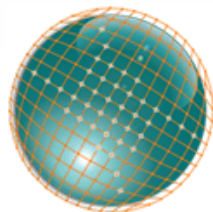


Korea Technology Roadmap and International Collaboration

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4th International Conference on
**Integration of
Renewable and Distributed
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December 6-10, 2010
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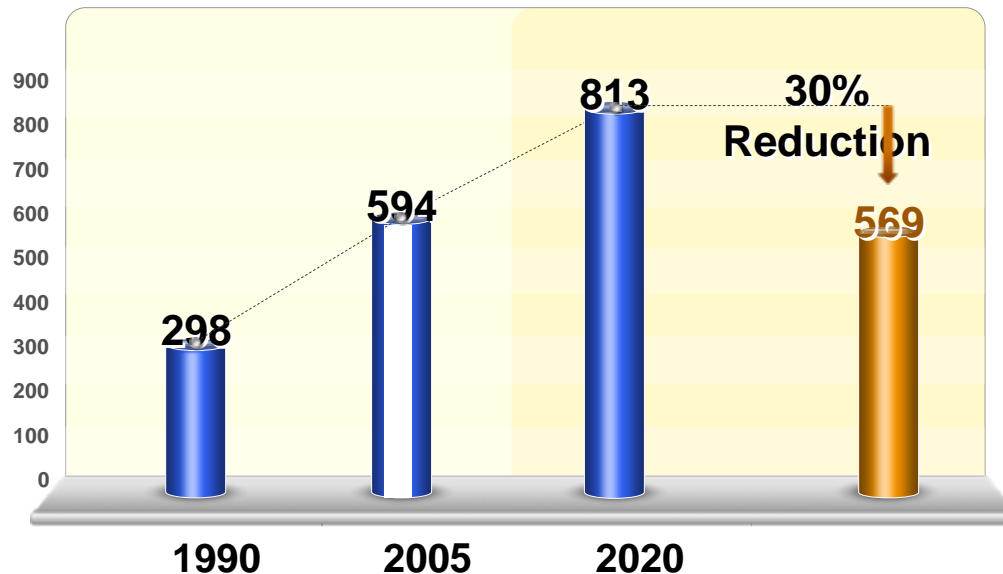
- Introduction of Korea's Energy Policy and Korean Power System
- Renewable Energy Policy of Korea
- Green Energy Technology Development Roadmap of Korea
- Smart Grid Roadmap and Pilot Tests in Korea

Korea's Green Energy Initiative

- New Government's Energy Policy (1)
 - Low Carbon Green Growth (2008)
 - Green Technology Development as a New Growth Engine
 - Green Energy Paradigm
 - Improvement of quality of life
 - Contribution to the Global Community
 - Core Green Technologies of the Green New Deal
 - Renewable : Photovoltaic, Wind, Fuel Cell, IGCC, Nuclear
 - Clean Fossil Fuel : Clean Fuel (GTL, CTL), CCS
 - Energy Efficiency : Smart Grid, LED, Energy Storage, Combined Heat & Power, Heat Pump, Superconductivity, Green Car, Energy Efficiency Building

Korea's Green Energy Initiative

- New Government's Energy Policy (2)
 - Determination of National GHG Reduction Target (2009)
 - Reducing emissions 30% from the BAU level by 2020 (813Mton → 560Mton)
 - 2010 Announcement of Introduction of Emission Trading Scheme from 2013

