Development of
KEPCO smart energy city operating system for integrating distributed energy resources

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Contents

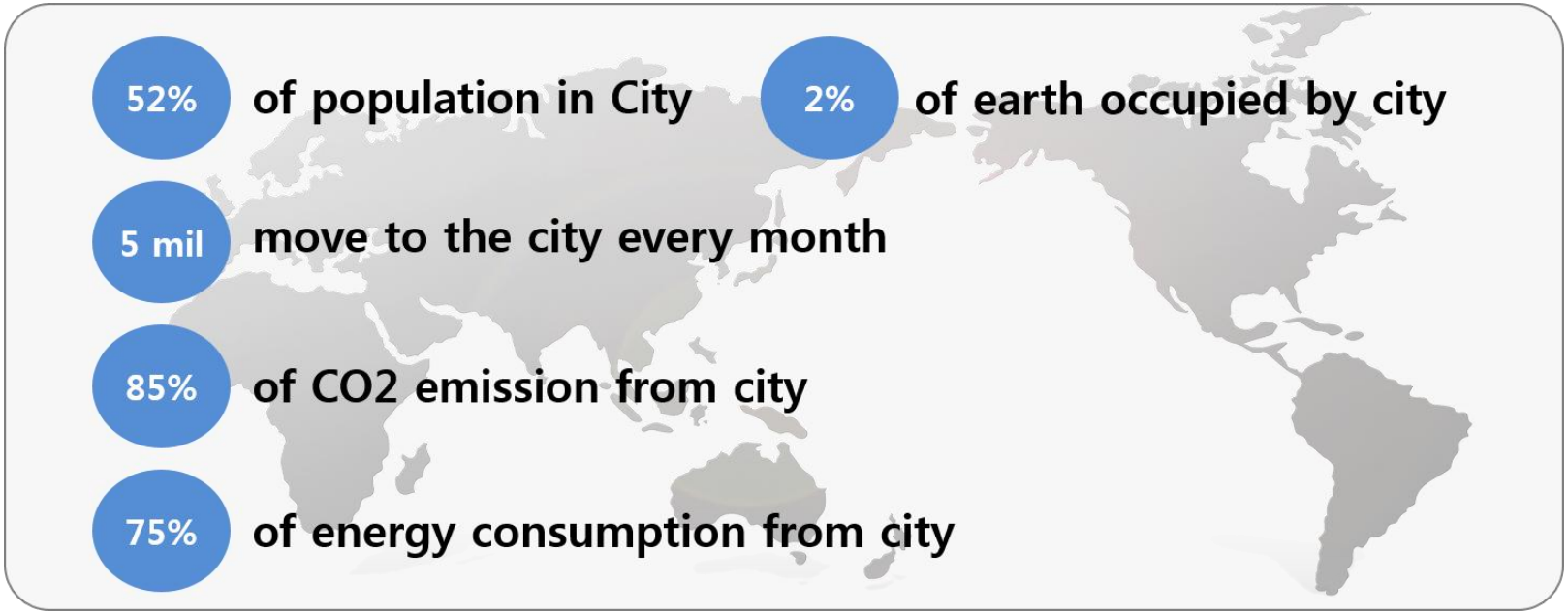
Defining the Smart City

The pace of urbanization is increasing exponentially. Between 2011-50, the world's urban population is projected to rise by 72 %. The need for sustainable cities using management of energy and GHG emissions is increasing.

Smart City?

The future city with the integration of technology into a strategic approach to sustainability, citizen wellbeing, and economic development.

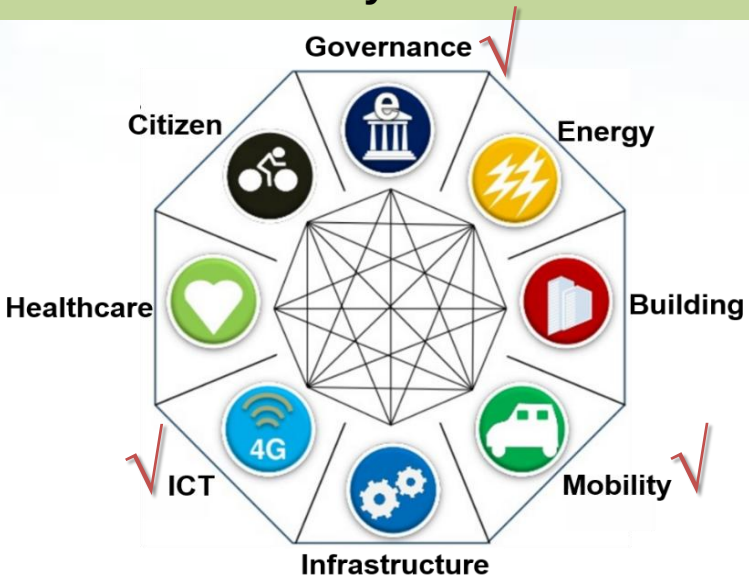
Cities are increasingly required to become "smart"



