Smart Grid-based Low Carbon Green Growth

Goals



Strategies

System Improvement

- Diversify rate tariff and introduce competition

Market Creation

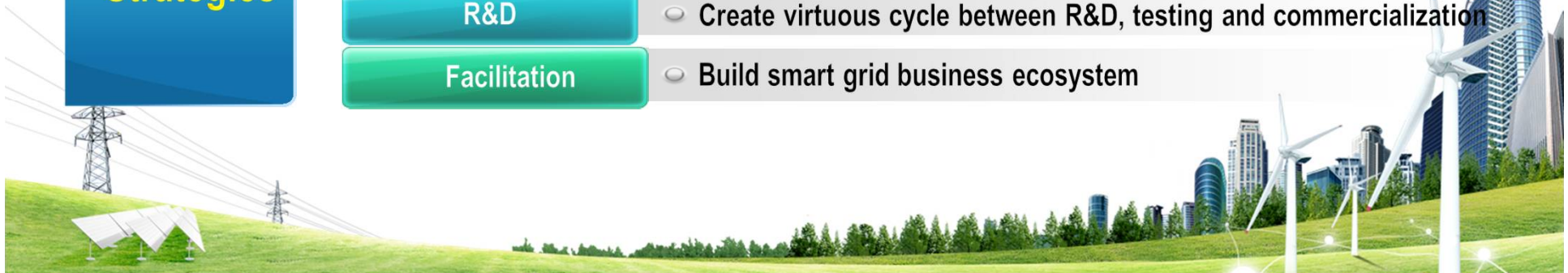
- Support Test Bed, Pilot Cities, and Hub Cities in steps

R&D

- Create virtuous cycle between R&D, testing and commercialization

Facilitation

- Build smart grid business ecosystem



<Ref. > Goals

	Goal	R&D	Test	Market Creation	Range of Smart Grid	National Plan
2030	Build nationwide smart grid				Nationwide	
2021	Build city-wide smart grids	Develop leading technologies	Exports through global test projects	Expand into domestic and global markets	City-wide	
2016	Build 7 hubs			* Promote Hubs		
2014	Business operation; Business ecosystem building	R&D Test Commercialization	Additional tests at home and abroad		• Select 7 Hubs - Field evaluation-based planning - Open market / Energy Special Zones	
2012	Commercialize technologies and business models	Continue a virtuous cycle		• Create market (device distribution, new services) - Build advanced metering infrastructure (AMI) in line with diversifying tariff regimes - Distribute energy storage system (ESS) in line with demand response service - Establish EV charging Infra in line with distribution of EVs - Renewable energy storage system in line with smart renewable energy distribution (1 million green homes)		
2010	Test		• K-MEG (for urban areas) • Jeju Test Bed (for rural areas)			
2005	R&D	• National Smart Grid Road Map (5 Sectors: Consumer, Power Grid, Transportation, Renewable, Electricity Service) • Power IT technologies developed: Top 10 technologies mostly in power transmission and distribution				

The 1st Basic Plan

Energy Storage Commercialization Strategy (2011 ~ 2020)

5th Basic Plan for Electricity Supply and Demand (2010 ~ 2024)

1st Basic National Energy Plan (2008 ~ 2030)

Green Car Business Promotion Strategy

(2010 ~ 2015)

3rd Basic Plan for Renewable Energy (2009 ~ 2013)

-6. 1st National Smart Grid Plan Object Objectives

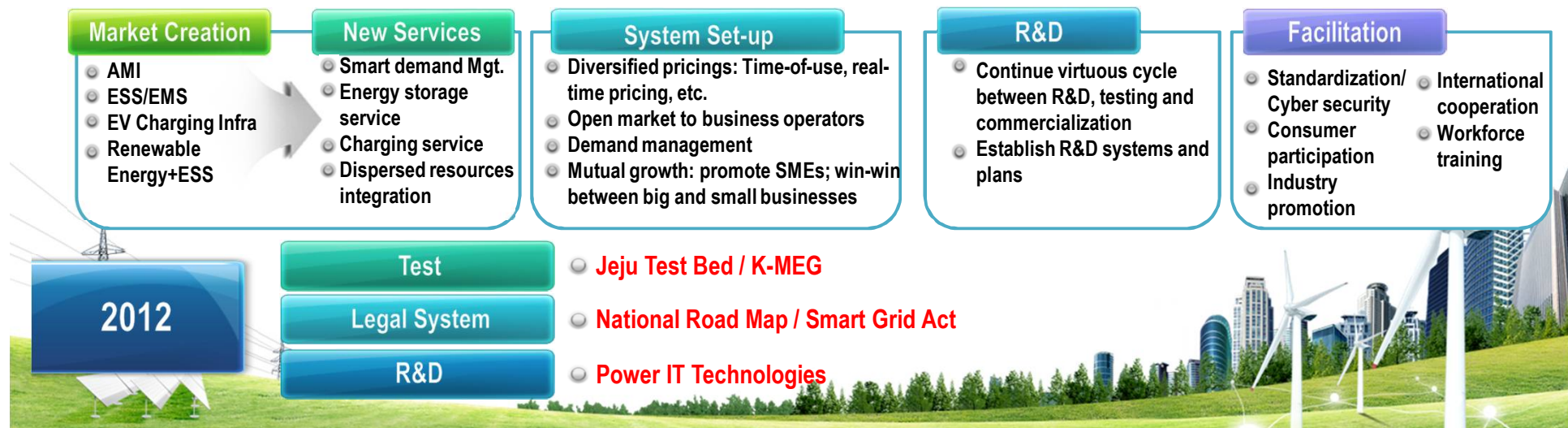
2016

Build World's First 7 Hub Cities (Energy Special Zones)

Smart Grid Hub City



Wider Distribution of Electric Vehicles and Renewable Energy



-7. Smart Grid Roadmap



Activation of Jeju demonstration project

- **Expansion of the area and scope of Test-bed**
 - Current test-bed complex is restricted to commercial facility, factory, apartment etc.
 - expand from suburban to downtown in Jeju
- **Enactment of the operating guidelines about demonstration project**
 - Development activation of new business models
- **Reinforcement of connectivity with new businesses**
 - K-MEG ⇒ connected with Jeju test-bed complex
- **Activation of the organization promoting Smart Grid**
 - contents reinforcement and development of the theme tourist route



- 8 Results and Future Plans of Project

System reformation for new business creation

- **Establishment of the demand management market**
 - Provider ⇒ Reduction of the power demand ⇒ Reward of the performance
- **Introduction of pricing by the season or the time for housing**
 - Real Time Pricing
- **Activation of the zone electric business applying Smart Grid**

Infrastructure to spread and expand Smart Grid

- **Spread of the smart metering infrastructure like AMI**
 - 100% dissemination, specially IHD, by 2020
- **Early construction of the charging infrastructure for EV**
- **Construction of Smart Grid building**
 - K-MEG (Korea-Micro Energy Grid) technology and development
- **Method promoting the model city of Smart Grid**
 - later 2012, the base zone of commercialization



