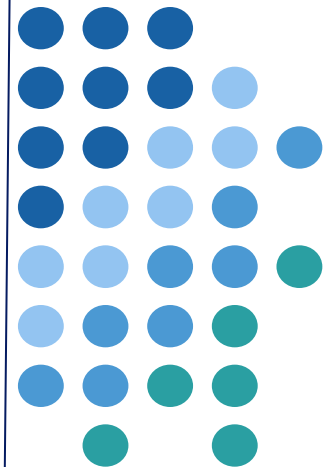




Vision of Korean Smart Grid

September 2010

Professor Seung Il Moon
School of Electrical Engineering
Seoul National University



Power System Laboratory, Seoul National University



Seung-Il Moon

**1985. B.S in Electrical Engineering,
Seoul National University**

**1989. M.S in Electrical Engineering,
The Ohio State University**

**1993. Ph.D in Electrical Engineering,
The Ohio State University**

**Professor, School of Electrical Engineering,
Seoul National University**

Member of Presidential Committee of Green Growth

Advisor to Ministry of Knowledge Economy

Smart Grid Session Chair of 2013 World Energy Congress

CO₂ Reduction

Green Growth

Energy Security

Why Smart Grid in Korea?

**CO₂ Emission Increase Rate :
1st in OECD Countries (1990~2004)**

**Energy Consumption Increase Rate :
9th in the World (2008)**

**High Energy Basic Unit :
Korea (0.34), Germany (0.18), Japan (0.11)**

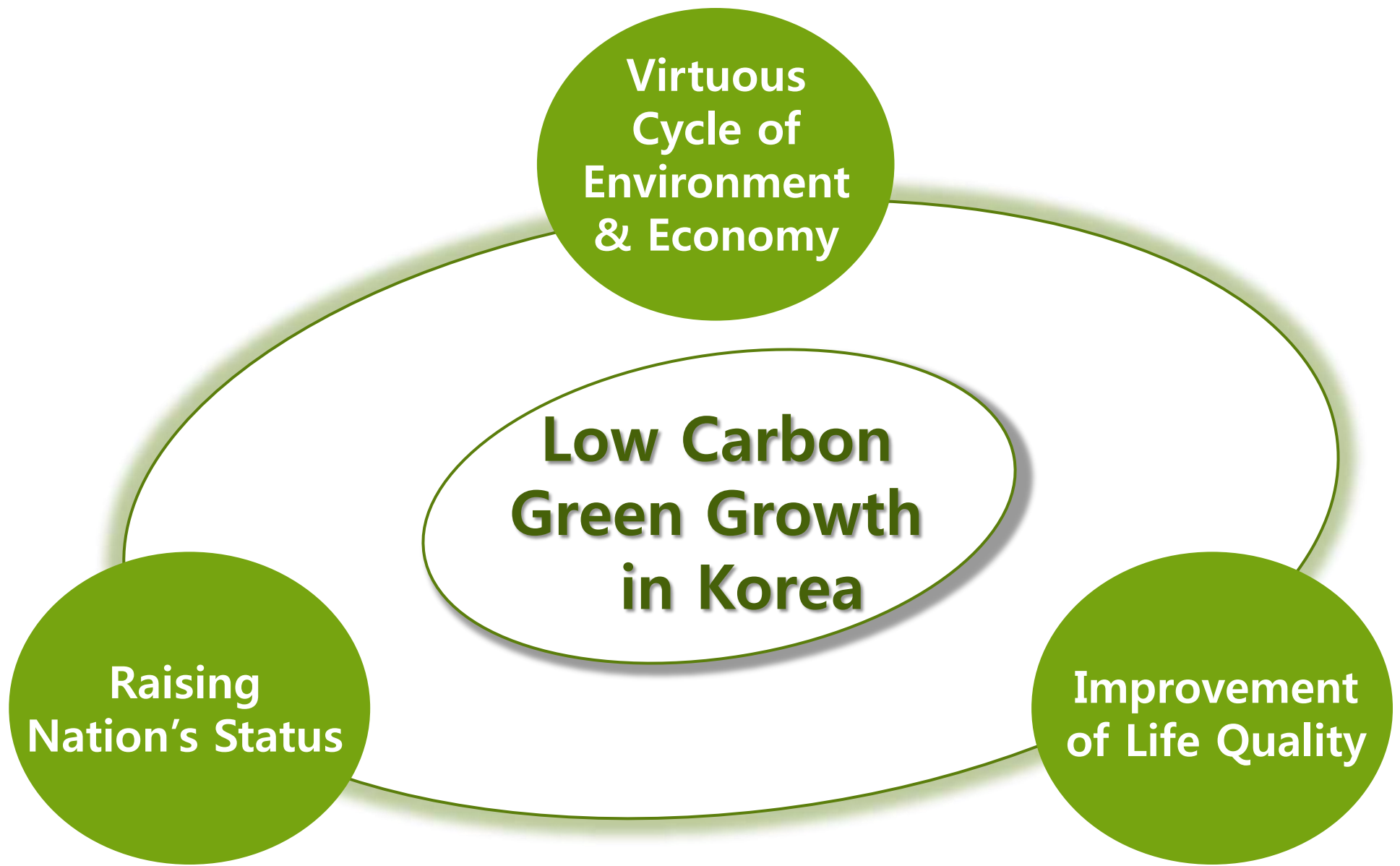
CO₂ reduction is not easy in Korea



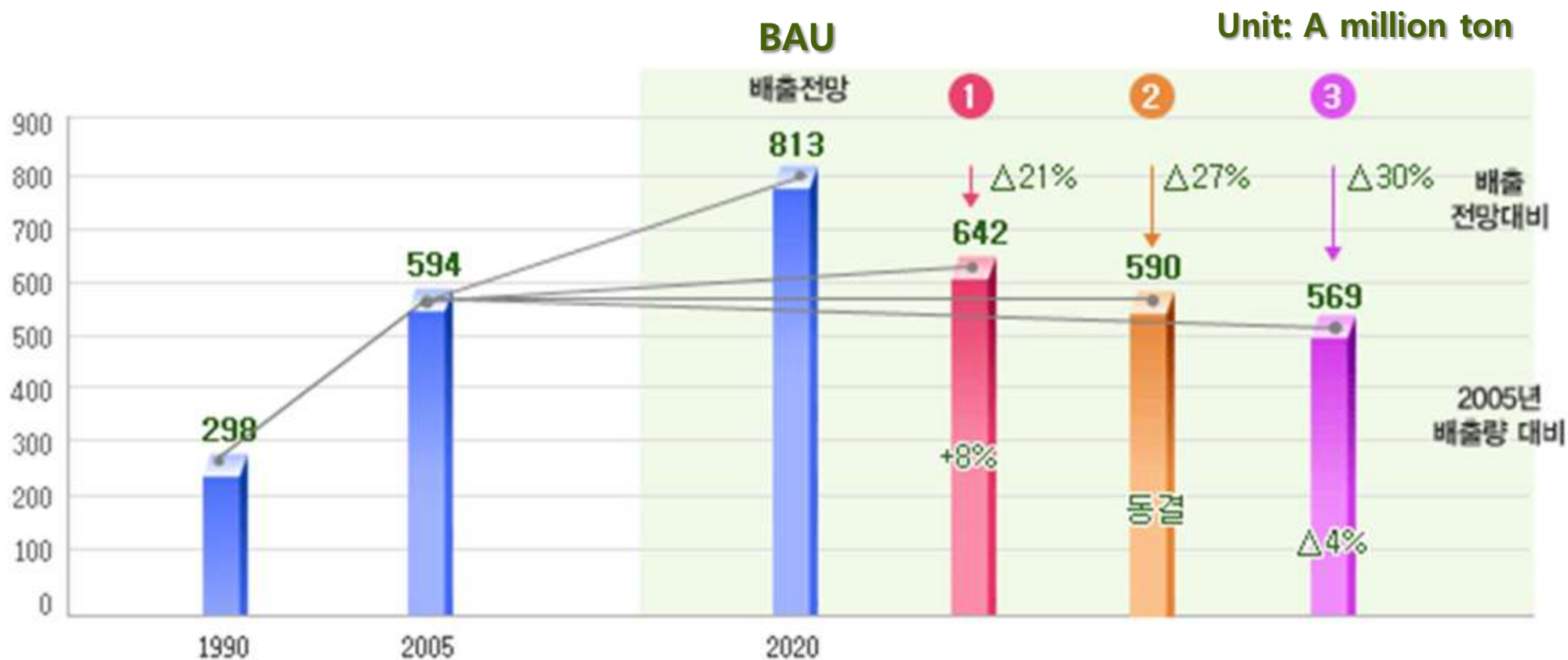
"Low-carbon Green Growth is not a matter of choice."