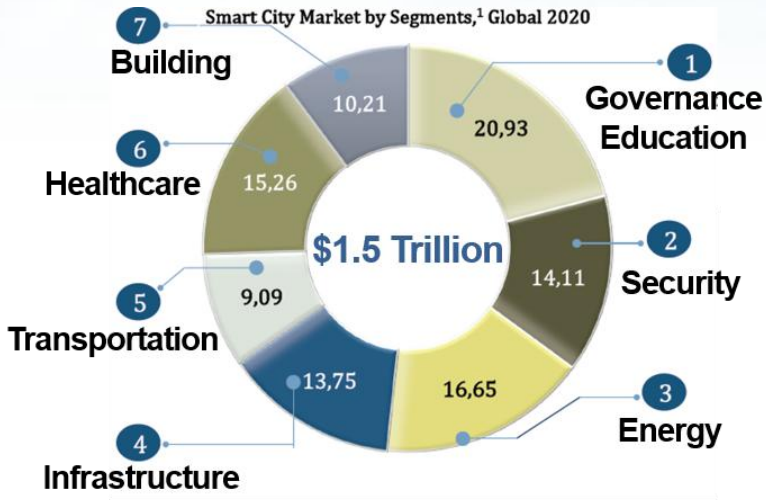
Smart City Market Trends

The main themes of the smart city comprise eight areas. Countries and companies are mainly interested in governance, ICT, mobility, and platform techniques. Smart cities will create huge business opportunities with an estimated market value of $1.5 trillion by 2020.

Smart City Diamond



Smart City Market Size in 2020



Emerging Themes

- **Smart service for citizen : public safety, health, and economic security**
- **Big data : ability to harness real-time data of operations and services of city**
- **ICT : IoT, platform, data security, Smart city data and network standard**

II KEPCO's Smart Energy City

KEPCO's Smart Energy City

KEPCO is an electric utility company. KEPCO focuses on efficient energy use and service provision in smart cities.
KEPCO is conducting a smart city demonstration in Naju, where its head office is located.

Smart Energy City?

Based on renewable energy, smart grid and ICT technologies

- **Provides integrated urban energy management services**
- **Reduces the consumption of resources, operational costs, and CO2**

Energy Valley in Naju, Korea

- **KEPCO is conducting a smart city demonstration**

  'Energy Valley infrastructure projects through smart grid technologies'

- **The purpose of this project**
  - **to improve city's energy efficiency with intelligent systems and smart infrastructure**
  - **to develop and utilize the new energy technology**
  - **to promote SMEs(small and medium enterprise)**