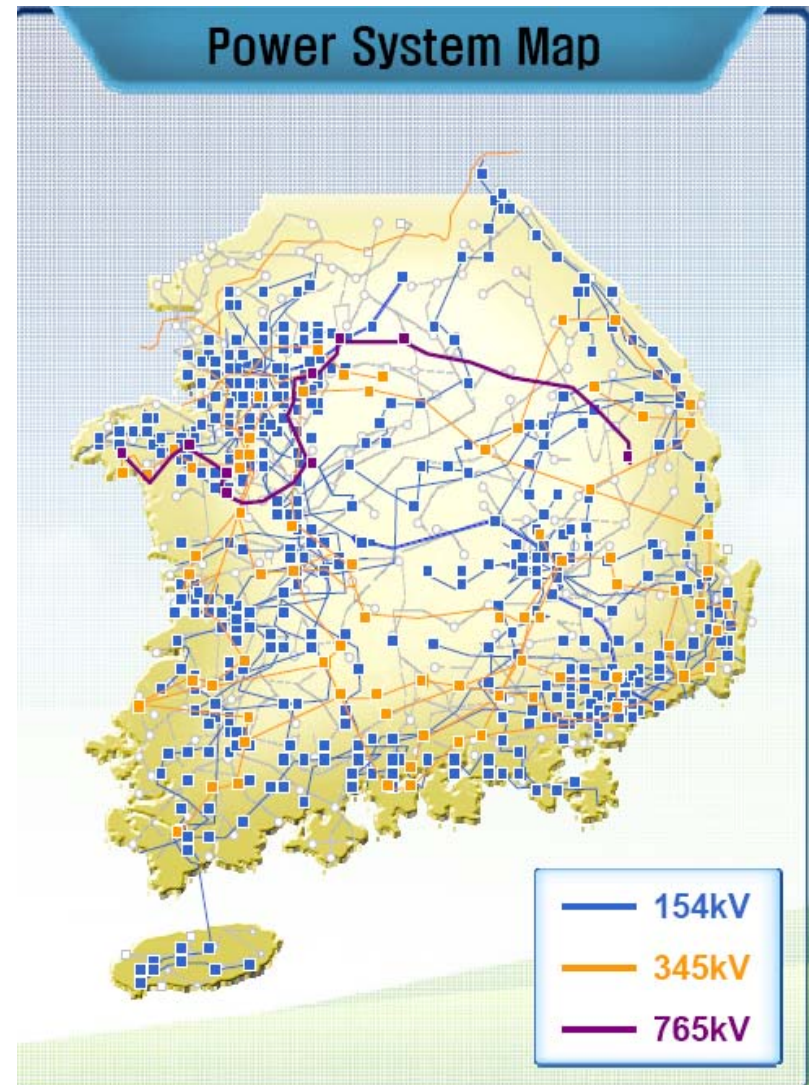


Korea's Green Energy Initiative

- New Government's Energy Policy (3)
 - Increase of Renewable Energy by 10% until 2022
 - 2010 Announcement of Introduction of RPS from 2012
 - Establishment of Smart Grid Initiative (2009)
 - National Smart Grid Roadmap Development (2009)
 - Jeju Island Smart Grid Pilot Projects (2009~2013)
 - Smart Grid Promotion Act (2010)

Outlines of Korean Power System

- Korean Power System (1)
 - Transmission
 - 765kV/345kV/154kV
 - Isolated Power System
 - 2 Congested Areas (Seoul-metro, Cheju Island)
 - HVDC Interconnection (Mainland-Cheju)
 - Distribution
 - 22.9kV
 - T/D/Retail
 - Monopoly by KEPCO



Outlines of Korean Power System

- Korean Power System (2)
 - Generation (77,662MW)
 - Nuclear : 17,715MW
 - Coal : 24,205MW
 - LNG : 17,805MW,
 - Oil : 5,437MW
 - Cogen : 1,610MW
 - Renewable : 2,750MW
 - Competition in Generation
 - 6 Gencos (KEPCO Subsidies)
 - IPPs (5%)
 - Cost-Based Pool Wholesale Market

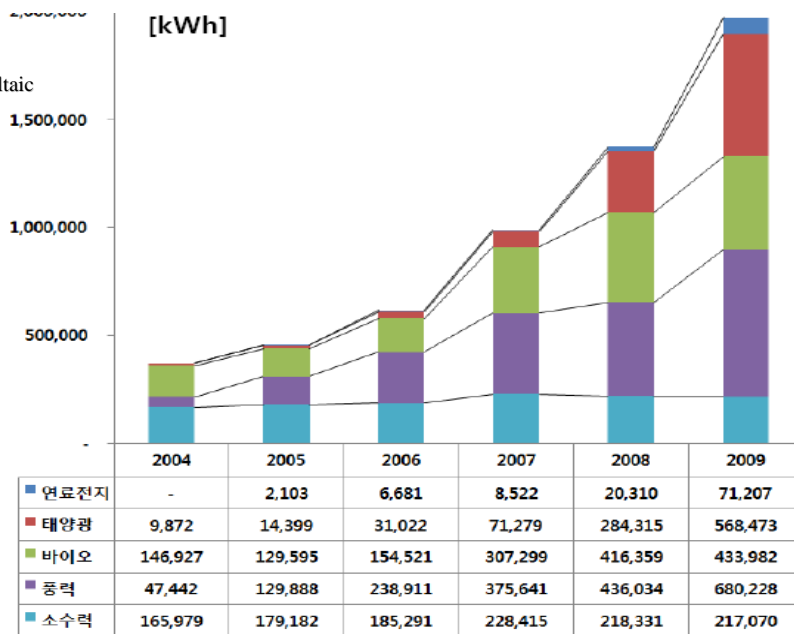
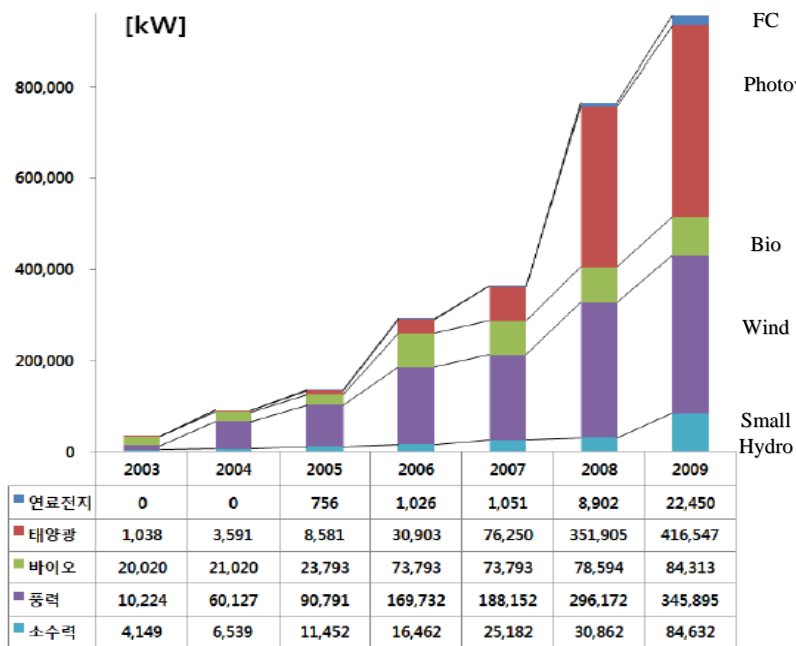