– Expected Effect

In the view of Korea

Reformation of 3E(Energy - Environment - Economy)

Energy

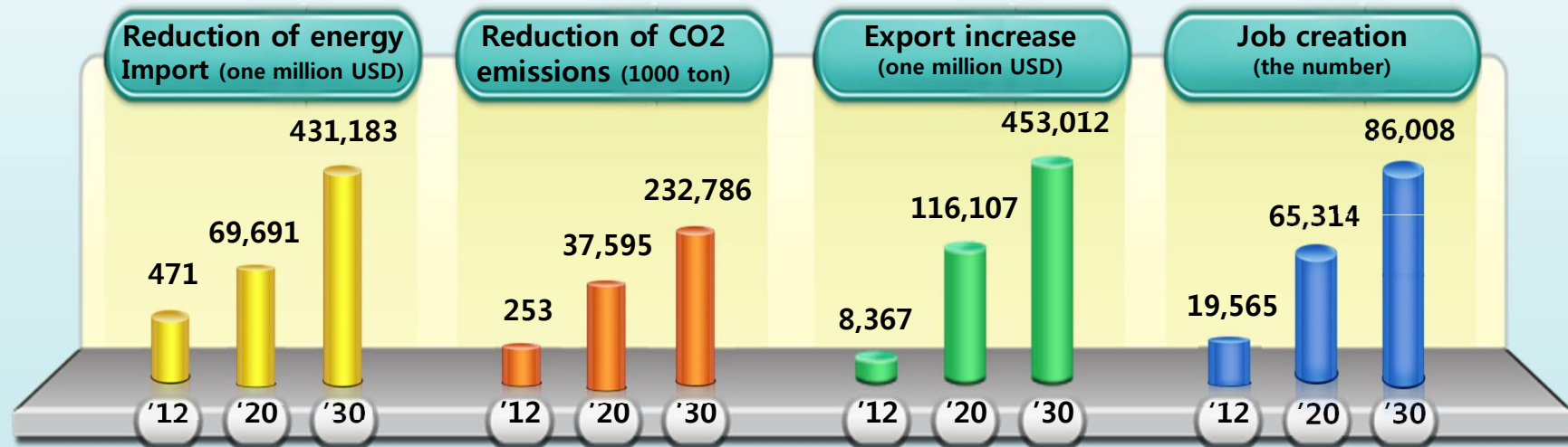
Decrease of Korean energy consumption by 3%(electronic energy 10%) and its pick loads by 6%

Environment

Decrease of Korean greenhouse gas emissions by 230 million ton

Economy

Import decrease of fossil fuels ➡ Energy import decrease by 43.2 billion USD



Smart Grid, Why in Jeju? *Jeju Carbon Free Island*

Jeju Special Self-Governing Province

Easy reformation of system and legal system

Proper Scale Electric Power System

Easy construction and distribution of Smart Grid

Global Clean & Green Image

The best optimal place of promotion for the world market

Connection of 4 lines of HVDC

minimization of system influence and expansion of infra applying new technology

10 Million Tourist Visitors per year

Experiential space for the people in green growth period

Optimal Place Applicable to Green Energy

abundant resources such as Wind, Solar etc

Global Platform Island

Optimal Place of Electric Vehicle operation

Easy construction of optimal-scale infrastructure

Powerful Driving Will of Jeju Province

Fosterage of Smart Grid as New Growth Engine



행원리 풍력단지



동광리 태양광 마을



가파도 Carbon Free Island



-2. Vision and Strategy of Jeju

Vision

Global Green Growth Model, Jeju

- Create local income and jobs by improving industrial structure
- Promote high value-added green high-tech industries
- Create business models, and allow immediate commercialization(Object)

Goals

Phase 1 (by 2012)

Develop Carbon-free Island Model
(Gapado Carbon Free Island)

Phase 2 (by 2020)

Establish Carbon-free Island Infrastructure
(offshore wind power generation, smart grid, electric vehicles)

Phase 3 (by 2030)

Fossil Fuel Free
Global Green
Growth City



Gapado Carbon Free Island System

Gapado Carbon Free Island system

- ❖ period : 2011.11~2013.10
- ❖ Power : renewable energy 100%
- ❖ Car ; EV home : smart meter



– Jeju Smart Grid Plan

Promote Jeju as global smart grid platform to bring forth green technologies through upgrading the world's current largest and most advanced Jeju Smart Grid Test Bed into a Jeju-wide one

Test Bed (R&D) → Pilot City (Business model development) → Hub City (Commercialization)