- President M.B. Lee

Presidential Committee on Green Growth



Concept of Green Growth in Korea



Source: Presidential Committee on Green Growth

Target of CO₂ Reduction by 2020

**To Cope with Climate Change
and Green Technology**

Pioneering Role in Green Growth of the World

**Roles of the Presidential Committee
on Green Growth**

『Fundamental Law on Low Carbon Green Growth』

**Thermal Power
Generation**

Fossil Fuel Cars

**High Energy-
Consuming
Industrial
Structure**

**Nuclear Power
Renewable Energy
Carbon Capture &
Storage**

Electric Vehicle

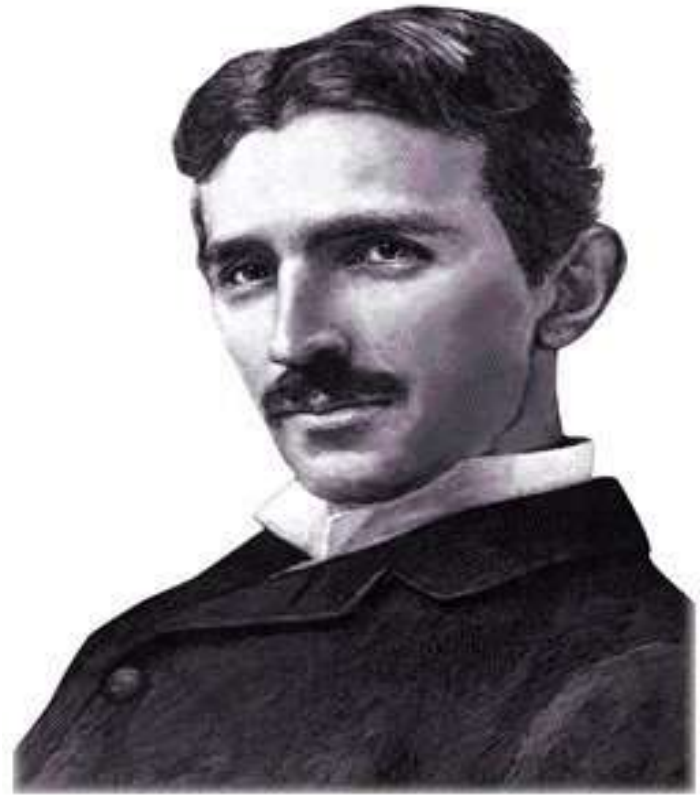
**Low Energy-
Consuming
Industrial
Structure**