Renewable Energy Policy of Korea

- Renewable Energy Policies
 - Introduction of Feed-in-Tariff (2001)
 - Photovoltaic, Wind, Bio, Small Hydro
 - Feed-in-Tariff Resources Expansion (2006)
 - Fuel Cell, Tidal, etc
 - RPS Introduction Announcement (2010)
 - Target Share of Renewable Generation (2012: 2.0%, 2022: 10.0%)
 - Obligations to 14 Generation Companies (500MW above)
 - Market Split between Photovoltaic & Other Renewables
 - Weight Changes among Renewable Resources (0.25~2.0)

Renewable Energy Policy of Korea

- Renewable Energy Penetration Trends
 - Rapid Increase of Renewables due to FIT
 - 35MW(2003) → 954MW(2009)
 - 370MWh(2003) → 954MWh(2009)
 - Excluding Large Hydros



Renewable Energy Policy of Korea

- Renewable Generation Target & Weights in RPS
 - 2.0%(2012) – 10.0%(2022)

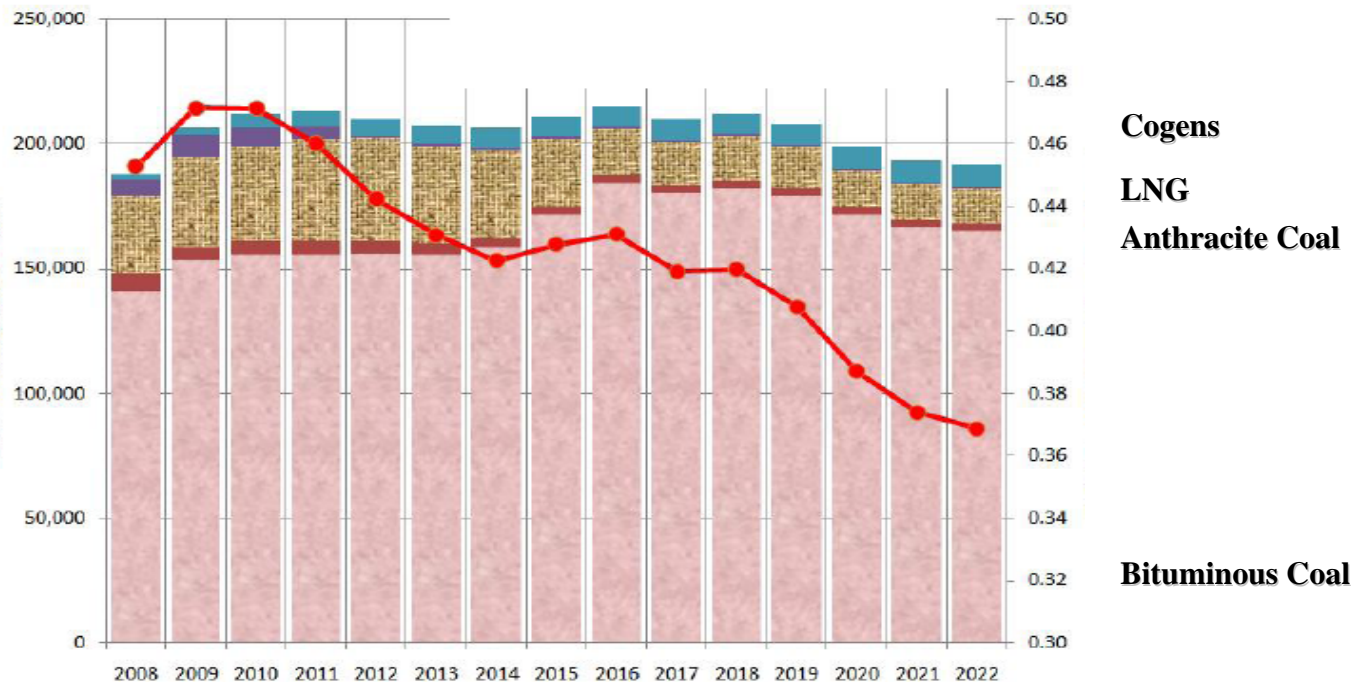
'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22~
2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
0.5%p ↑					1.0%p ↑					