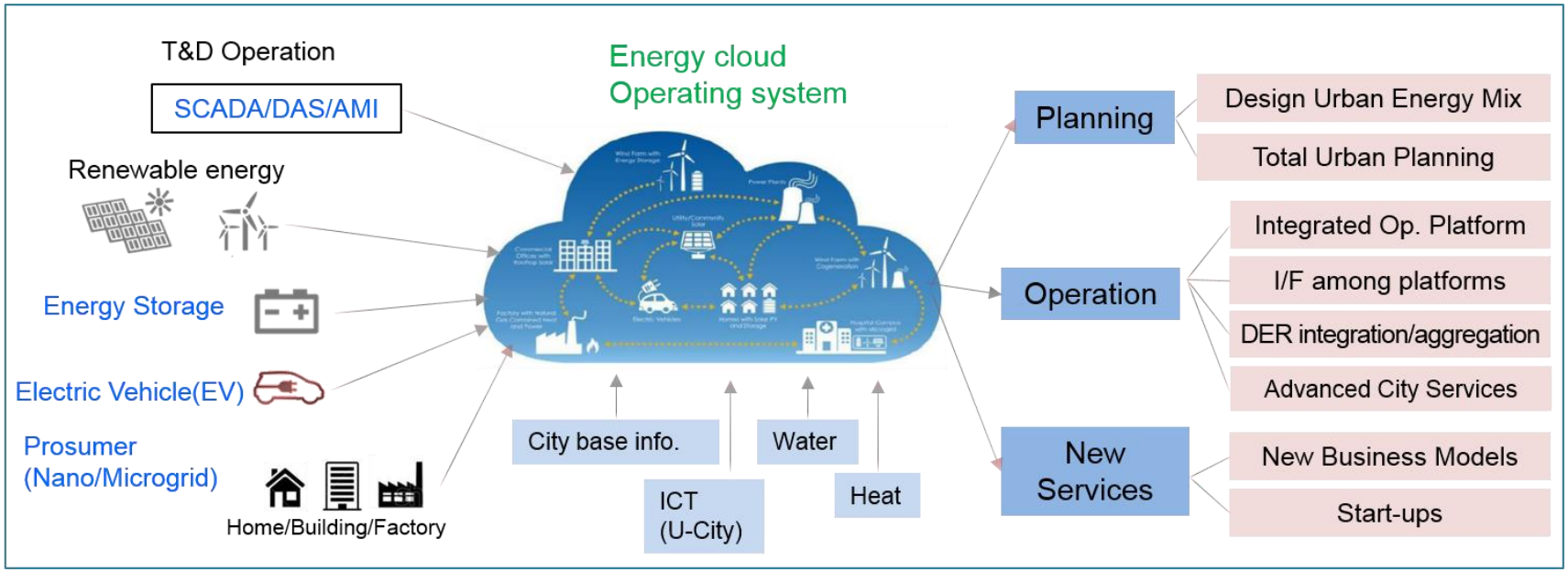
Smart Energy City Demonstration Project

We plan to build a smart city by installing renewable, ESS, and EV charging infrastructure and by linking data from various institutions. Many data generated in the city are managed in the smart city operating system.

The aim of this project

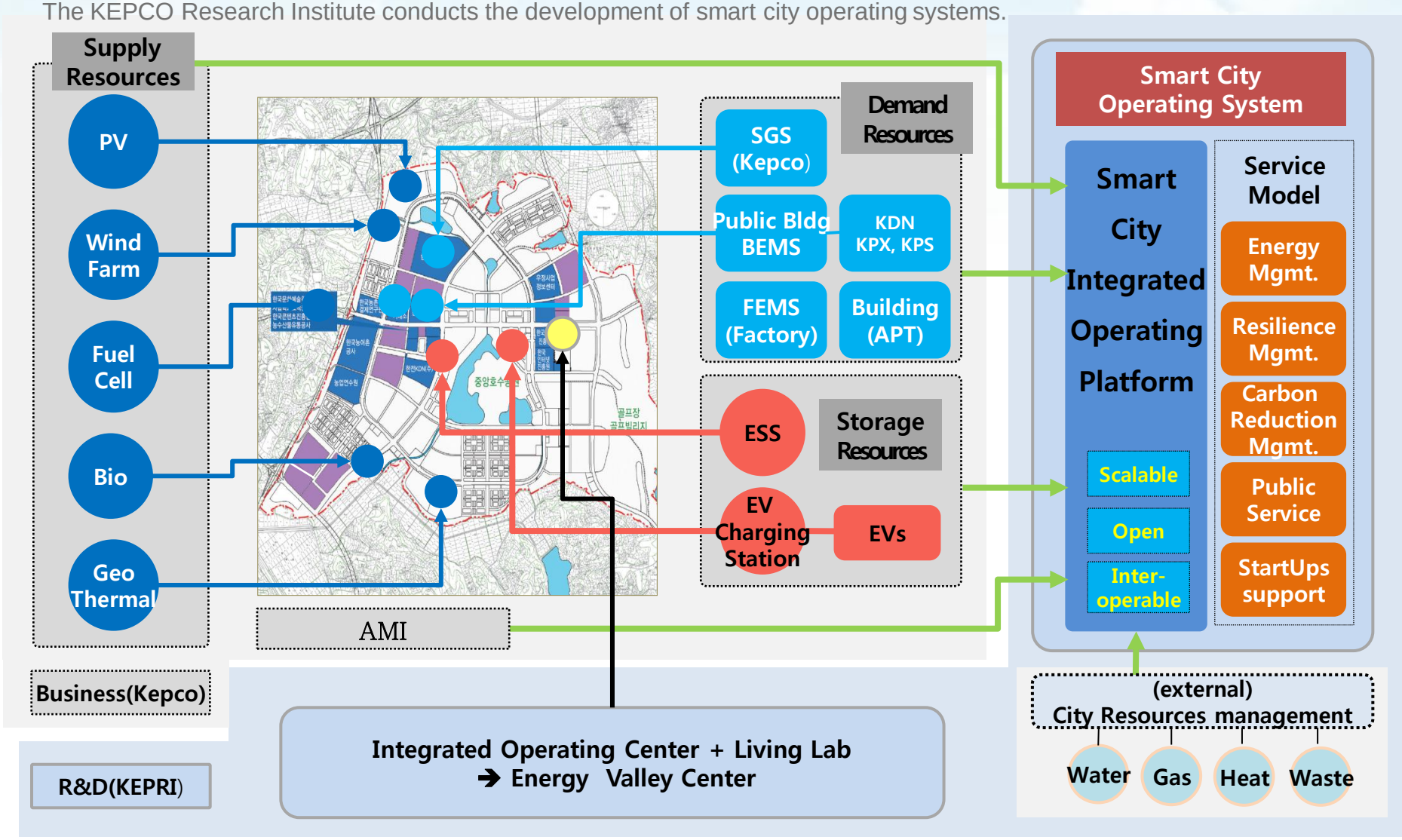
- **Energy supply rate through renewable energy : 20%**
- **Energy efficiency improvement : 15%**
- **SME(small and medium enterprise) incubator : 30 companies**