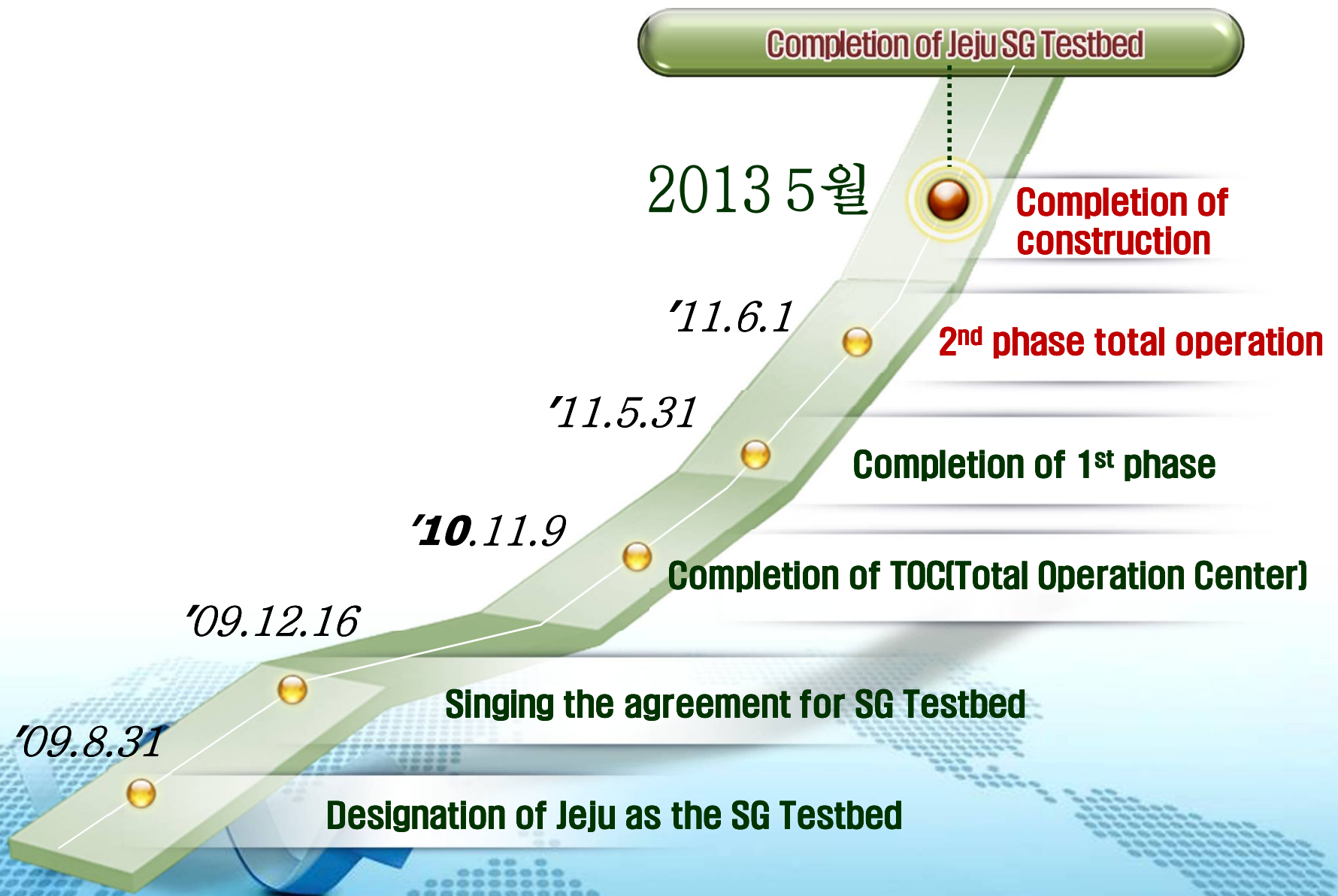
Build Jeju-wide Smart Grid City

- By 2013 → Operate Jeju Smart Grid Test Bed
- By 2014 → Establish Jeju Smart Grid Hub City(s)
- By 2020 → Build a Jeju-wide Smart Grid City

Jeju Smart Grid Plan

- **Extend Smart Grid Test Bed operation by 2016**
 - Establish smart grid interoperability test center based on test bed infrastructure
- **Designate and operate Smart Grid Hub Cities as pilot zone**
 - Distribution of smart meters, energy storage devices, electric vehicle chargers; smart demand management
 - Apply commercialized models to big commercial buildings and tourism facilities in Yeon-dong and Nohyeong-dong areas, and Jungmun Resort
- **Build converged (consumer+EV) Smart Grid Hub City**
- **Anticipated effects**
 - 10 percent less electricity consumption, green life environment, smart grid-converged industries

- Jeju Smart Grid Testbed



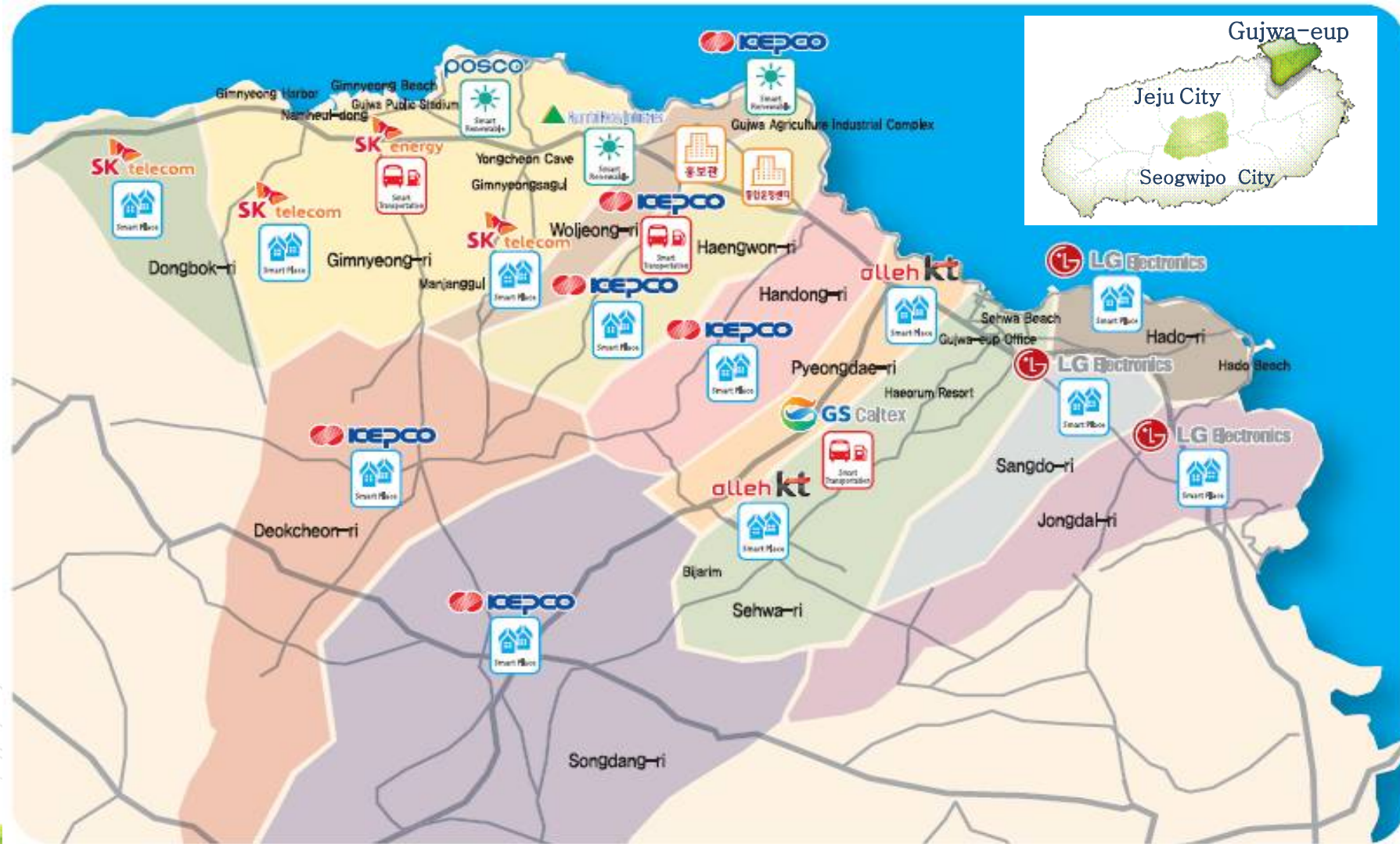
-5. Overview of Smart Grid Testbed

- **Objective** : to early construct the world-biggest and high-tech Smart Grid Demonstration to stimulate commercialization of the related technology and the export industrialization
- **Period : Dec. 2009 ~ May 2013**
 - ❖ (Basic Phase) Dec. 2009 ~ May 2011 : Infra construction
 - ❖ (Extensional Phase) June 2011 ~ May 2013 : integration operation
- **Working expenses : 224 million US dollars**
 - ❖ government - 64 million US dollars, Private - 160 million US dollars
- **Location and target : Gujwa-eup Jeju-si / 6,000 families**
- **Project contents** : Technology development of Smart Grid and demonstration associated with Power Grid
 - ❖ **Five domains : Smart Place, Smart Transportation, Smart Renewable, Smart Power Grid, Smart Electricity Service**
 - ❖ **Participants : 12 consortiums, 168 companies**