– Weights among Renewables

- General RPS Market
 - Tier 0 (0.25) : IGCC, Tier 1 (0.50) : RDF, LFG
 - Tier 2 (1.0) : Small Hydro, Wind, Bio Gas, Biomass, Ocean 1
 - Tier 3 (1.5) : Off-shore 1
 - Tier 4 (2.0) : Off-shore 2, Ocean 2, Fuel Cell
- Photovoltaic Market : 0.5-1.5

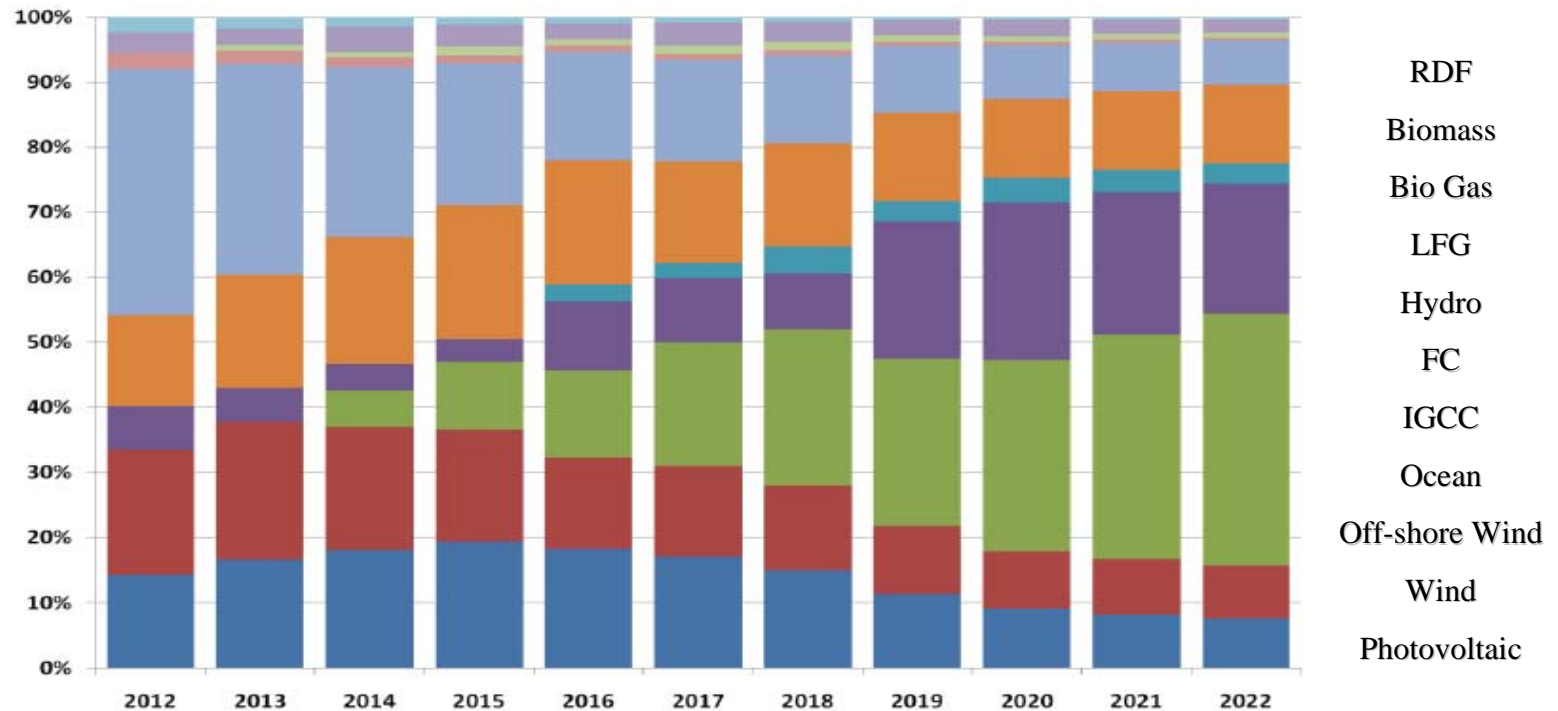
Renewable Energy Policy of Korea

- GHG Emission Reduction (RPS)
 - Decrease of CO2 Emission in Power Sector due to RPS
 - 187MCO₂t (2008) → 211MCO₂t(2015) → 191MCO₂t(2022)
 - 0.45[CO₂t/MWh] → 1.13[CO₂t/MWh] → 0.37[CO₂t/MWh]



Renewable Energy Policy of Korea

- Renewable Portfolios in 2022
 - Rapid Increase of Off-Shore Wind (39%) and Ocean Energy (20%)
 - Steady Fuel Cell Penetration (12%)