Overview of KEPCO's smart energy city



Configuration of Smart Energy City

The project consists of two major parts. The head office performs resource installation and cooperation with other organizations. The KEPCO Research Institute conducts the development of smart city operating systems.



III Smart Energy City Integrated Operating System

Development of Integrated Operating System

KEPRI (KEPCO Research Institute) conducts the development of smart city integrated operating systems.
The development is divided into several areas such as applications, devices, networks, security, services, and platforms.

Smart Energy City Integrated Operating System

- Performs energy management and power systems operation to improve the city's energy efficiency and energy self-sufficiency
- Establishes energy planning in the city and provides services for citizens
- Manages the city's carbon emissions

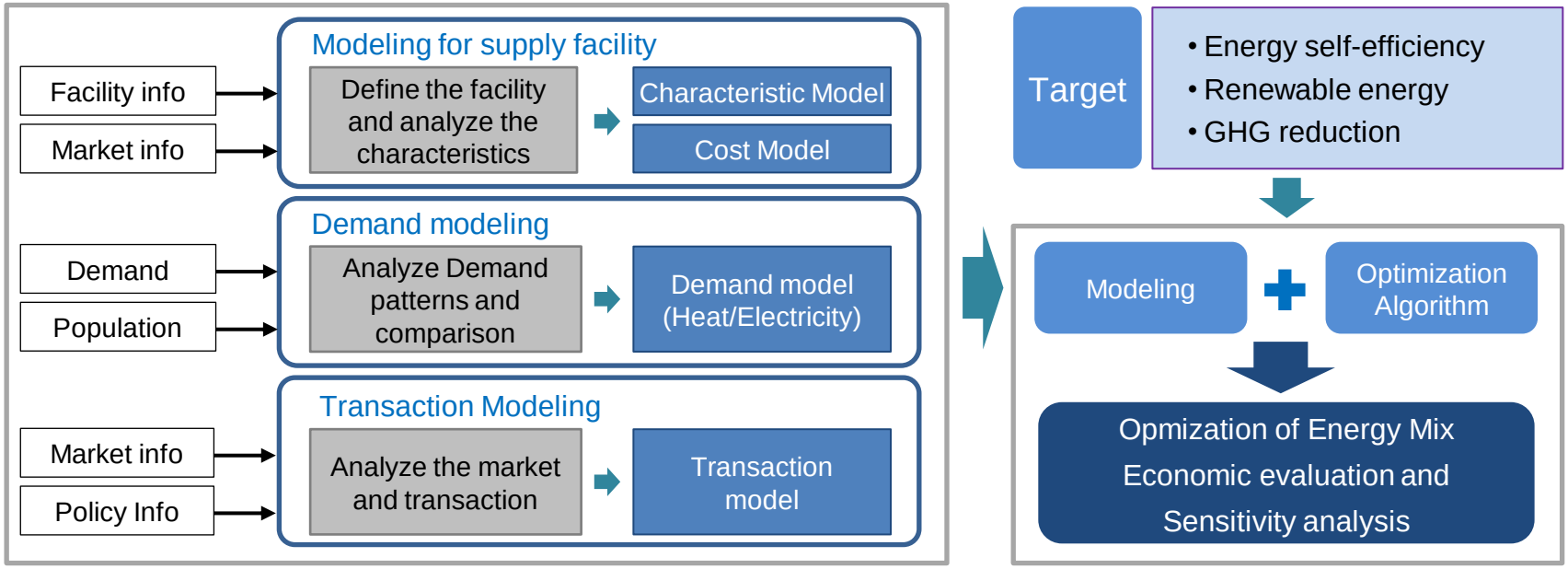
Major Developments