-6. Jeju Smart Grid Test-bed (Guiwa-eup)

Area : 186km² (1/10 of Jeju island, 1849km²), population : 15,000, #household: 6,250



- Jeju Test-bed Consortiums

	Leads	Participating
Smart Place (94)	   	• Samsung electronics, Taihan Electric Wire, Nuri Telecom etc (37) • Samsung electronics, Korea Cable TV, NexG etc (28 companies) • Samsung SDS, Samsung Trade, Rootech etc (14 companies) • LG U+, G pure cell, GS construction etc (15 companies)
Smart Transport (42)	  	• Samsung SDI, Lotte data communication, P&E Solution etc (22) • SK network, Iljin Electrics, Ientech etc (13 companies) • LG CNS, ABB Korea, NexCon Take etc (7 companies)
Smart Renewable (32)	  	• KOSPO, Hyosung, LSIS etc (16 companies) • Maxcom, Icel Systems Korea etc (6 companies) • LG Chem, Woojin Industrial Systems, DaeKyung Engineering(10)
Smart Power Grid		• KEPCO KDN, LSIS, AnyGate etc (16 companies)
Smart Electricity Service	 	• Wooam, Bitech Information & Communication etc (5 companies)



– . Characteristics of Jeju SG Testbed

Enterprise Competitiveness

- ▶ globally competitive business industries
- ▶ Total of 168 companies participating in Electricity, telecommunication, vehicles, oil refining, smart appliances etc.
- ※ reduction of power consumption by 20% using smart meters

Jeju Bigbang

- ▶ Convergence project of various businesses
- ▶ creation of innovated BIZ models using state of the art technologies
- ▶ Integrated demonstration of 5 areas such as Smart Place, etc.

Big Investment

- ▶ Companies are making greater investments for the demonstration project
- ▶ 171 billion won (160 million US dollars) of private investment



– Smart Grid Promotion & Experience Hall

It affords people the chance to experience diverse Smart Grid technologies and services such as smart meters, IHD, EV charging and ride, and utilization of renewable energy .

POSCO's Smart Renewables Experience Hall



Experience 'green life' where new and renewable energy as well as storage are applied

PR Center/KEPCO Experience Hall



Comprehend Korea's SG concepts and the Jeju Smart Grid Test Bed

LG Live Green



Experience smart green services that are based on smart home appliances and smart meters

Smart Grid Test-bed



Gujwa-eup

Gimnyeong Beach

Women Driver's Museum

Manjanggul

Hado Beach

SK/HHI Smart Grid Experience Hall



See a demonstration and experience home energy saving services connected via EVs and photovoltaics

Experience of electric car



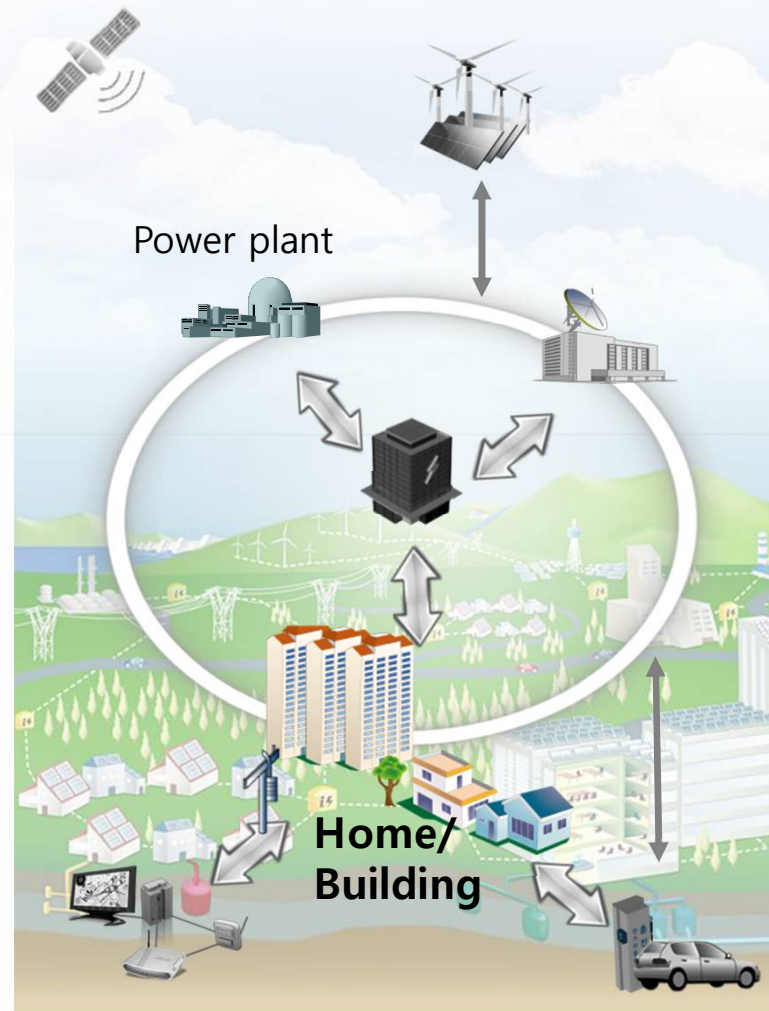
EVs are placed throughout the test bed to provide visitors with EV riding and charging.

KT/GS Caltex Smart Cafe



See a demonstration and experience services that integrate electric power, broadcasting, and telecommunications services

– Status of promoting – Smart Place



Contents

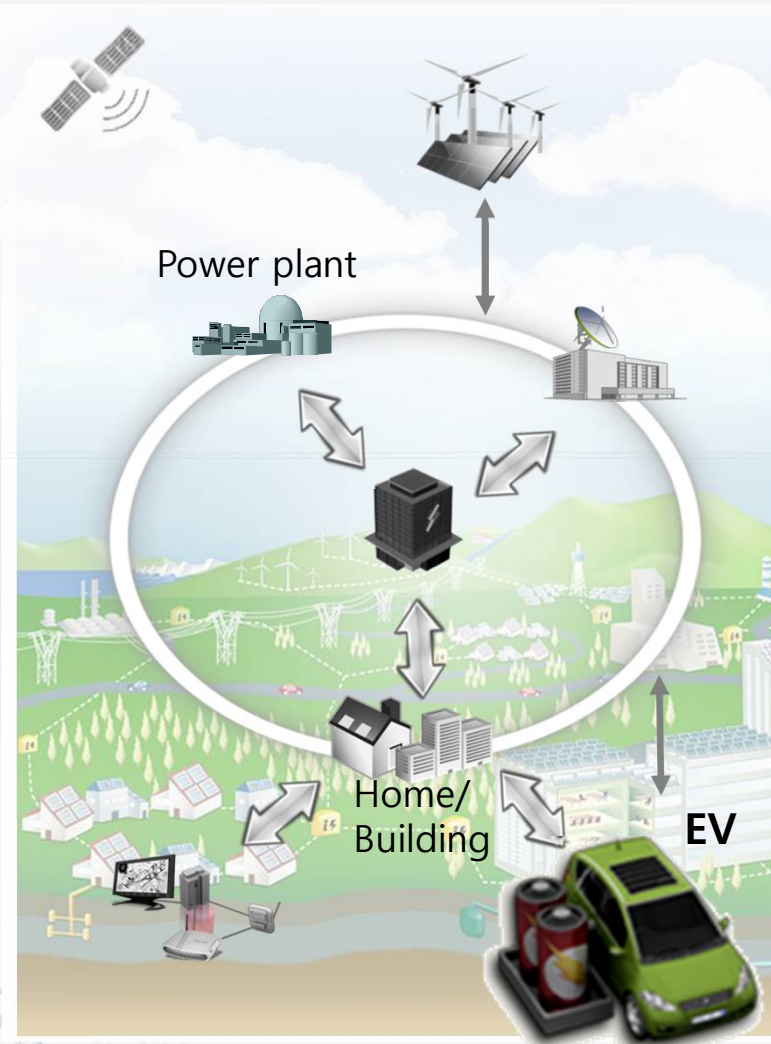
- Real-time confirmation of Power usage patterns
- Various power exchange (sales, inverse-sales)
- Optimization of power consumption of Home appliances