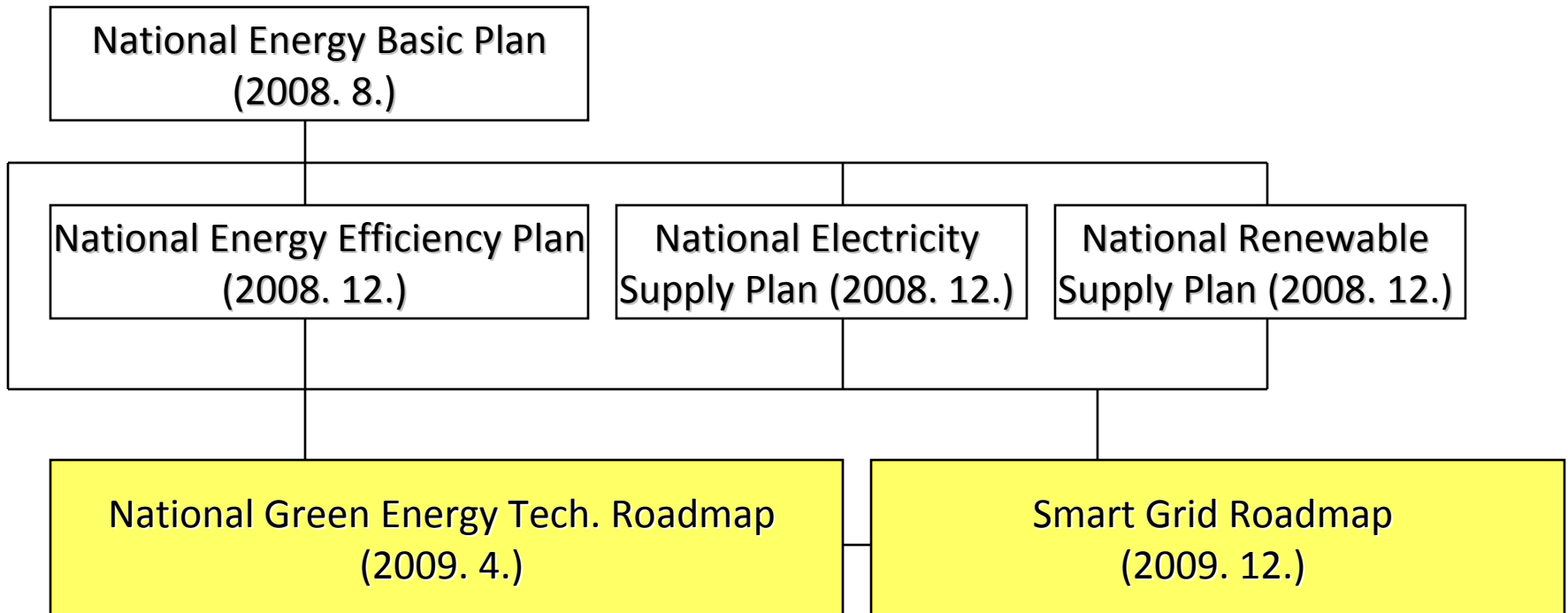


Renewable Energy Policy of Korea

- Rate Impacts Analysis
 - Rate Increase Impacts : 1%(2012) – 5%(2022)
 - Based on the Estimated REC Cost
 - Revenue Components of Renewables
 - Energy Payment from Wholesale Electricity Markets
 - Capacity Payment from Wholesale Electricity Markets
 - REC Payment from REC Market