Integrated Operating System Platform	Infrastructure Data Linkage
City Energy Coordinator	VPP Solution
Enhanced City Energy Services	Element Device(ESS, G/W, Controller)

City Energy Coordinator

The coordinator can derive the optimal solution for energy supply (electricity and thermal) according to the city's purposes. The tool will provide a roadmap for medium and long-term energy supply.

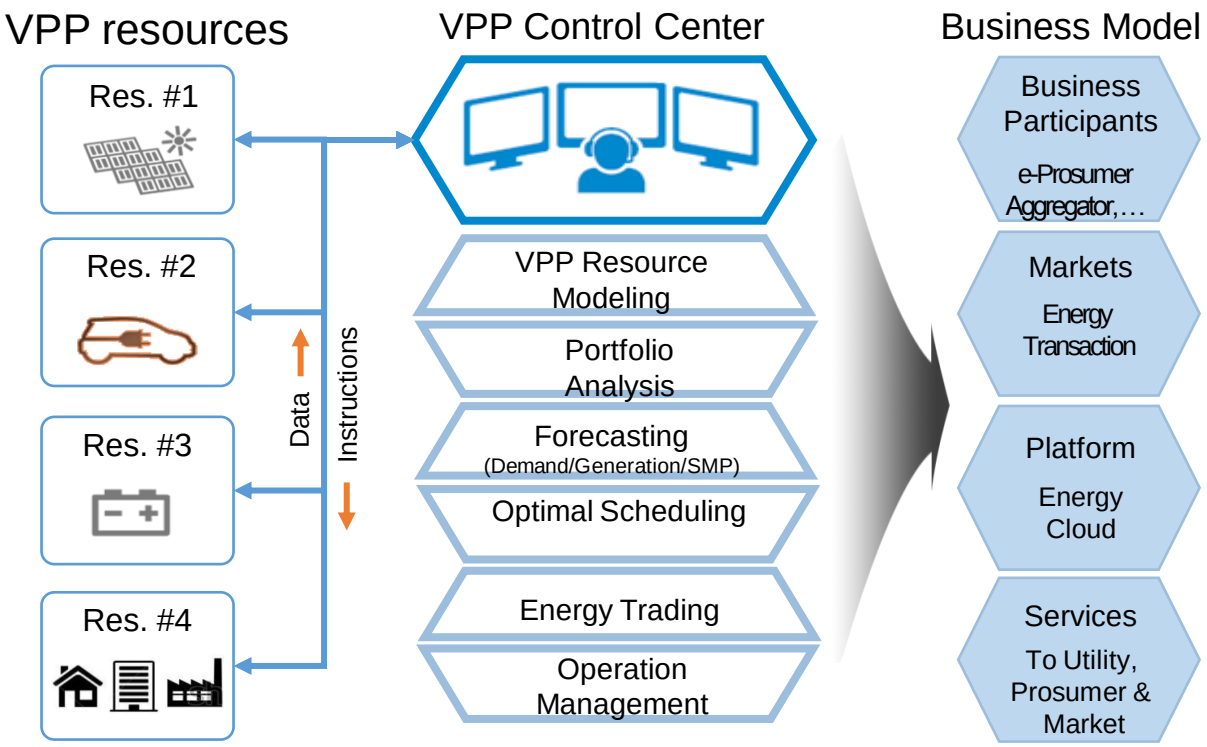
- **To design the city energy system and energy mix in the mid & long-term**
  - **Targeting the city's energy objectives (Energy self-sufficiency, Renewable energy, GHG reduction, …)**
  - **Energy modeling of electricity, heat and GHG emissions**
  - **Developing guidelines for energy planning (electricity + heat + transportation)**



VPP Solution to integrate DERs

A virtual power plant (VPP) is a system that integrates several types of small power sources.
The integrated resources can benefit from participating in the electricity market.