How to reduce CO₂ Emissions



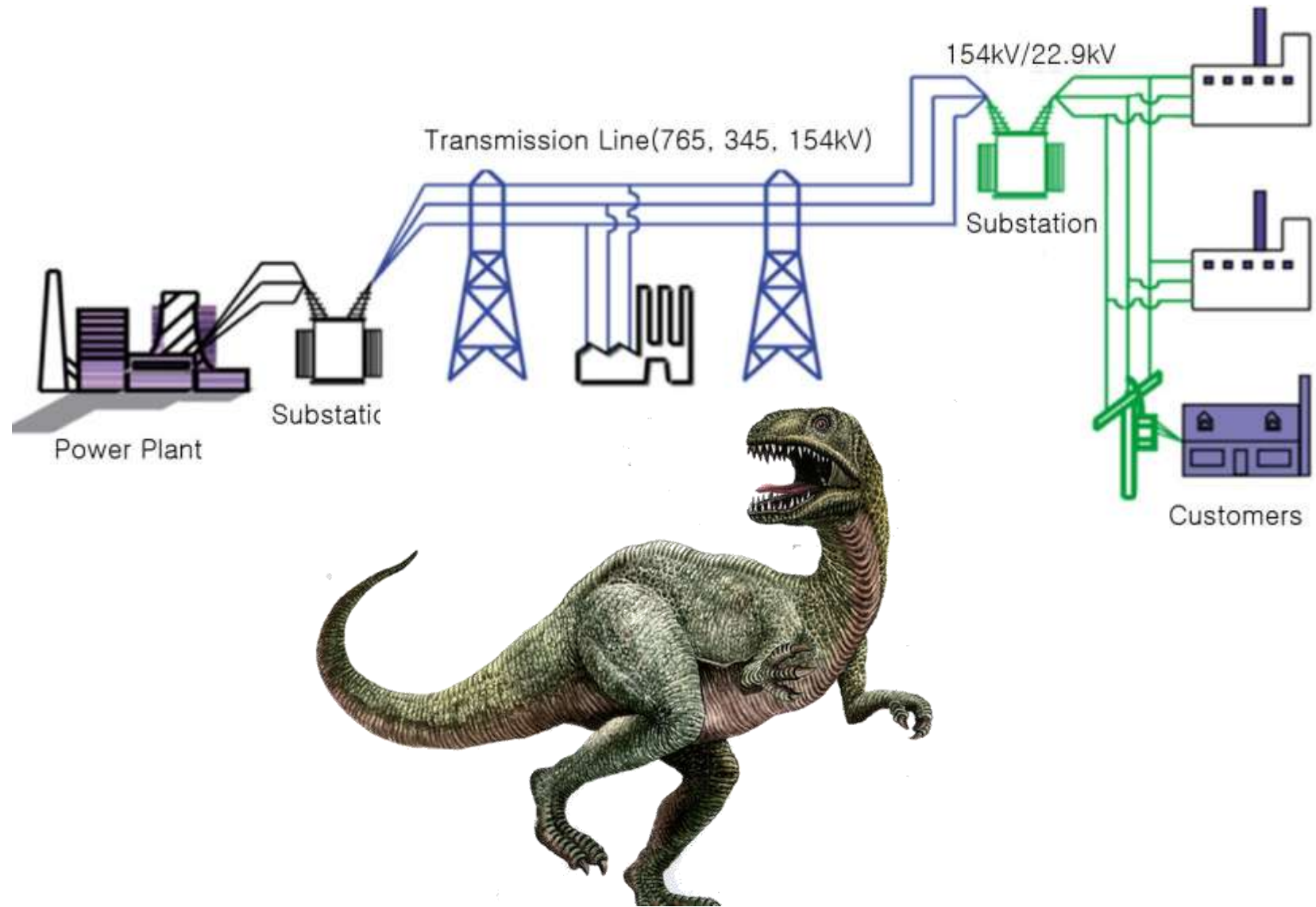
T. Edison

VS



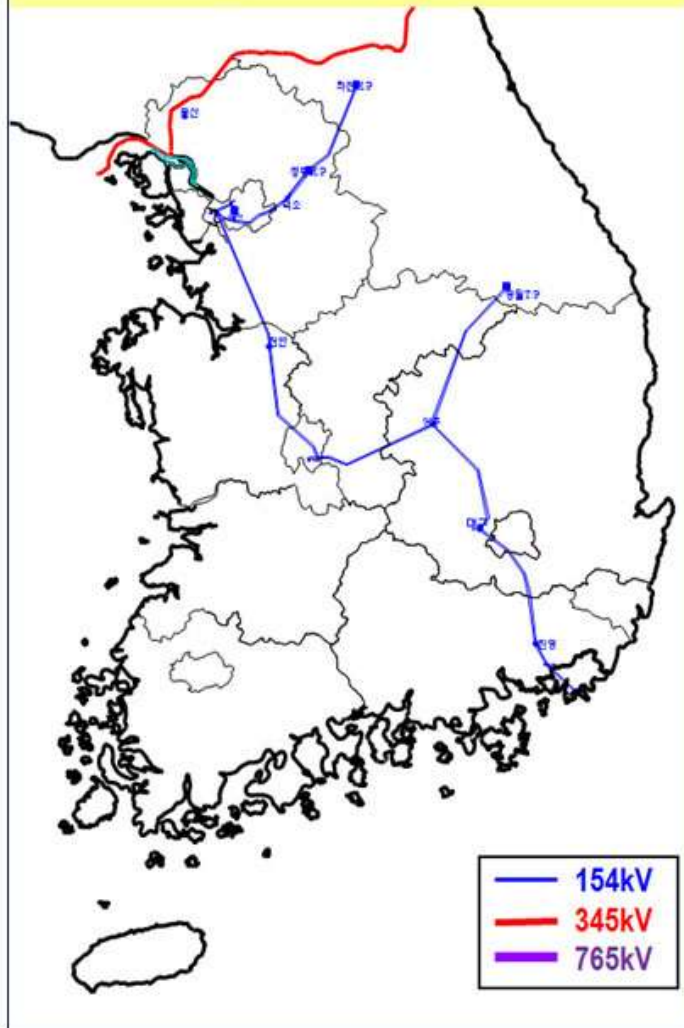
N. Tesla

Two Heroes in Electrical Engineering 100 years ago

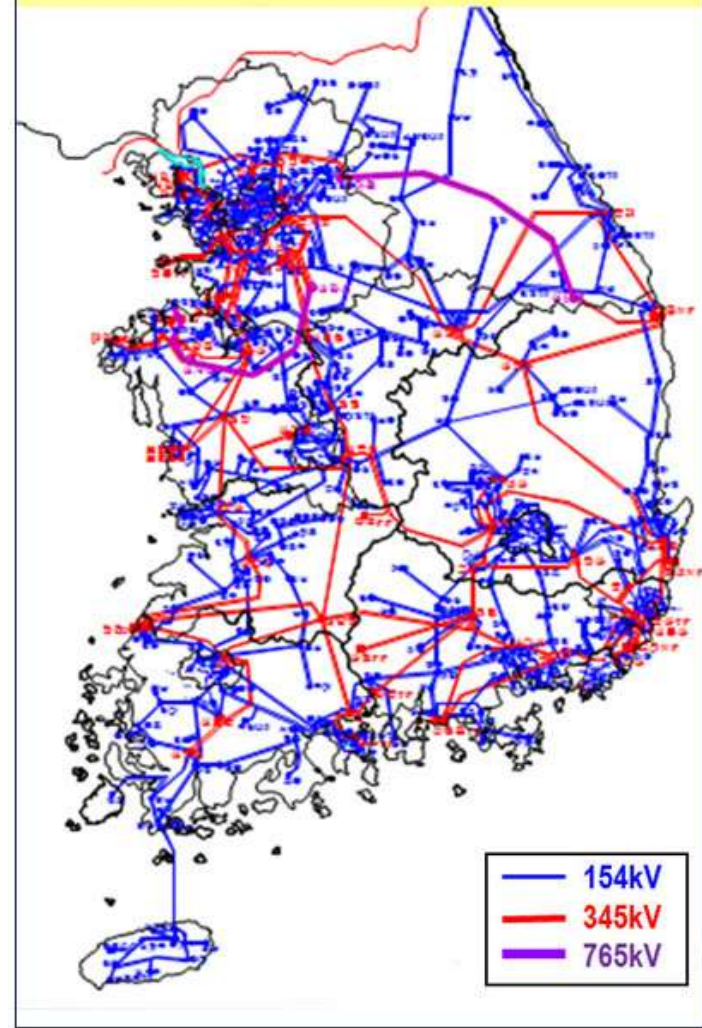


Modern Power System : Dinosaur

Power System in 1965



Power System in 2005

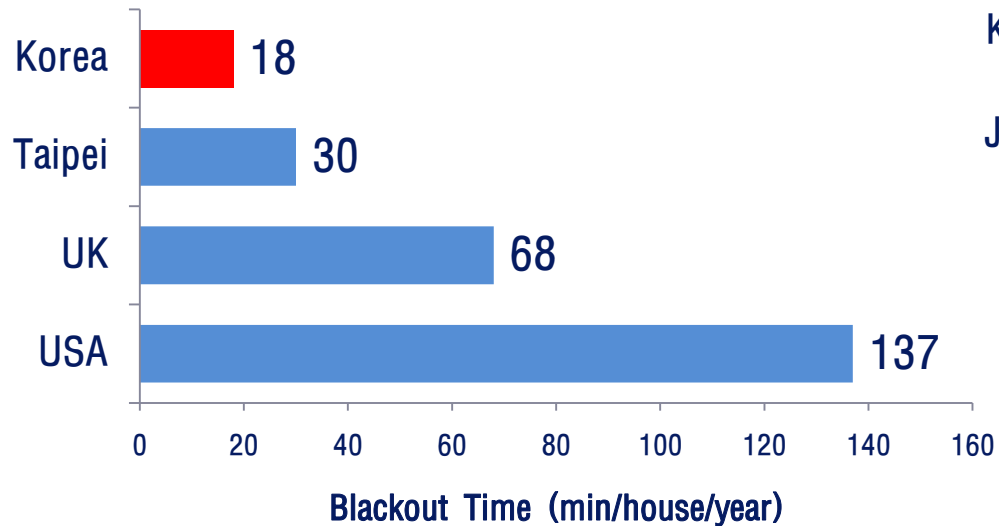


Development of Korean Power System

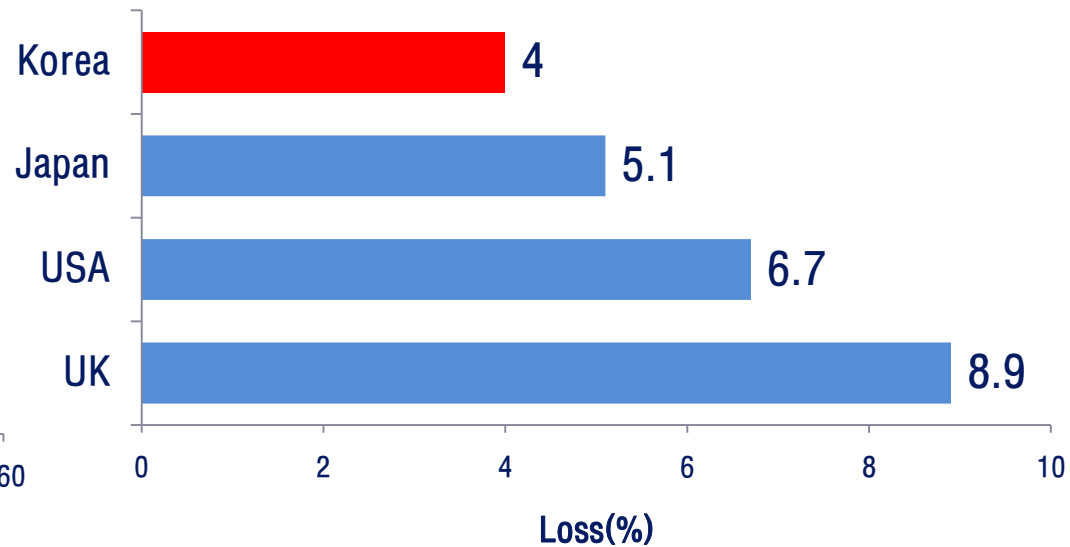


What happened in Communication Technologies

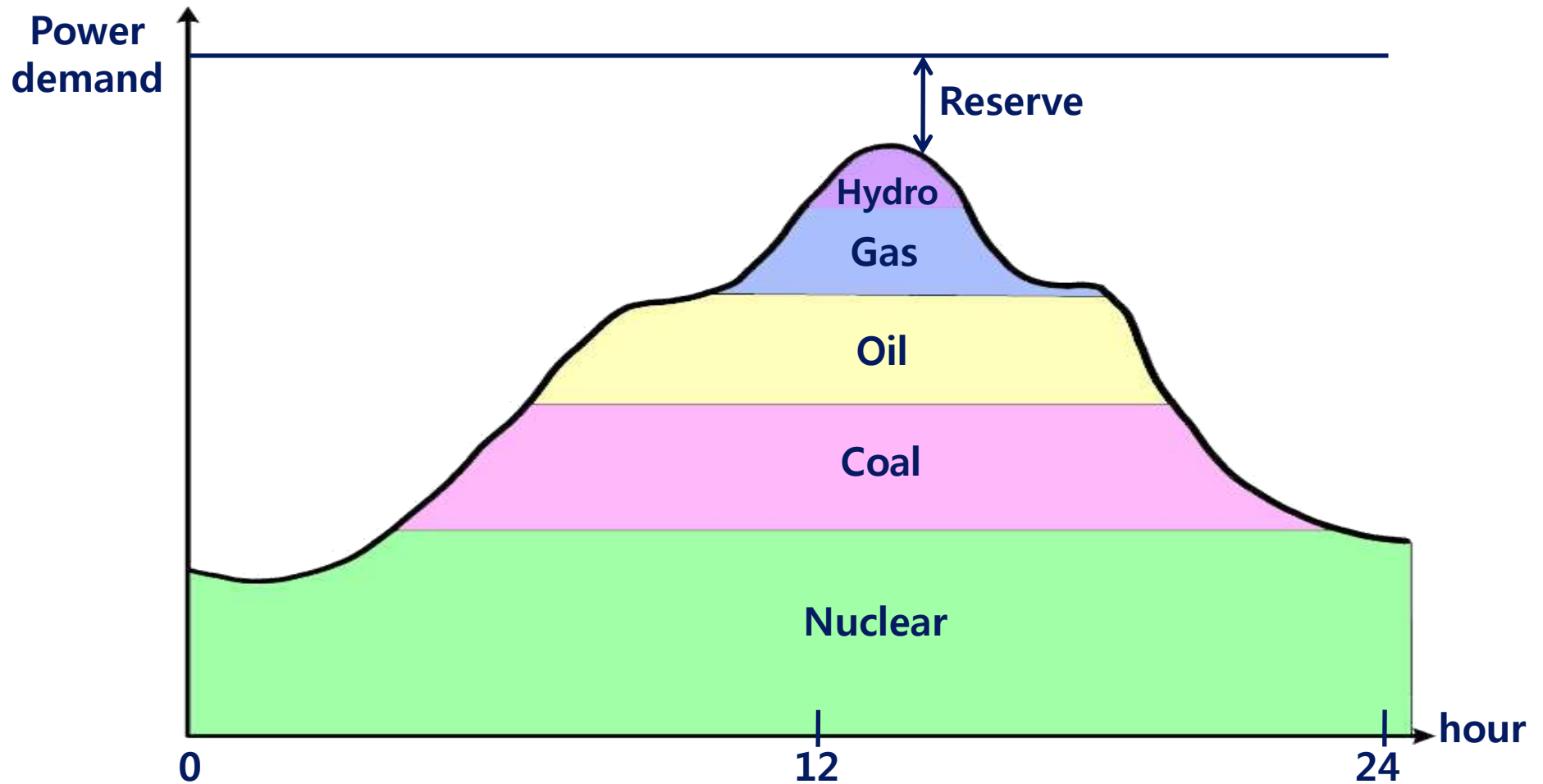
Annual Outage Time



Transmission Losses



Korean Power System : World best performance



Electric Energy can not be stored easily.