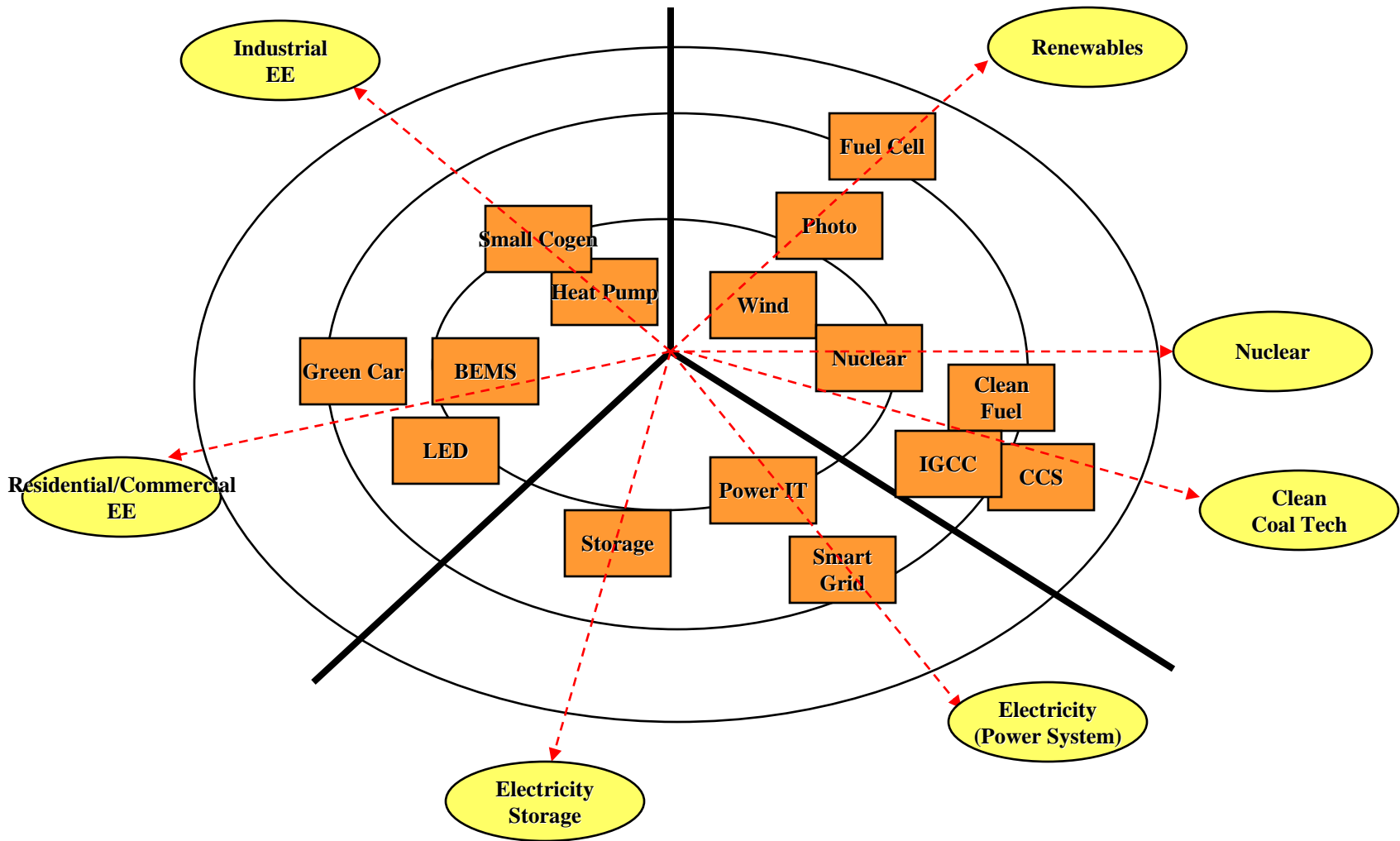
Green Energy Technology Roadmap

- National Energy Plan Governance



Green Energy Technology Roadmap

- National Green Energy Tech. Roadmap



Green Energy Technology Roadmap

- Characteristics of Green Energy Tech. Roadmap
 - Market Driven Policy
 - Multi-Layer Technology Development Strategy
 - Material and Component Level
 - Device Level
 - System and Implementation Level
 - Convergence Level
 - Short-term Tech. vs Long-term Tech.
 - Encouraging International Collaborations

Smart Grid Roadmap

- Smart Grid History in Korea

- Power IT Program Initiative ('05)

- Utility Focused R&D Projects (More than 10 Projects)
- Technology-Driven Policy

- Power IT Industry Growth Policy ('08)

- Commercialization-Driven Policy for the Products of Power IT R&D

- Smart Grid Initiative ('09)

- ICT/Industries Convergence Based Approach
- BM-Driven Policy

Impacts of Smart Grid Act of USA (2008)