- **Optimal aggregation and operation of VPP using city DERs**
  - **VPP : virtual power plant**
  - **DER : distributed energy resource**
- **Develop VPP operation framework and BM for KEPCO**



Enhanced City Services

The project mainly provides urban services related to energy and CO2 reduction.

Development of enhanced city services

- **Planning and management for city CO2 reduction and creation of city CDM business model**
- **Suitability and cost analysis of renewable energies (PV or WT)**
- **Home energy management**
- **Customized service contents using open data**

Suitability and cost analysis

Home EMS

Street lamp

Integrated Operating System Platform

The platform manages data originating from the city and common modules that are frequently used in applications.

Develop platform for application and service

City Energy data exchange model

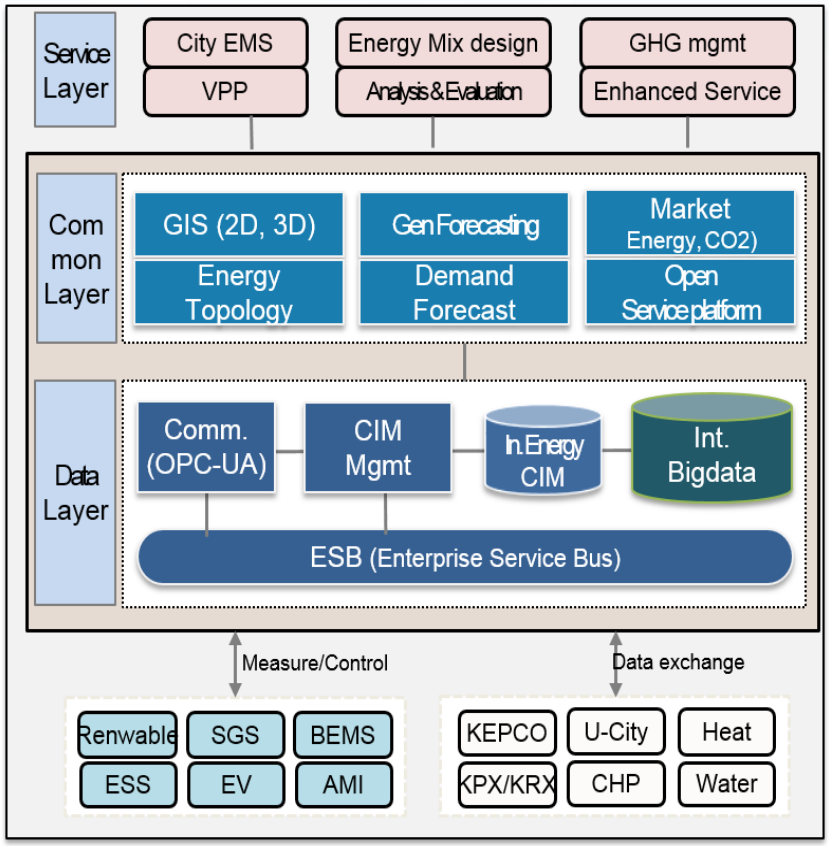
- T&D operational Data
- Data From city Energy resources
- Non electricity data

Standardized city energy information model

- Standardized comm. Interface (OPC-UA)
- Expanded city energy CIM
- Real-time op. DB and City big-date

Open Service platform

- City energy gen/demand forecasting
- Cloud based Open service platform
- Market mgmt. for electricity and CO2



IV Conclusion and Future Plans

Conclusions

Conclusions

- Cities are increasingly required to become “smart”
- KEPCO is establishing Smart Energy City infrastructure in Naju city
  - Headquarters (business), Research Institute (R&D)

Expected Effect

- Energy self-sufficiency : 15%, GHG seduction : 15%
- Develop integrated operation technique for smart city
- New business model fro KEPCO
- Action for city climate change, quality of life, energy efficiency

Future Plans

Phase I (~'17.5)	**Integrated Operating System Design**	○ Design system platform and service architecture ○ Design City VPP and City EMS ○ Design core city device and it's interface ○ Design city energy infra
Phase II (~'18.5)	Development Establish Infrastructure and interconnection	○ Monitoring system of City infrastructure ○ Develop the city op. platform and services ○ Develop the VPP and city EMS solution ○ Establish city int. OP. Center
Phase III (~'19.5)	Integrated Demonstration Performance Evaluation	○ Demonstrate and Test the system platform and Services ○ Evaluate the performance ○ Create the Business Model ○ Develop city Customized services

Thank you~*