Unpredictable Weather

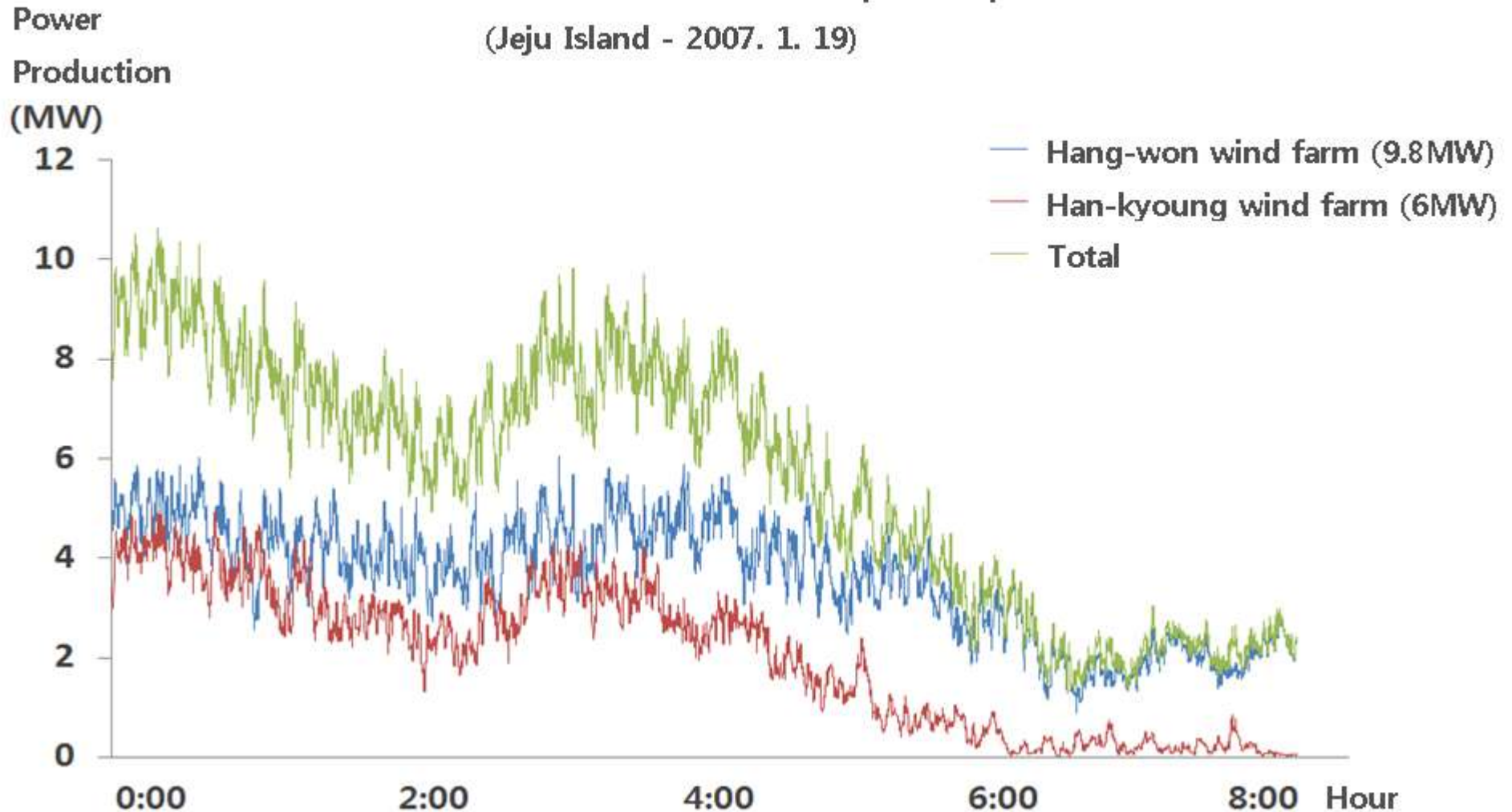
Irregular Power Output

Hard to Control Power Output

Most of Them are DC Power

Green Energy : Low Quality Energy

Fluctuation of wind power production (Jeju Island - 2007. 1. 19)