Characteristics

- | | |
|---|----------------------|
|  | Smart green home |
|  | Convergence services |
|  | Smart appliance |
|  | Energy Efficiency |

Participation

- Participating : 101 companies
(4 Consortiums)



Contents

- Construction of EV charging infrastructure
- Decentralized power associated with the EV battery
- Re-sales using charged power of EV

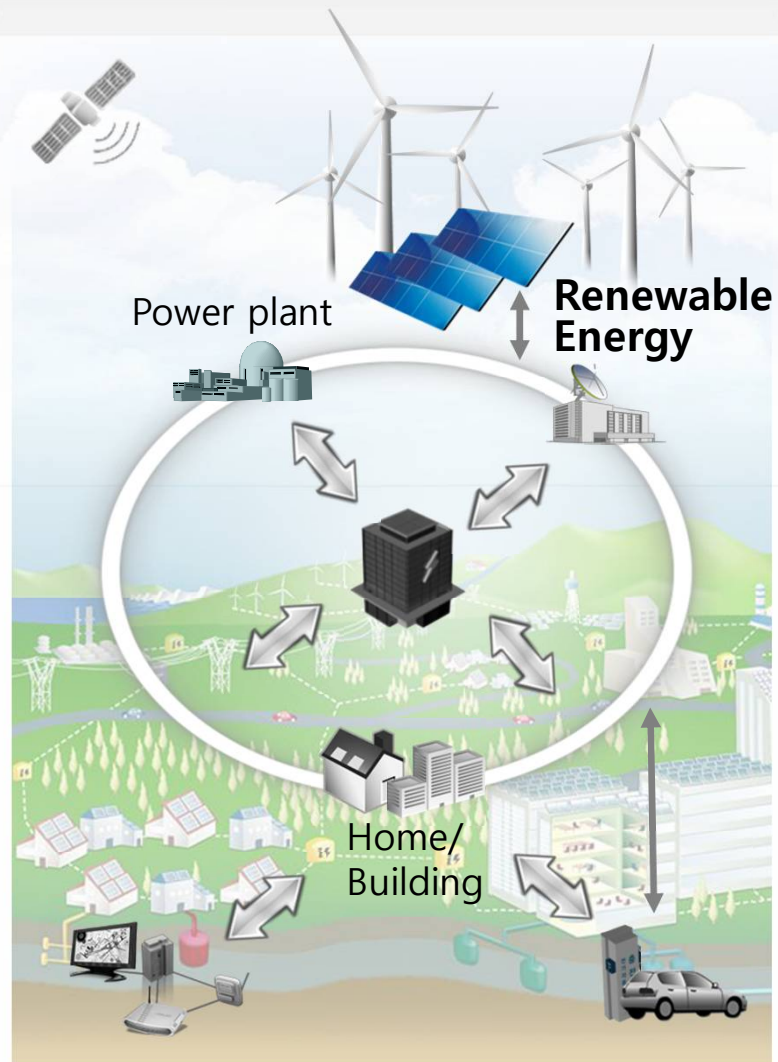
Characteristics

-  **High-speed charging Infra**
-  **Business model associated with the additional services**
-  **Charging using decentralized power**

Participation

- Participating : 39 companies
(3 Consortiums)

– Status of promoting – Smart Renewable



Contents

- Stable association of renewable energy with power grid
- Expansion of wind power and photovoltaics system
- Effective use of renewable energy

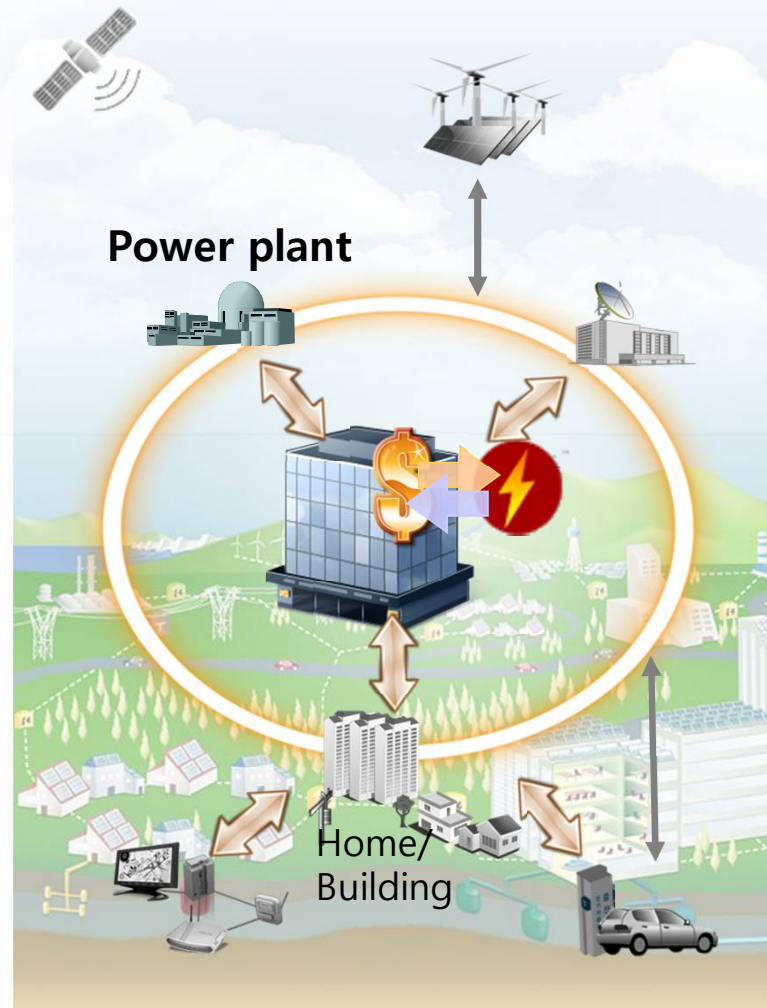
Characteristics

-  **Renewable energy source**
-  **Operation of RE.**
-  **Application of RE.**

Participation

- Participating : 37 companies
(3 Consortiums)