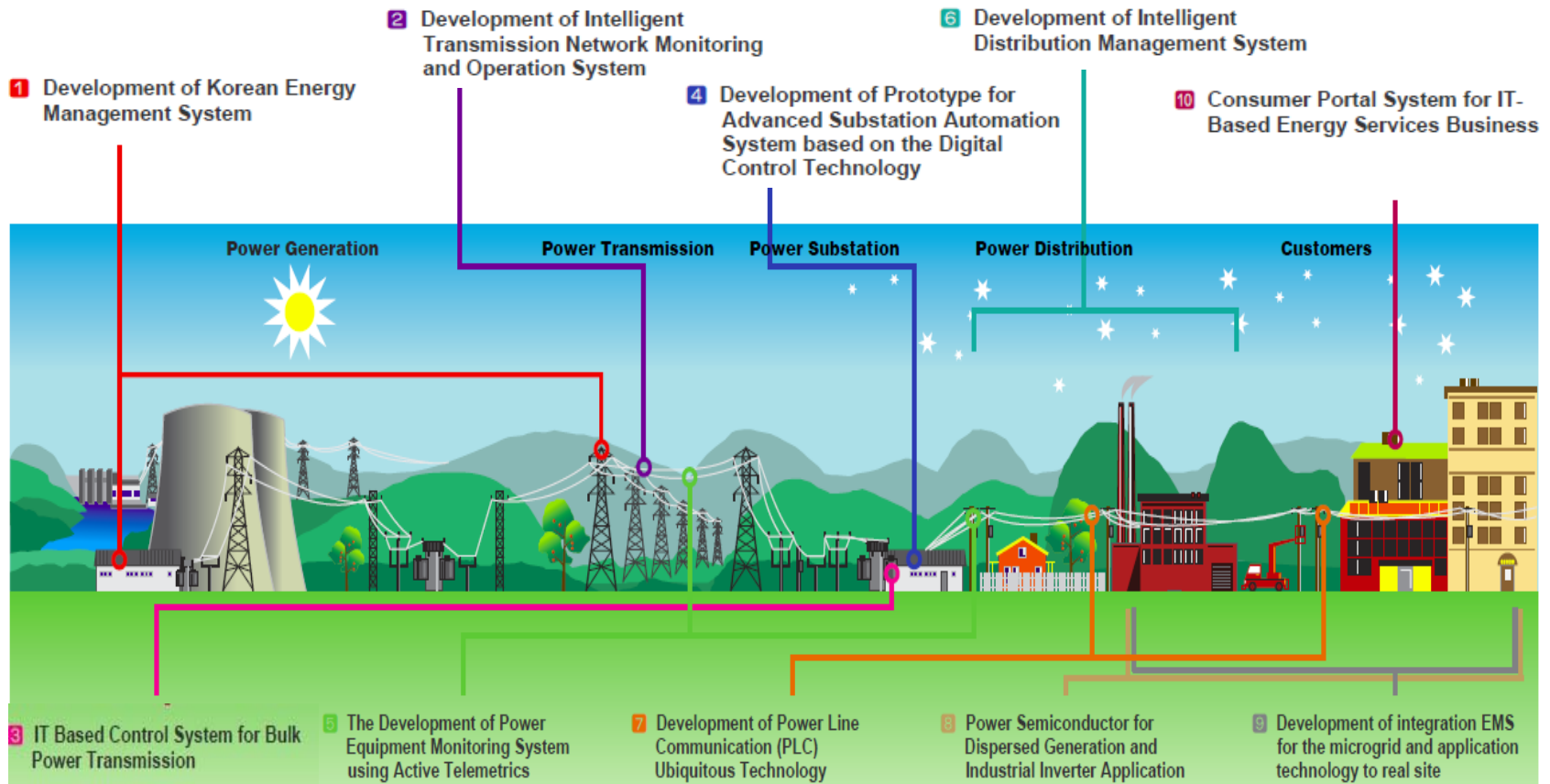


- Demonstration in Cheju ('09-'13)

- Core Part of Green-Growth Policy in Korea

Smart Grid Roadmap

- Summary of 10 Power IT Projects



Smart Grid Roadmap

- Visions of Smart Grid Initiative in Korea
 - Maximizing Efficiency & Reliability
 - Encouraging Convergence among Industries/Technologies
 - Role of Green Growth Platform

Korea Smart Grid



Smart Grid Roadmap

- Smart Grid Technology Roadmap (1)
 - Smart Power Grid
 - Smart Grid Architecture Design
 - Wide Area Monitoring System
 - Intelligent Transmission & Substation Device and System
 - Low and High Voltage DC Technologies
 - Power Line Communications
 - Smart Consumer
 - AMI Architecture
 - Demand Response & Storage
 - IHD, HAN/BAN/FAN Technologies
 - HAMS/BEMS/FEMS

Smart Grid Roadmap

- Smart Grid Technology Roadmap (2)
 - Smart Transportation
 - EV Material and Component
 - Motor Drive and Invertor (PCS)
 - Charging Infra Technology
 - V2G
 - ICT Service Platform Development
 - Smart Renewables
 - Grid Interconnection
 - Power Quality Compensation
 - Forecasting
 - Storage & Renewable Combination

Smart Grid Roadmap

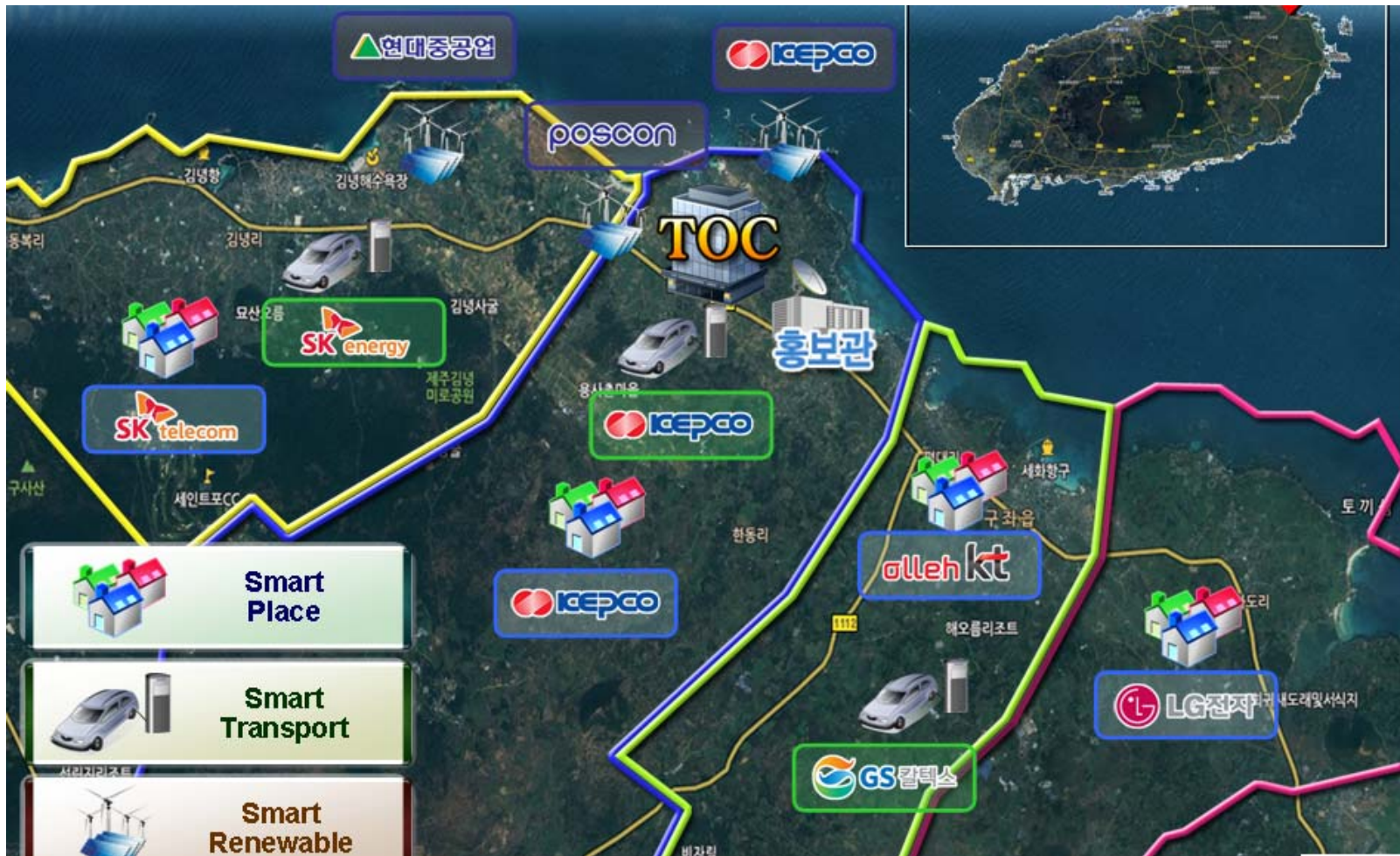
- Smart Grid Technology Roadmap (3)
 - Smart Electricity Market
 - Real Time Pricing
 - DR Applications (Ancillary Services)
 - Consumer Portal
 - Wholesale Market Evolution
 - Virtual Power Plant