Unpredictable Wind Power Fluctuation

**Total Capacity of
Generation Units
- 11,500kW**

**Wind Turbine
- 600kW x 1 unit**

**Blackout after 20days of
Operation**



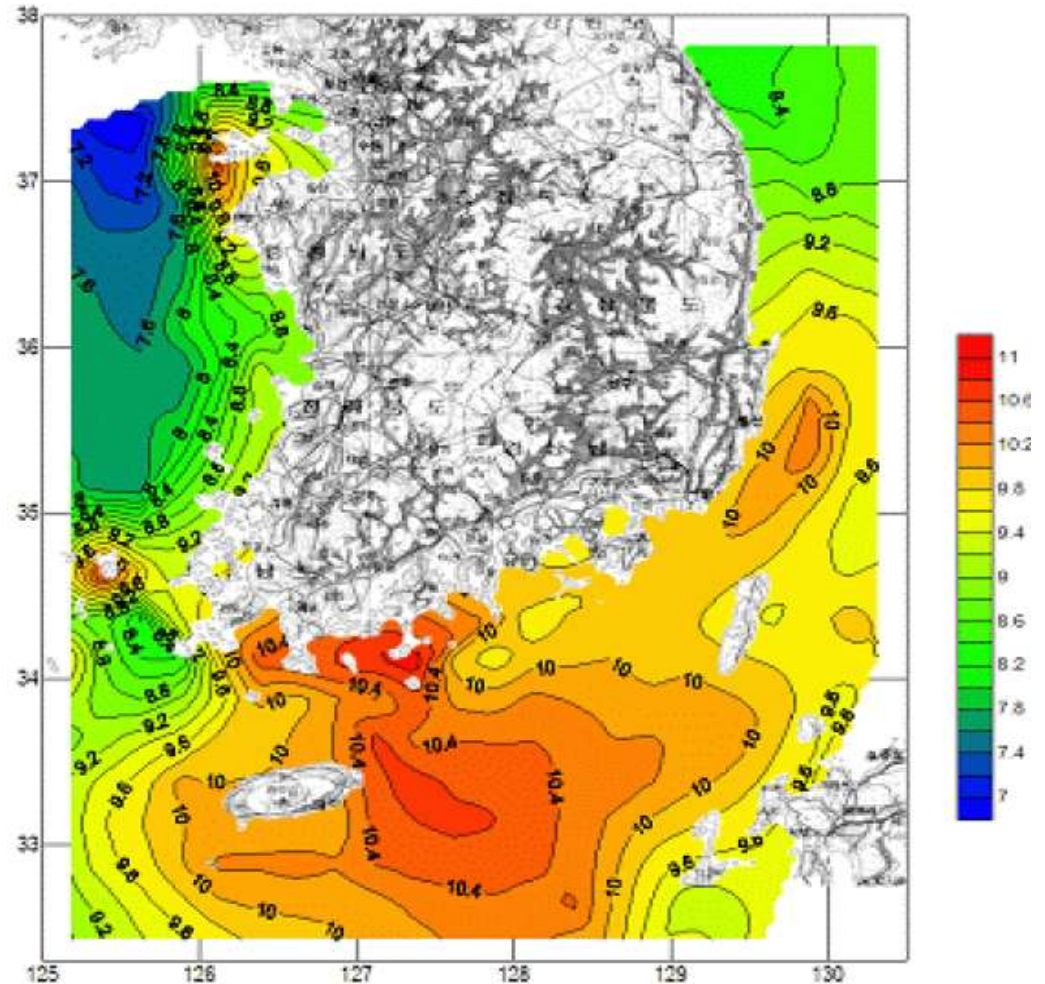
Ul-leung Island Blackout in 1999

**Electric Power Demand :
600MW**

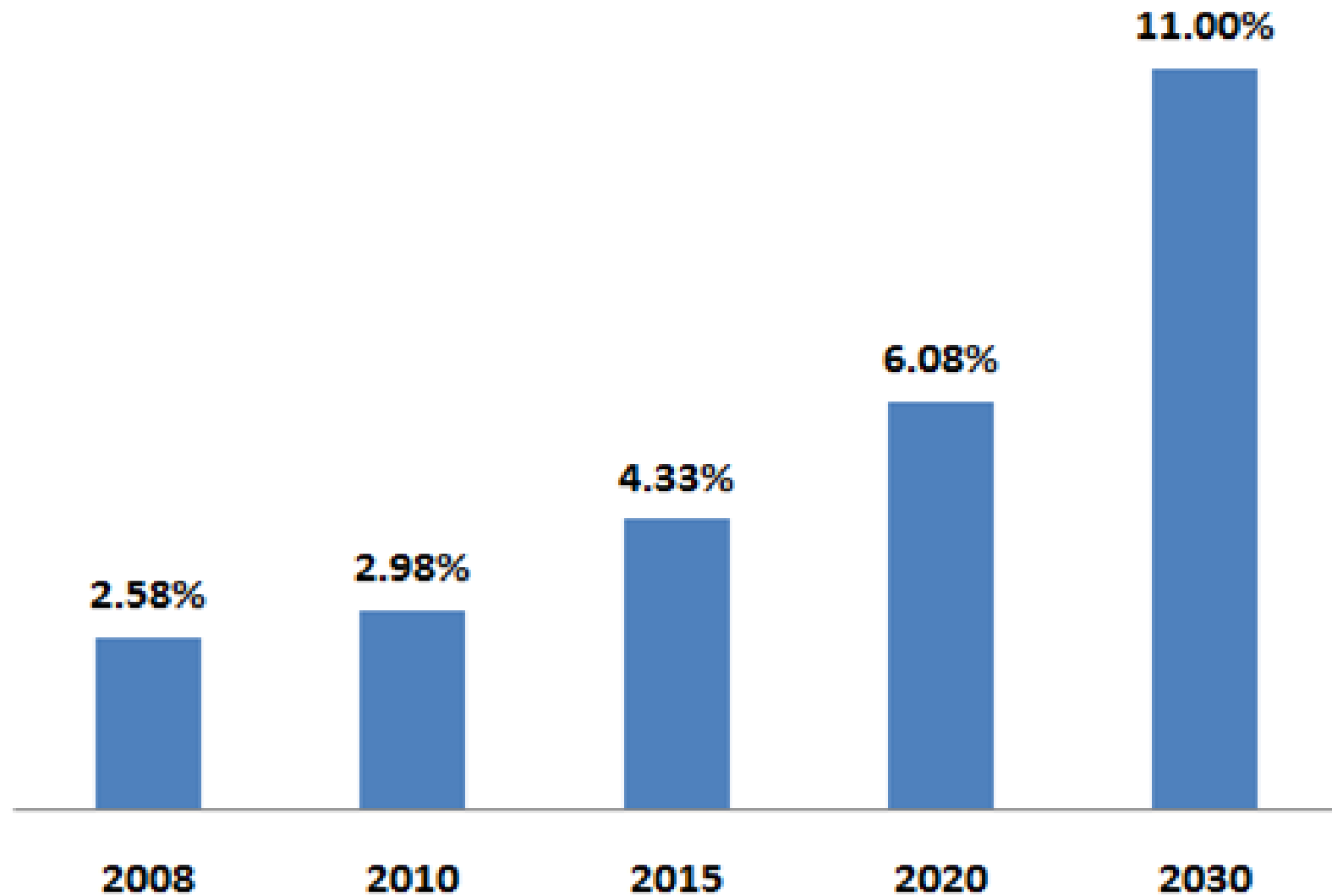
**Planned Wind Power :
223MW (2009)**

**Jeju Local Government :
500MW (2015)**

**Government plan for
whole Korea :
7,300MW(2030)**

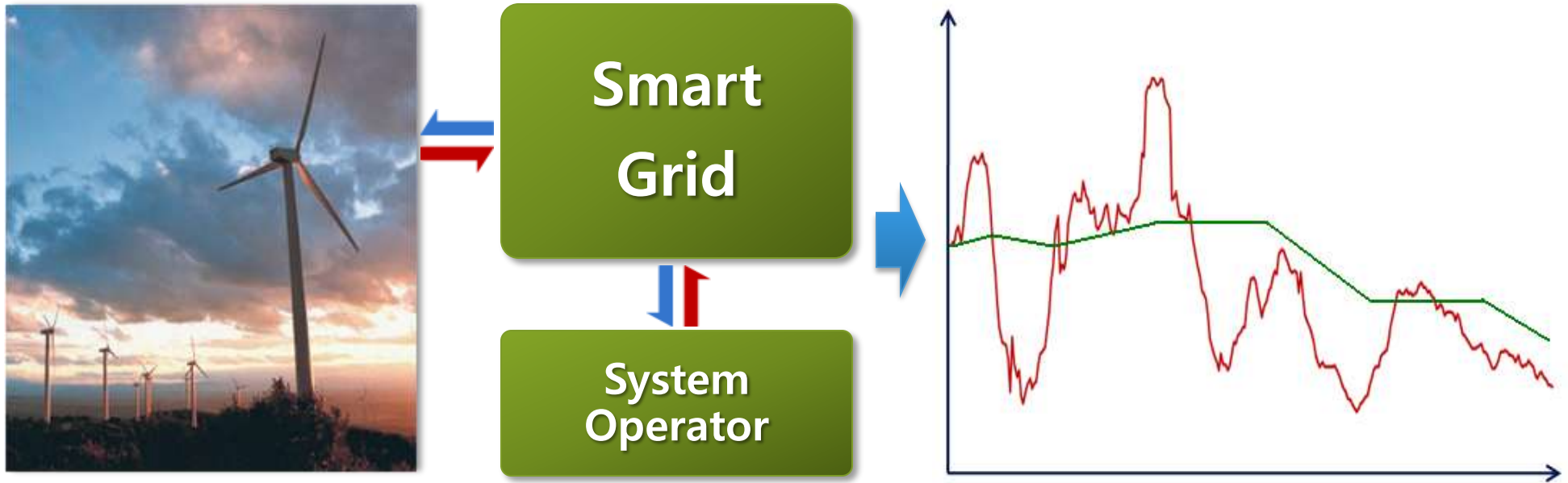


Jeju Island wants Smart Grid.

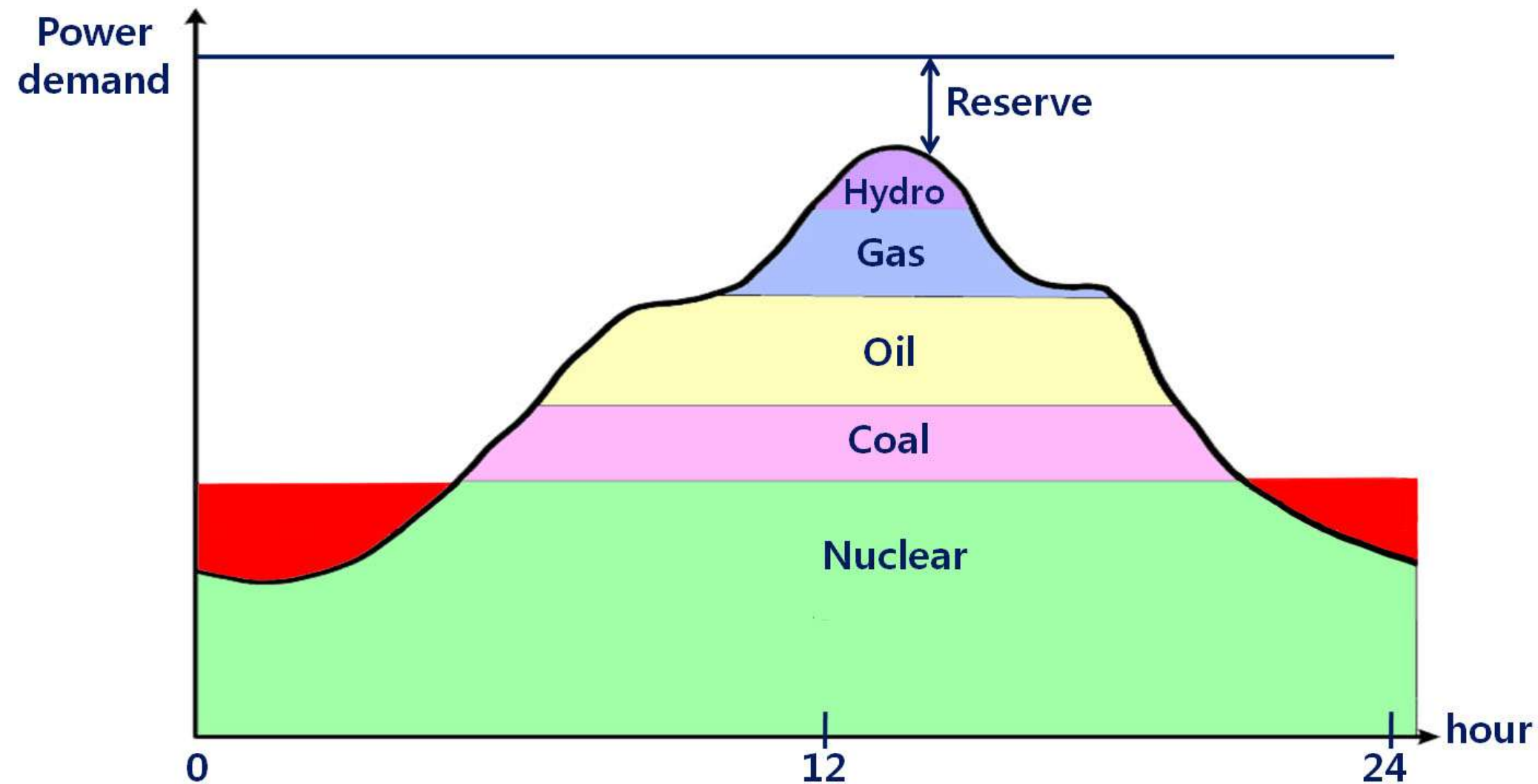


Government Plan for Green Energy Penetration

Wind Power and Smart Grid



Without Smart Grid, no more Wind Power



Who will store the excessive Power ?