– . Status of promoting –PG, ES



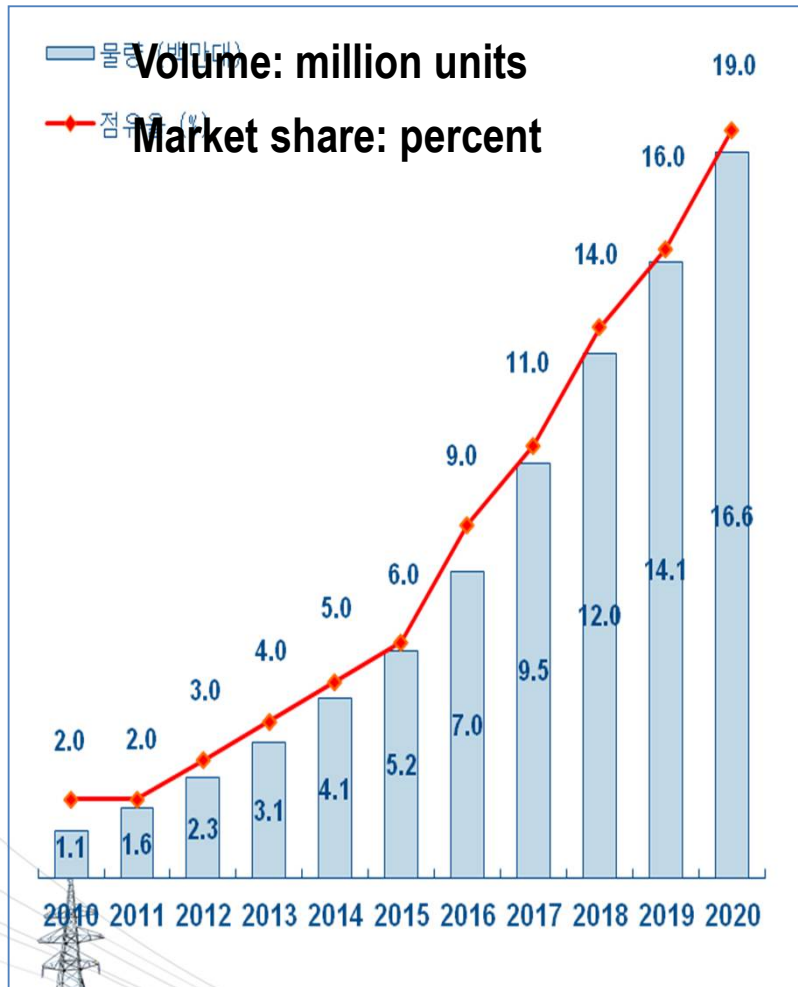
Power Grid

- Contents : intelligent power grid, fault detection and auto-recovery
- Participating 21 companies , KEPCO etc.

Electricity Service

- Contents : construction of TOC (Total Operation Center) new power exchange
- Participating 6 companies, KEPCO, Power Exchange etc.

World EV Market Forecast



Source: Deutsche Bank Report

- Advanced countries introduce tighter regulations on fuel efficiency and exhaust emissions to reduce greenhouse gas

- Greenhouse gas emissions target by 2020 can only be reached with non-emission eco-friendly vehicles

EV market forecast to surge

- Significant growth from 2012; 20 million units forecast to be produced and bought by 2025 (30 times more compared to year 2012)
- As of 2012, 120 EV models are in production

Projected restructuring of global car and relevant industries

- Boom in EV, battery, electric motor, electric control businesses
- User network built by charging infra operators



– Korea's EV Project Strategies

Vision

World's Fourth Green Car Powerhouse by 2015

Background

Introduction of electric vehicles backed by greenhouse gas regulations changing global automotive industry

Competitiveness of domestic auto industry must be strengthened in response to government-led promotion of green car industry in other countries

Objectives

R&D , Production

By 2015, annual domestic production of 1.2 million green cars, export of 0.9 million units
By 2020, annual domestic production of 1.9 million green cars, export of 1.3 million units

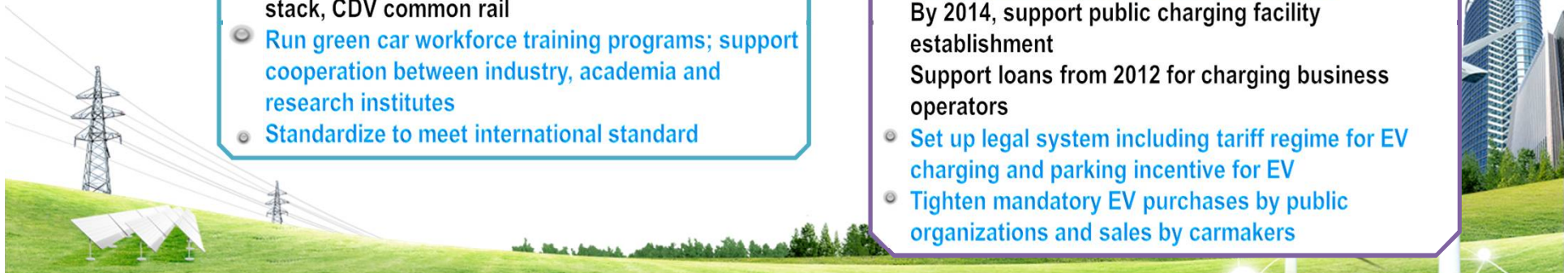
Market Promotion

Green car market share to reach 21 percent by 2015, 40 percent by 2020
By 2020, reduce greenhouse gas emission by 18 million tons

