LSIS

#### FUTURING SMART ENERGY

## Smart Grid : Futuring Smart Energy









### Dr. Ja-Kyun, Koo CEO and Chairman of LSIS

The 10th Asia Clean Energy Forum, ADB Headquarters, Manila, 17 June 2015

#### Growth in Asia continues outpacing that of other countries



#### Global Outlook for Gross Domestic Product Growth rates, 2014-2015

Note : Projections are based on trend growth estimates, which – for the period 2015-2019 are adjusted for remaining output gaps. Color ramp is based on GDP growth rates in 2015.

Source : The Conference Board Global Economic Outlook 2015.

#### **GDP Growth Contribution, 2010-2025**



#### Compounded Annual Real GDP Growth Rate

(unit: %, constant exchange rates)



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### Energy Demand is projected to be doubled by 2030



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### Why Smart Grid?







#### **Distributed Energy Resources with Renewables**



#### Water Floating PV System



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#### **References of Floating PV in Korea**



100kW in a Hapcheon Lake, South Korea, 2011



500kW in a Hapcheon Lake, South Korea, 2012



21kW in a Siwha Sea, South Korea, 2014



11kW in a Hapcheon Lake, South Korea, 2014

### Energy Storage System (ESS)



### High Voltage Direct Current (HVDC)



**HVDC System Diagram** 



#### **Converter Transformer**





Valve



### Factory Energy Management System (FEMS)



- 29% of whole energy consumption, and 34% of greenhouse gas emission.
- 20 millions of industrial motors spend 65% of energy spent in industry.



#### LSIS Cheong-ju Smart Factory



		ESS
2		79

Operation Status			> Temperature by Factory	FEMS
	• Gas 2 8/1 39	• Water 1 05/, 8/,	Allert	7
Milh	Nml Nml	()		
¥ 16.80%	¥ 24.74%	¥ 1.57%	Sanata Carta	
			and a second	
S Reporter 71	6 mail 47 s	♣ ∰ 7.14 co.		
Power Use by Fac	tory			
- <sup>50</sup>				
		Power Use Syfactory		
		37.3	Amage 7 10 Amage 21 10	$\sim$
Una may tickage Open Building Bail	utan Turakeration Educato Ing Ration Rating	ally .	E Humility 47 5 E Humility 43 5	

Utility	Uti
Cooling lachine <b>2 Ea</b> ement	leating/Cooli Water Machi Replacemer
er <b>2 Ea</b>	Boiler Replacemer
nverter <b>4 Ea</b>	Pump, Invert Replacemer

**PV System** 

ESS

Generation

Installed

Area

Battery

PCS

2 MW

Roof

1 MWh

1 MW

#### **Cost and Expected Effect**

(in Million USD)

	Item	Cost
Major Cost	ESS	1.1
	PV	3.4
	FEMS	0.4
	Etc.	1.2
Total		6.1
	ltem	Cost
Expected Effect in each year (Saved Cost)	ESS	0.06
	PV	0.63
	FEMS / Energy Efficiency	0.16

Total

0.85

### **Building Energy Management System (BEMS)**



- Buildings spend 24% of whole energy.
- 33% or more of energy is for lighting.
- 50% or more of energy is for HVAC.



### LSIS R&D Center

B/C store	
V System V System produce which is provided and the system of the syste	Operation     PV Generation
	Annual An
	Interpendure 211° ★ Sunlight 107.6 W/m²
	<ul> <li>PV Generation (this month)</li> <li>from month</li> </ul>
	• • • • • • • • • • • • • • • • • • •
+Model: LSP-T090LT +Capacity: SOW	Current 4.0 kW Amount of Generation floderal 252.2 kWh



Operation Status	J Temperature   21°C	Humidity   17%	DEMS
> Temperature by Floor	> Power	› Gas	DEIVIS
610 mm	6,654.6	772.3 <sub>Nm</sub>	199.0 ㎡
	Change in percentage compared to previous day ▼ 14.69 %	Change in percentage compared to previous day ▼ 20.87%	Ounge is percentage compared to previous day ▼ 25.47 %
		Gal MOL	
	Power Use by Floor	Compare to Last Month 🔳 I	Sood 📕 Normal 📕 Bad
	1,500 kWh	11	Aug.Power
Longertun     Langertun     Langertun	0 B3F B2F B1F 1F	2F 3F 4F 5F 6F	Consumption 258.6 kWh 7F & F 9F

1 MWh	Battery
1 MW	PCS
ty	Utilit
2 Ea.	Heating/Cooling Water Machine
	Replacement
2 Ea.	Boiler Replacement
2 Ea. 4 Ea.	Boiler Replacement Pump, Inverter Replacement

**PV System** 

ESS

Generation

Installed

Area

50 kW

Roof

#### Cost and Expected Effect

	(in	Million USD)
	ltem	Cost
Major Cost	ESS	1.12
	PV	0.14
	BEMS	0.11
	Lighting & Facilities	0.56

1.93

Total

	ltem	Cost
Expected Effect in each year (Saved Cost)	ESS	0.03
	PV	0.01
	BEMS	0.01
	Lighting & Facilities	0.03
Total		0.08
Energy Saving		9 %

#### Home Energy Management System (HEMS)



- Household spends 27% of whole energy.
- \$250M market in 2030. (Morgan Stanley)



#### **HEMS for Active House**





Main



Generation / Consumption



Charge / Discharge



**Settings** 

### **Demand Response**



#### **Micro Grid Solution**



#### Micro Grid in Korea : Energy Self-Reliance Island

#### Objectives

- Establishing self-reliance island for CO<sub>2</sub> reduction, energy cost reduction and operation efficiency enhancement
- Minimizing existing diesel generators by applying renewables with ESS
- Supplying electricity with the price lower than diesel power generation cost

#### **Targets**

- Area : A total of 62 islands to which KEPCO provides electricity
- System Configuration :

Diesel Generation + Renewable Energy(Wind Turbine, Photovoltaic, etc.) + ESS

Power Purchase Agreement (PPA) between KEPCO and private companies

Source : Ministry of Trade, Industry & Energy(MOTIE), 2015.2.

#### Micro Grid in Korea : The 'D' Island



- Power Consumption('14) : 9,462 WWh/yr (Max 1,770<sup>kW</sup>, Avg. 1,080<sup>kW</sup>)
- Diesel Generator : 2,900 kW (500 kW × 4, 300 kW × 3)

Details		
Area	20.87 km²	
Avg. Temperature	<b>12.1</b> ℃	
Avg. Wind Speed	2.9 m/s	
Population	1,669	



# Futuring Smart Energy

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