Nuclear power



+

Pumped storage power



or

Nuclear power



+

Smart Grid



Without Smart Grid, no more Nuclear Power

Fossil Fuel Car



Fuel tank

Transmission
Gearbox

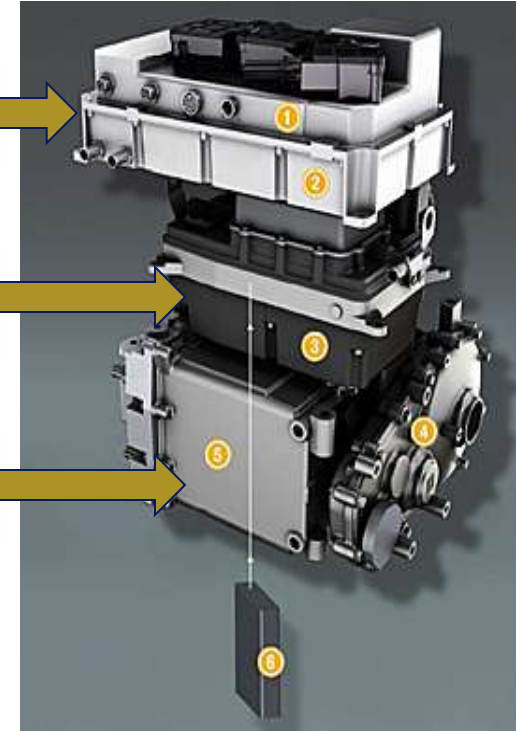
Engine

Electric Vehicle

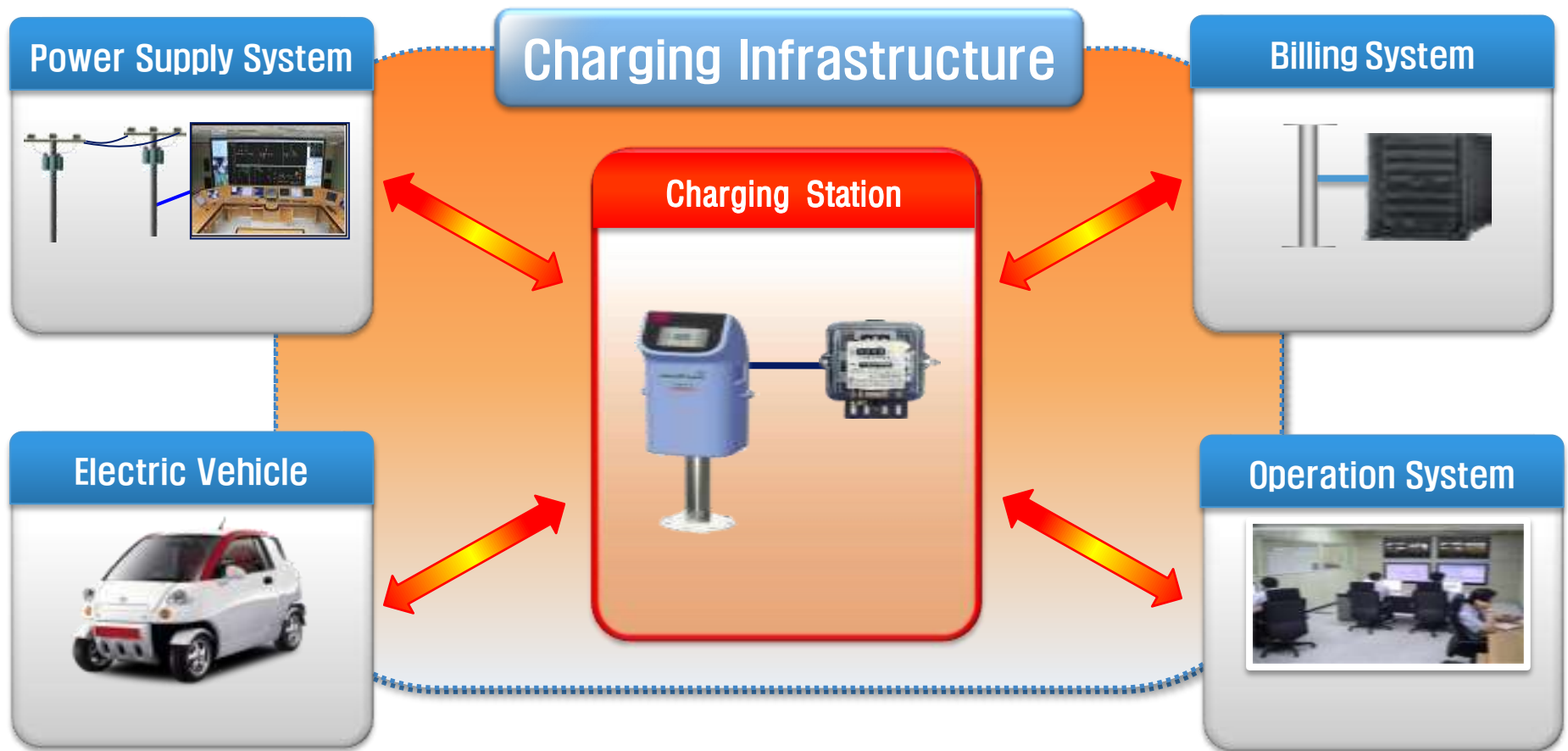
Battery

Inverter

Motor



Electric Vehicle is not a Mechanical Product.