Strategies

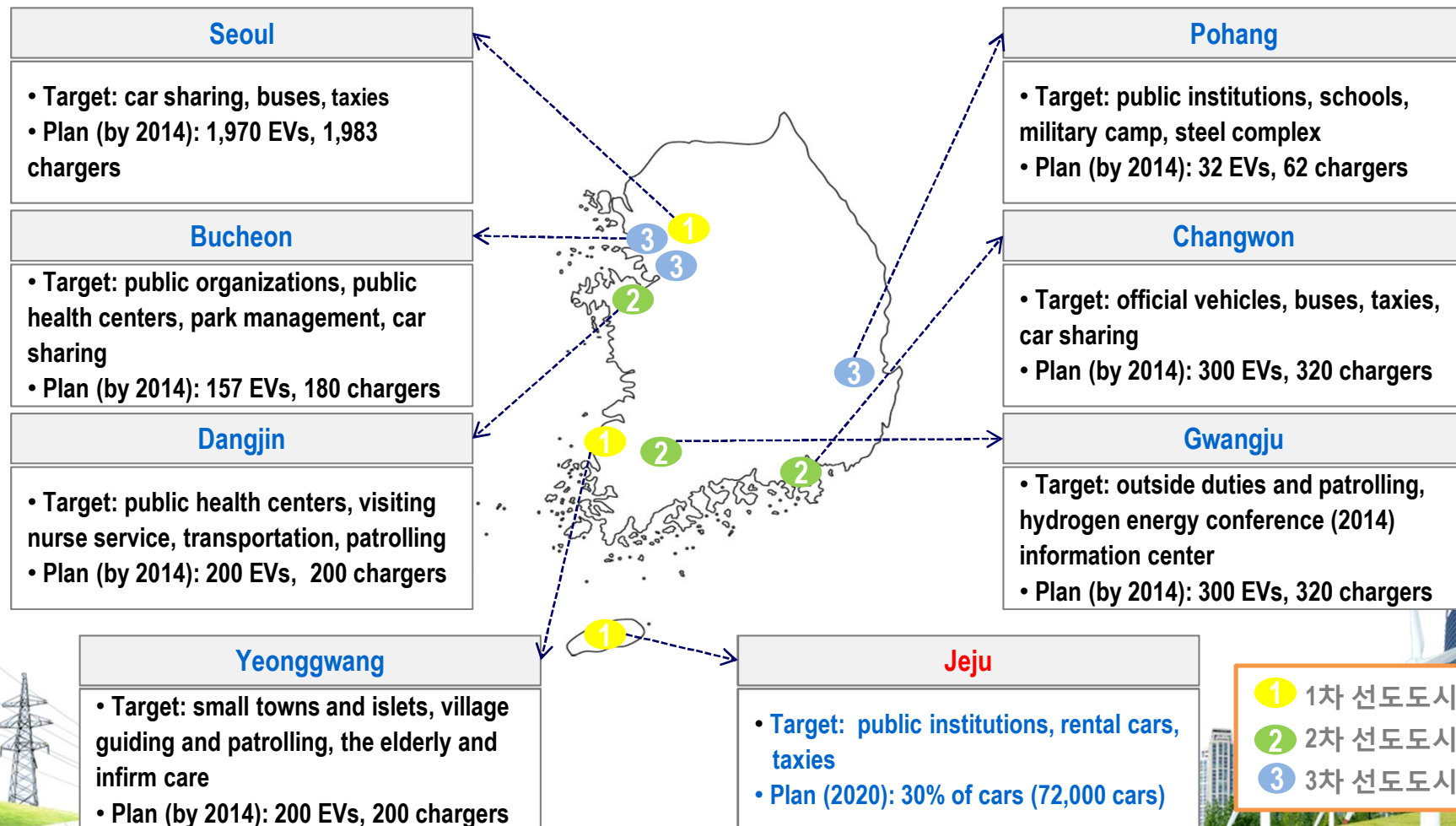
- Encourage mass production of finished car makers and support investment fund to part suppliers
- Obtain source technology for 8 major car parts and produce them domestically
 - batteries, motors, ventilation parts, lightweight materials, chargers, power transfer units, fuel cells stack, CDV common rail
- Run green car workforce training programs; support cooperation between industry, academia and research institutes
- Standardize to meet international standard

- Provide financial incentives for green car purchase (pilot operation to public consumers, then expand provision to private consumers)
Tax incentives to PHEV, EV, FCEV in a level equivalent to that to HEV
- Support charging infra for plug-in vehicles
By 2014, support public charging facility establishment
Support loans from 2012 for charging business operators
- Set up legal system including tariff regime for EV charging and parking incentive for EV
- Tighten mandatory EV purchases by public organizations and sales by carmakers



– Korea's EV Project Cities

- Selected pilot city for wider distribution of EVs and chargers
- Pilot cities expected to lead region-specific commercial EV model market



Vision and Strategy

Vision

Build Jeju-wide EV Pilot City

- Develop Jeju into EV Pilot City
- Promote Jeju as global hub for EV industry

Goals in phases

Phase 1 (by 2017)

Replace 10% of public organizations' and rental car fleets with EVs (29,000 units)

Phase 2 (by 2020)

Replace 30% of buses and rental cars with EVs (94,000 units)

Phase 3 (by 2030)

100% replacement with EVs (371,000 units)



Promote Jeju as global hub of EV industry through development as EV Pilot City utilizing Jeju's premier EV infrastructure and operating conditions

● EV Distribution Target

- ❖ Phase 1 (by 2017): 10% replacement, including public-use and rental cars (29,000 vehicles)
- ❖ Phase 2 (by 2020): 30% replacement, including buses, rental cars (94,000 vehicles)
- ❖ Phase 3 (by 2030): 100% distribution (371,000 vehicles)

● Plan

- ❖ EV distribution target in 2013: 300 cars (currently 223: 146 public, 77 private)
 - Provincial subsidies for public transportation and private EV consumers: 2.5 billion won
- ❖ Set up integrated operating system for charging infrastructure in first half of 2013
 - Establish integrated EV charger operating center: 371 chargers (including 179 pilot chargers)
- ❖ Develop Jeju EV industry into key local industry by measures including attracting EV companies to Jeju



IV – Jeju EV Charging Infrastructure Strategy

Infrastructure Considerations

EV Distribution

- Public-use cars
- Rental cars
- Taxis
- Buses

Infrastructure Installment

- Public organizations
- Major roads, downtown areas
- Bus garages

- Reflect characteristics of each area in establishment planning
- Consider existing charging facilities in future plan

Directions in charge infra.

Phase 1

Test bed
centered
expansion

Phase 2

More
infra.
hubs

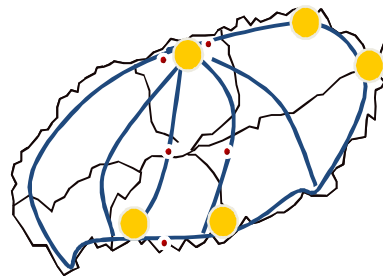
Phase 3

Full
coverage

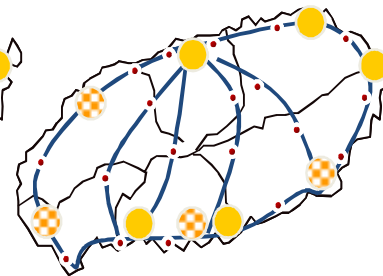
Infra.
Map

Plan
(Details)

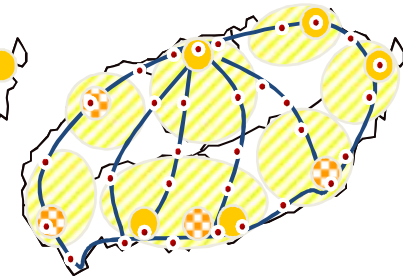
Phase 1 (~2017)



Phase 2 (~2020)



Phase 3 (~2030)