Smart Grid Roadmap

- Cheju Island Pilot Projects (1)
 - Isolated Power System (Interconnection via HVDC)
 - High Portion of Renewables
 - Peak Demand : 700MW
 - High Reliance on HVDC(150MW) and Wind : 180MW(2011), and Oil Power Plants
 - Demonstration Domains
 - Smart Place, Smart Renewable, Smart Transportation, Smart Power Grid, Smart Electricity Service

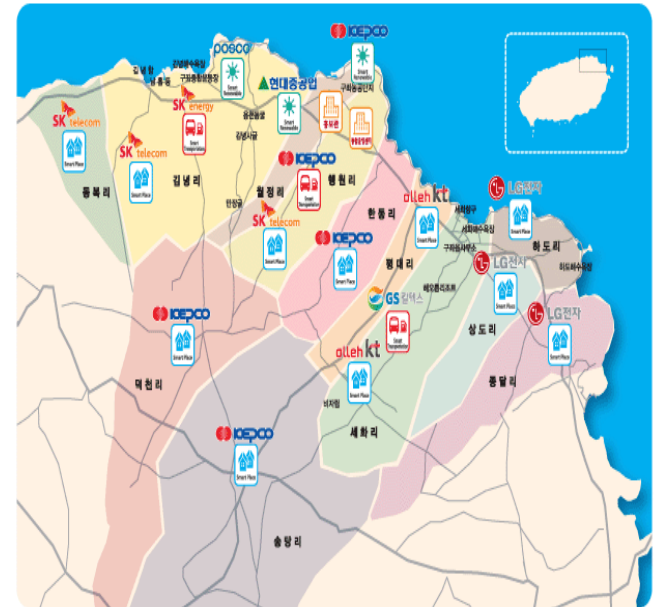
Smart Grid Roadmap

- Cheju Island Pilot Projects (2)



Smart Grid Roadmap

- Cheju Island Pilot Projects (3)
 - Consortiums of Cheju Projects
 - Smart Place Domain : KT, SKT, LG Electronics, KEPCO
 - Smart Transportation Domain : SK Energy, GS Caltex, KEPCO
 - Smart Renewable Domain : KEPCO, Hyundai Heavy Industry, POSCO
 - Smart Power Grid : KEPCO
 - Smart Electricity Service : KEPCO, KPX
 - Total 266 entities are participating the Cheju pilot projects



Smart Grid Roadmap

- International Collaboration
 - Illinois Partnership
 - Smart Transportation, Smart Building
 - MEF (Major Economic Forum) Smart Grid Roadmap
 - Corporation with Italy
 - ISGAN (International Smart Grid Action Network)
 - Partnership with IEA
 - International Collaboration in Pilot Projects

Smart Grid Roadmap

- Future Plan

Smart Grid Promotion Act

2010

2012

2013

2020

2030

Starting Cheju Pilot Projects

Implementation of Total Operation Center

Smart Grid Demonstration City

Ending Cheju Pilots
Starting Major City Projects

Finishing Smart
Consumer

Finishing National
Smart Grid

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- KETEP, National Green Energy Technology Roadmap, 2009.
- MKE, Smart Grid Roadmap, 2009.