Source : KEPCO

Electric Vehicle Charging Infrastructure

Electric Vehicle



**When and where can
we charge our cars?**

**Power Supplying
Network**

**Charging/Discharging
System**

**Billing & Metering
Network**

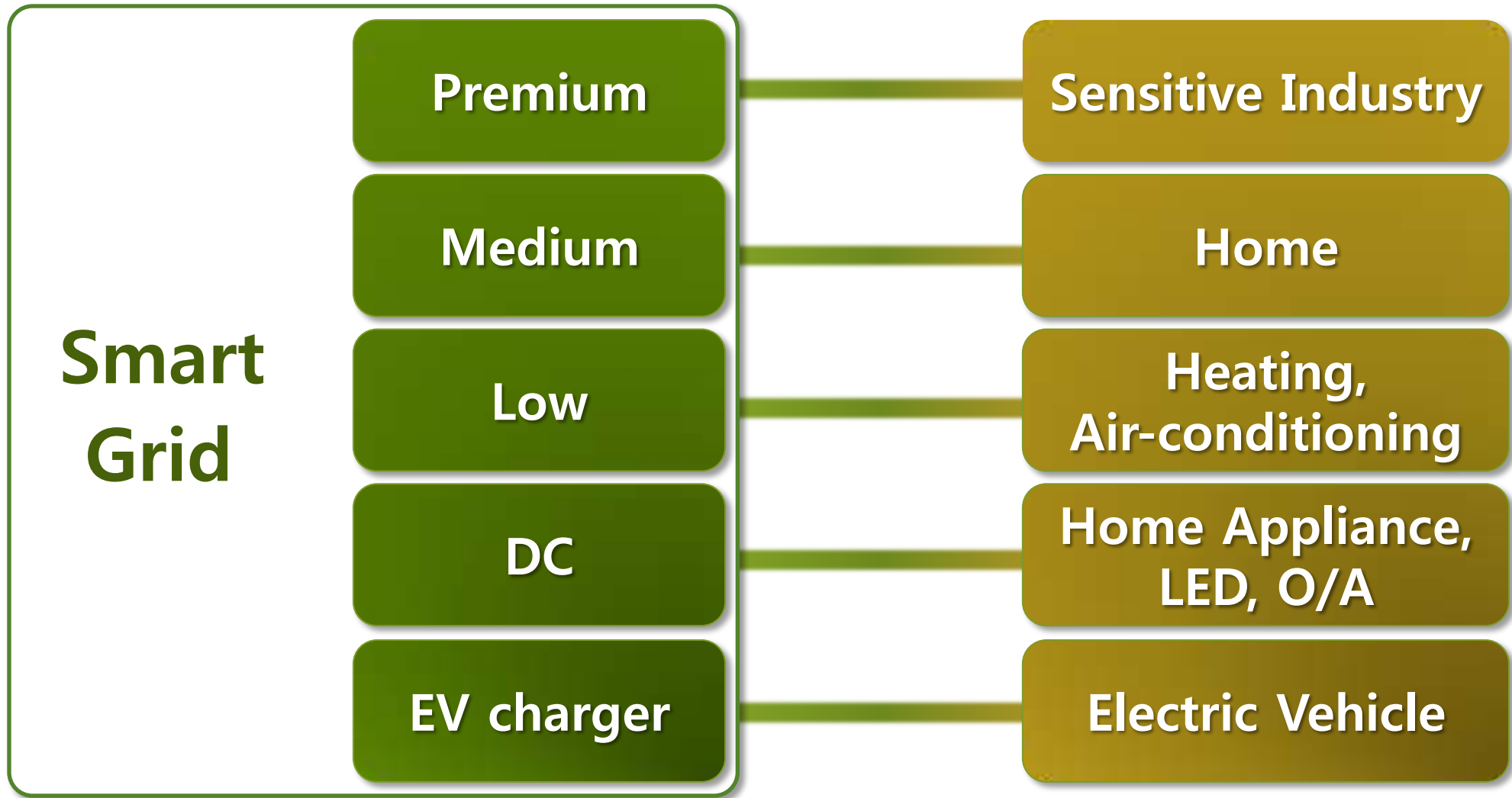
**Stable Operation of
Power Grid**

Smart Grid

Without Smart Grid, no more Electric Vehicle



Smart Meter : Information Window to Customers



Various Power Services : Consumer's Choice

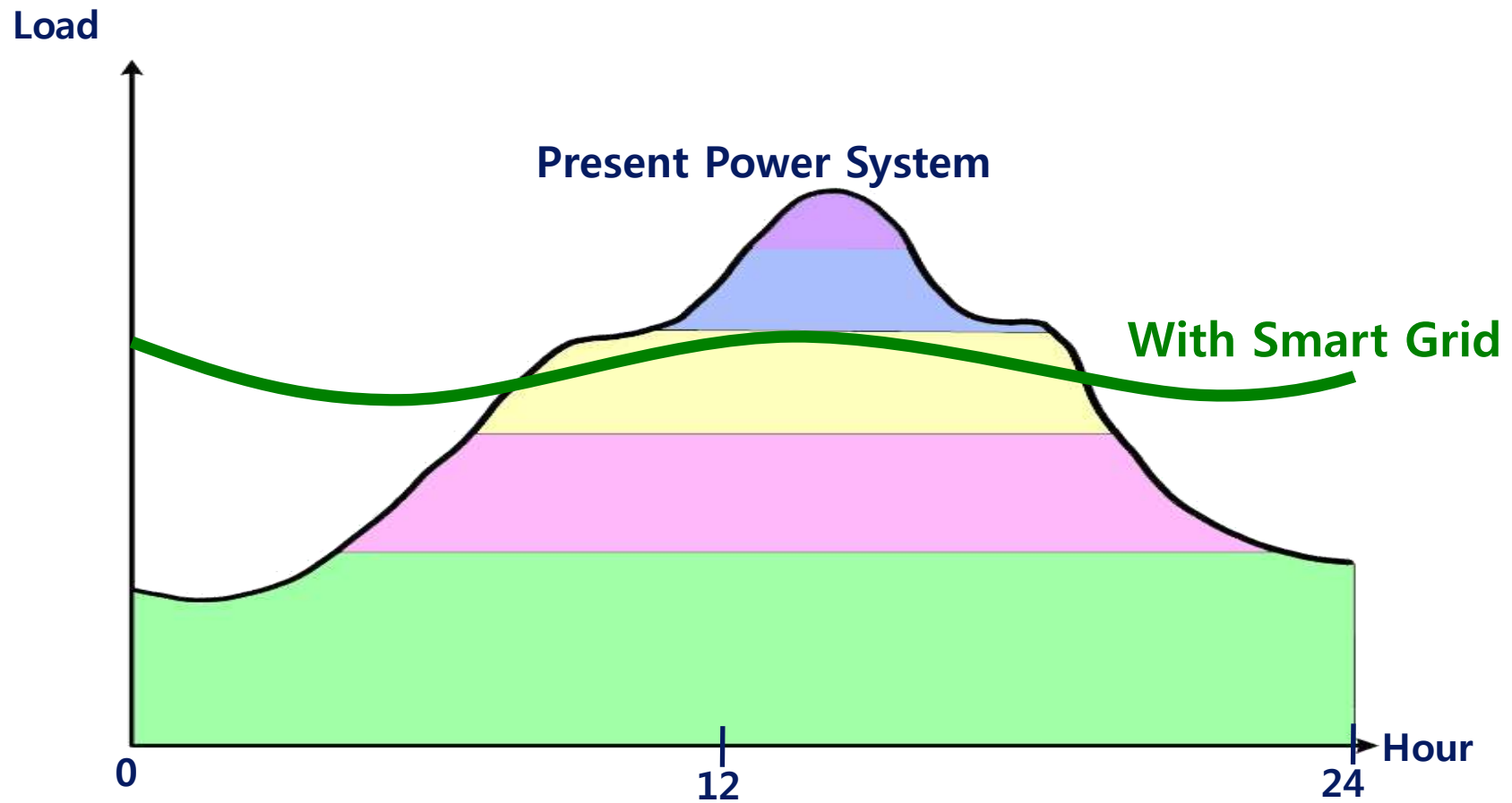


**Flexible AC
Transmission System**



Highway Congestion

FACTS : Electrical Changeable Lane System

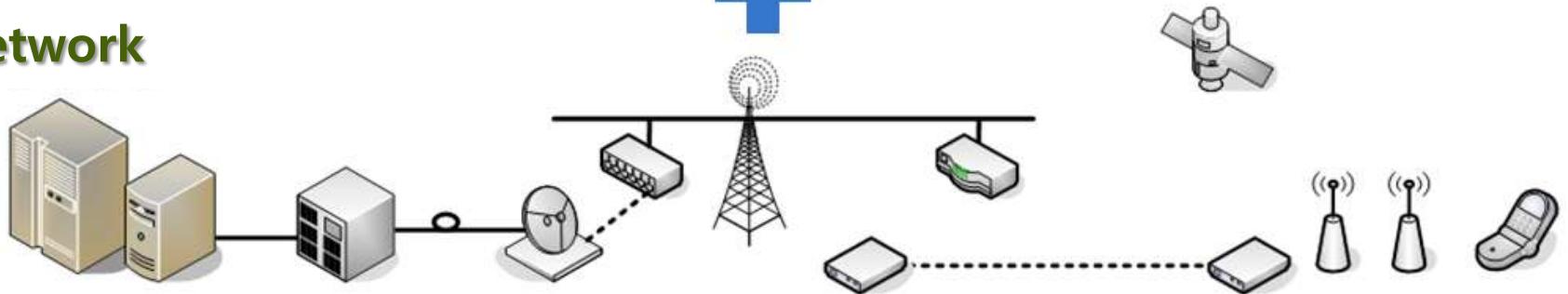


Smart Grid will Save Money.

Power Network



IT Network



Source : EPRI

Smart Grid : Convergence of Power Technology and IT

**Low-carbon Power
Generation**

**Renewable Energy
Nuclear Power**

**Efficient Energy
Consumption**

**Energy Saving
Efficiency Enhancement**

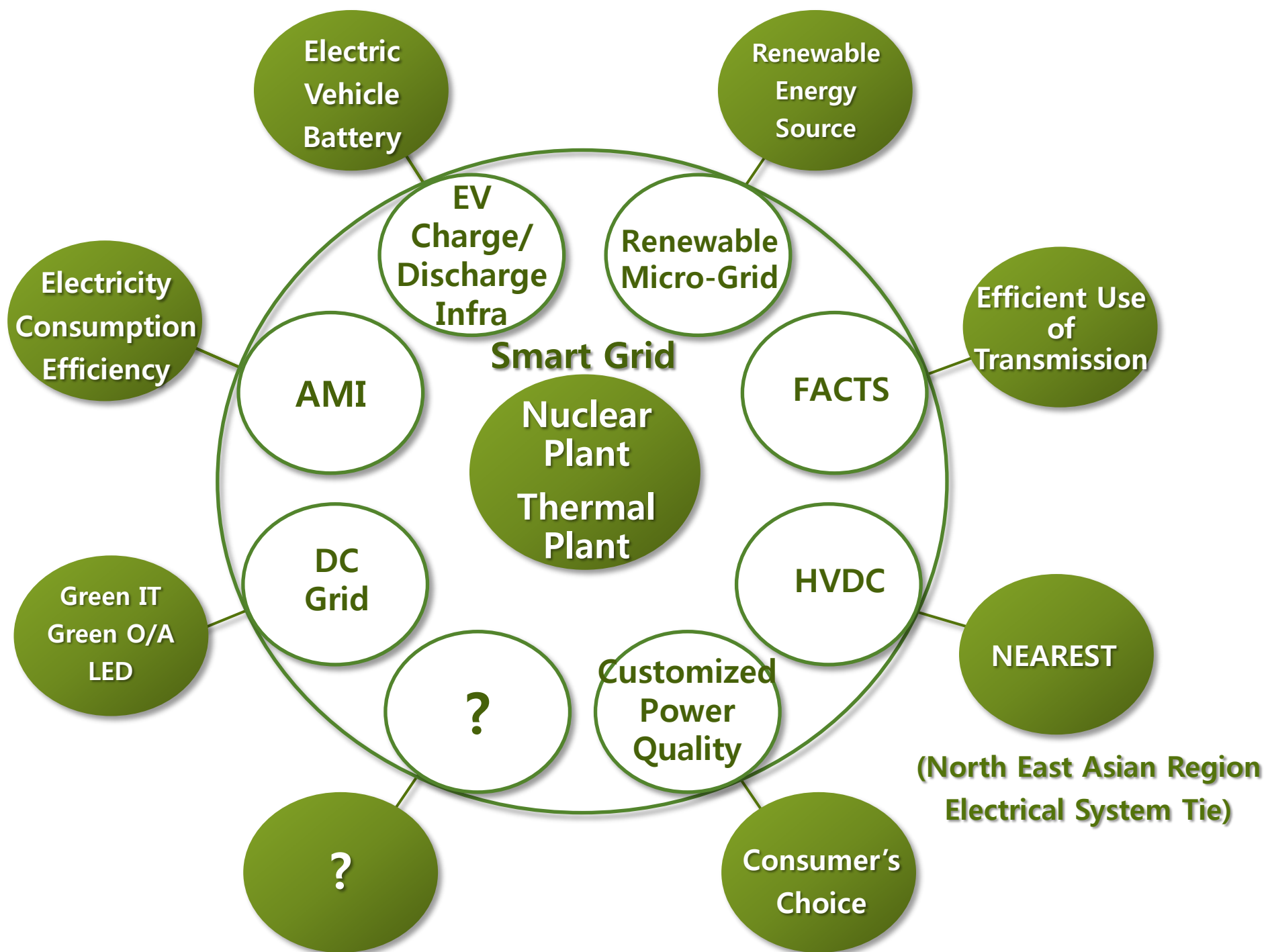
**New Customer
Services**

**Various Power Service
Infrastructure for Electric vehicle**

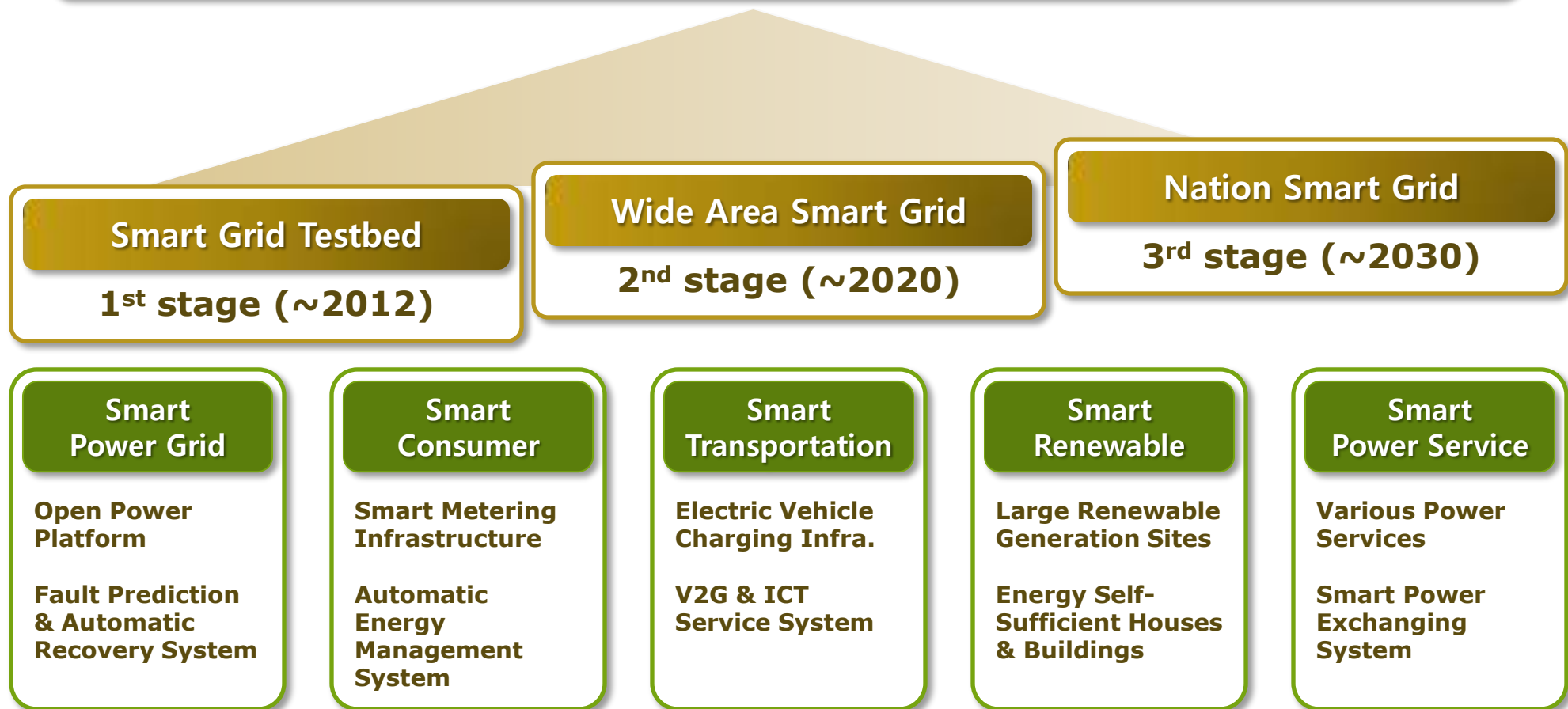
Energy Security

**Prevention of Large Blackout
High Quality Reliable Power Supply**

Target of Korean Smart Grid



Smart Grid for Low Carbon Green Growth



Source : National Smart Grid Roadmap

Korean Smart Grid Roadmap

Part	First Stage (~2012)	Second Stage (~2020)	Third Stage (~2030)	Total
Technical Development	300	1,400	3,500	5,200
Infrastructure	600	5,300	9,500	15,400
Total	900	6,700	13,000	20,600