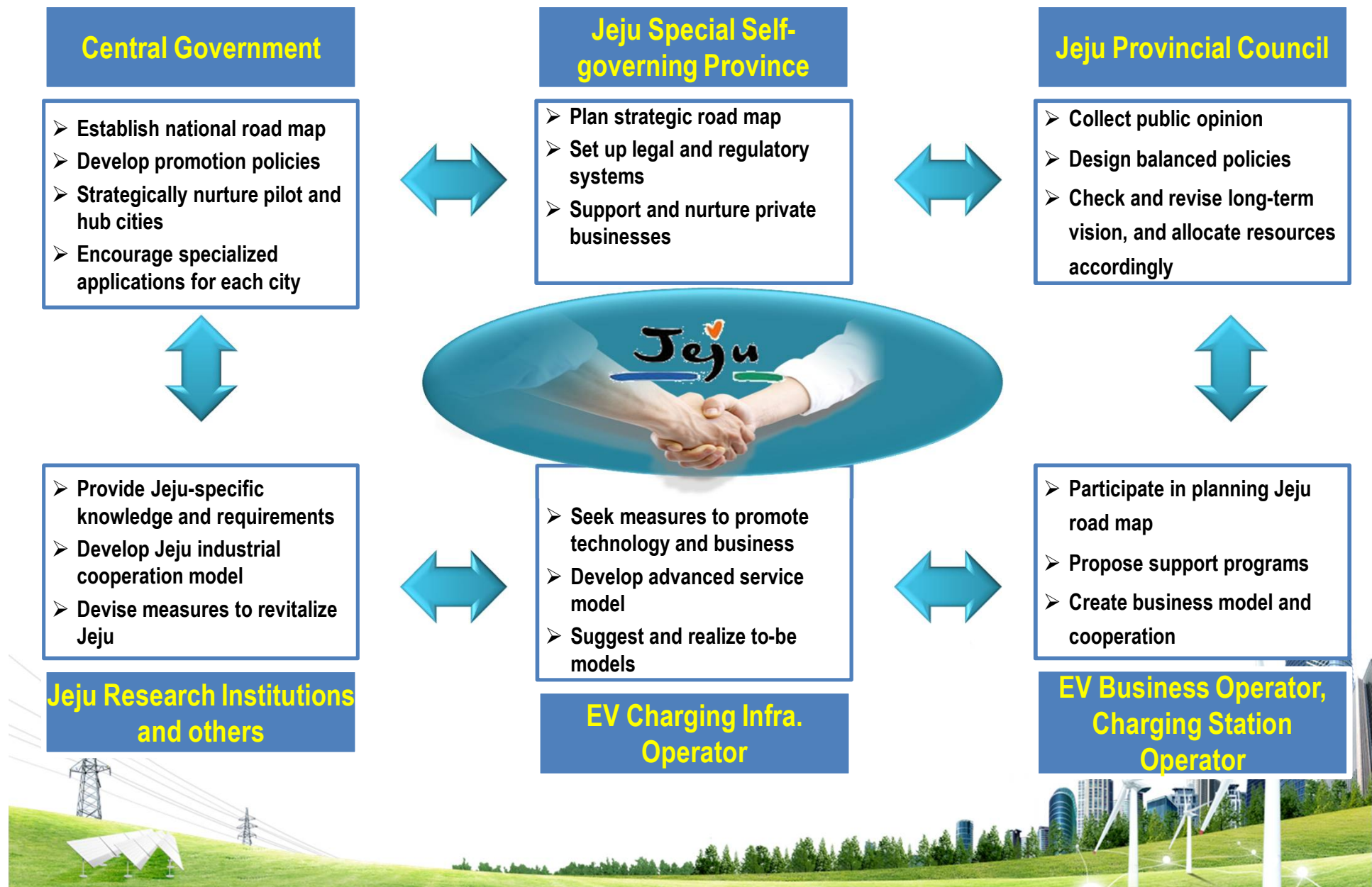
- Operate charging facilities established for test-bed projects and establish more facilities to cover wider area
- In line with the phase 1 of EV distribution strategy, establish charging infra. at public organizations, rental car and bus garages
- Considering needs of rental cars and taxis, build fast-charging and battery exchange stations along major roads

- Complete charging infra. establishment for rental cars (major tourist attractions, and accommodations)
- Complete establishment of charging and battery exchange stations for public transport
- To meet wider EV use, build more charging infra. in residential and commercial zones

- Complete charging infra. distribution to satisfy volume of EV use



IV – Jeju EV Cooperation System



IV – Jeju-Posco-Nagasaki MOU on EV&ITS

MOU on EV & ITS with Nagasaki, Japan (in Jeju)



- MOU between Posco ICT and Nagasaki on EV & ITS
- In cooperation with the Jeju Provincial Office, Jeju National University, Jeju Development Institute

Attended Nagasaki EV & ITS Conference



- Attended Nagasaki EV & ITS Conference (Goto Islands)
- Technological exchange with the Nagasaki Ebisu Consortium



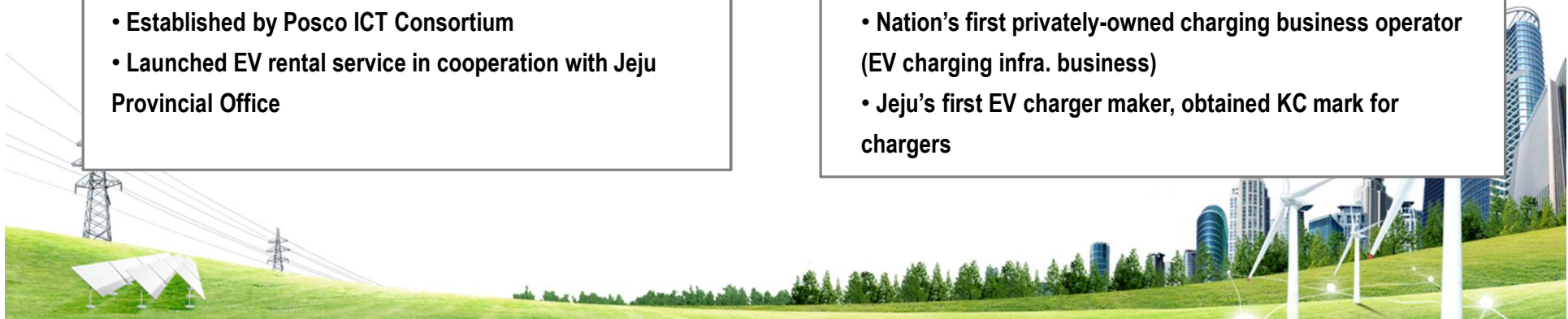
➤ Established (Aug. 23, 2012)



- Established by Posco ICT Consortium
- Launched EV rental service in cooperation with Jeju Provincial Office



- Nation's first privately-owned charging business operator (EV charging infra. business)
- Jeju's first EV charger maker, obtained KC mark for chargers



IV – . Expansion of Electric Vehicle Service in Jeju

Smart Grid-affiliated project; Integrated operation testing; EV charging infra. testing

Best practices regarding EV test bed

Integrated Micro Grid Operation Center



Electric Vehicle Charging Demonstration





Thank You