Million €

Source : National Smart Grid Roadmap

Government Investment Plan by 2030



Beautiful Green Island, Jeju

**Experience the
Future**

**Vision for
Green growth**

**Develop New
Technologies**

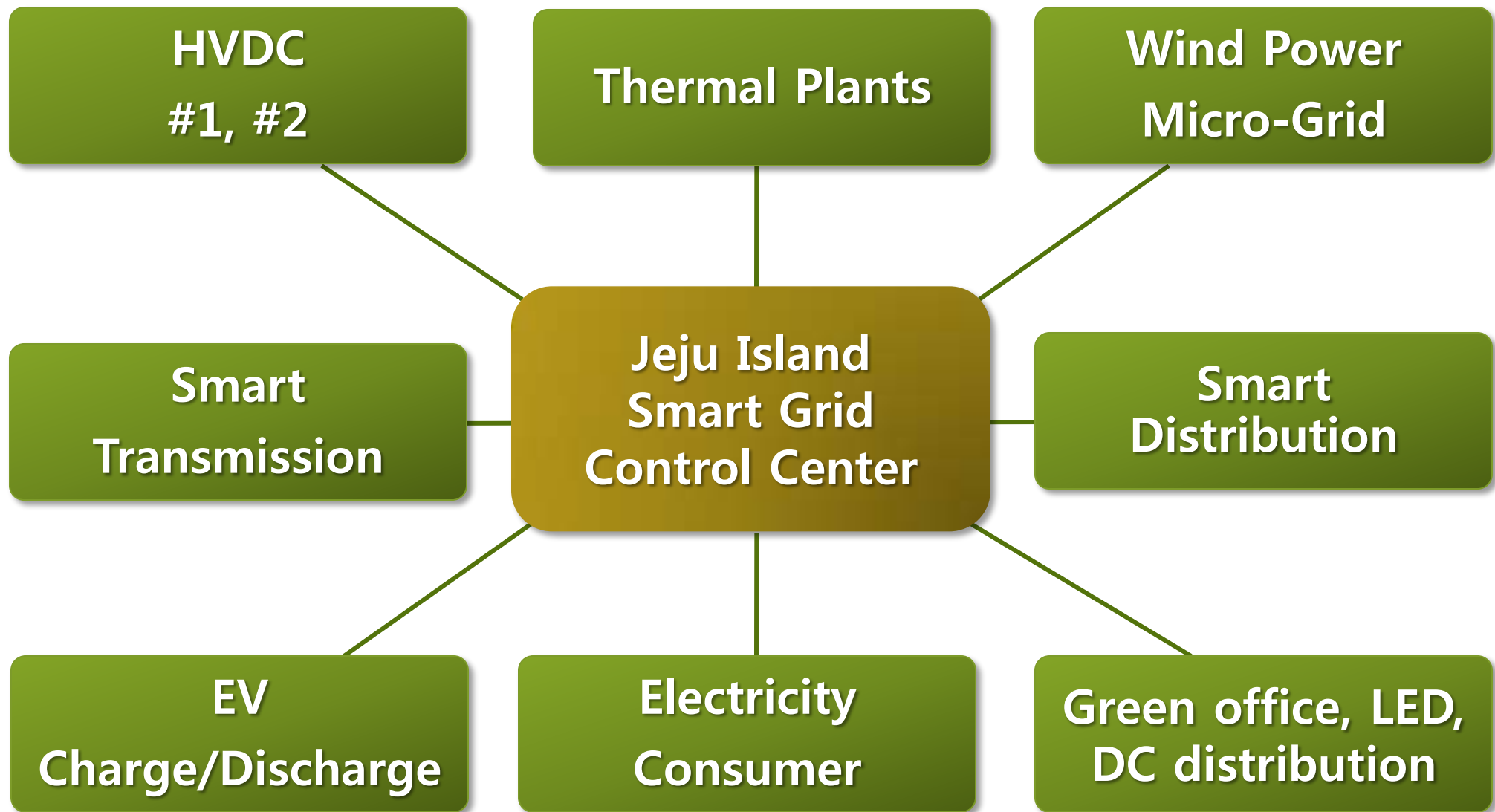
**Development of
advanced
Green-technique**

**Demonstrate
Smart Grid**

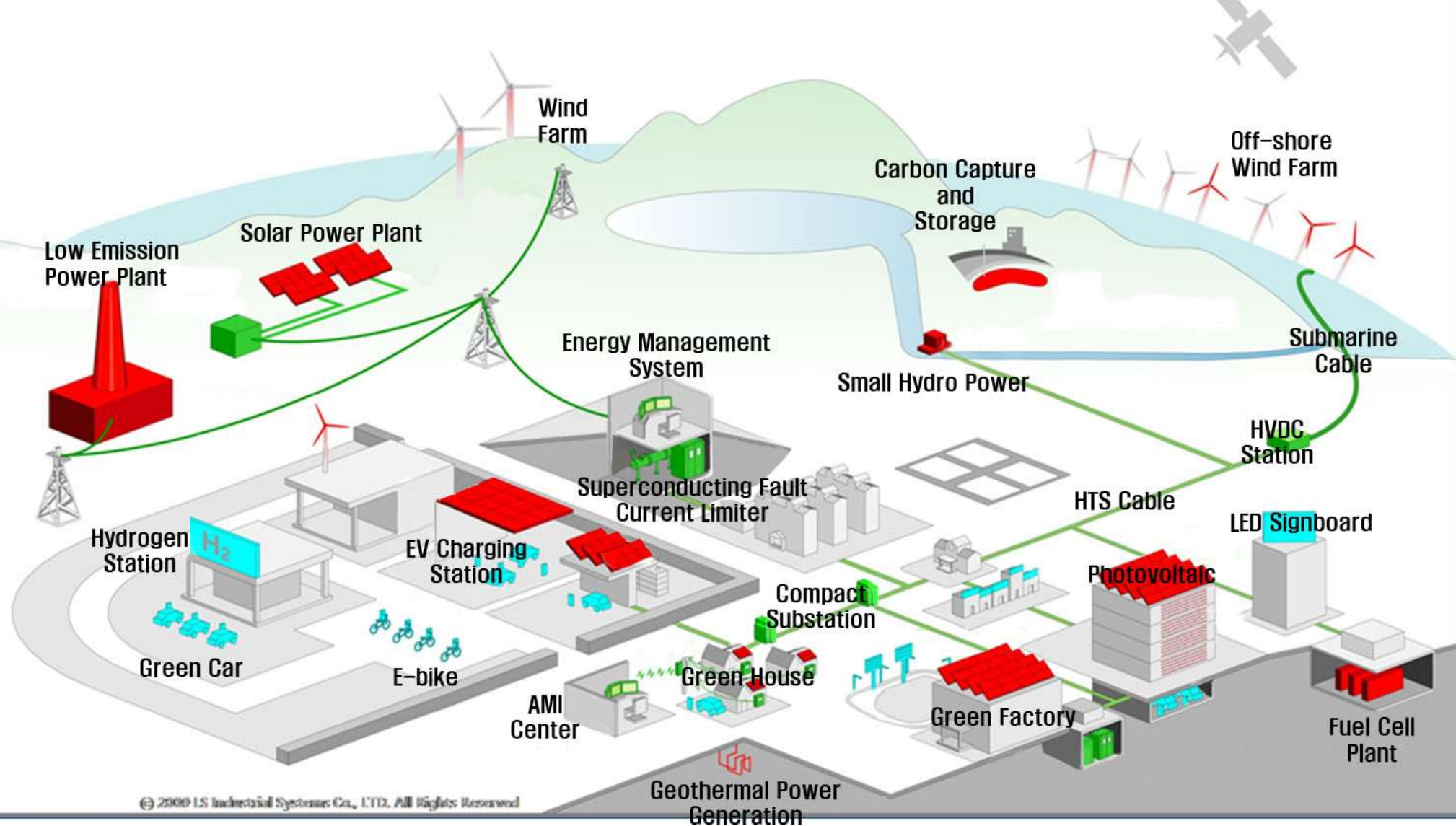
**Demonstration of
Korea smart grid to
world market**

Carbon Free Island, Jeju

Jeju : Future of Green Growth



World's First Complete Smart Grid System in Jeju



Source : LS Industrial Systems. Co. LTD

Dream Island, Jeju



"POSCO has plans to cope with climatic changes by low-carbon steel processes and green business."

CEO of POSCO, Joon-yang Chung

9% CO₂ emission reduction until 2020

€ 5.3 billion investment for Green Business until 2018

Create 87,000 New Green Jobs

POSCO's Vision for Low-carbon Green Growth

Global Green Growth Leader

- CO₂ emission reduction : 9% until 2020
- Greenhouse gas reduction : 14 million ton

Green Steel

Steel Process
Innovation

Green Business

Renewable,
Green
Technology

Green Life

Carbon-Neutral
Program

Green Partnership

Preparing for
Framework
Convention on
Climate Change

POSCO's Vision for Low-Carbon Green Growth



- Smart grid(Korea, Italy)
- Energy efficiency(USA)
- Solar energy(Germany)
- Bio-energy(Brazil, Italy)
- Advanced vehicle(Canada)
- Wind Power(Germany, Spain, Denmark)
- High efficiency and lower emissions coal technology(Japan, India)
- Carbon capture, use and storage (UK, Australia)

“G8 summit meeting – Eight technologies to change the world as ways to cope with climate change”

Korea & Italy – Smart Grid Lead Country

G20 Summit Meeting

Smart Grid Korea 2010

Nov. 8~9, 2010

KSGA
한국스마트그리드협회
Korea Smart Grid Association





Smart Grid : Gateway to Green Future