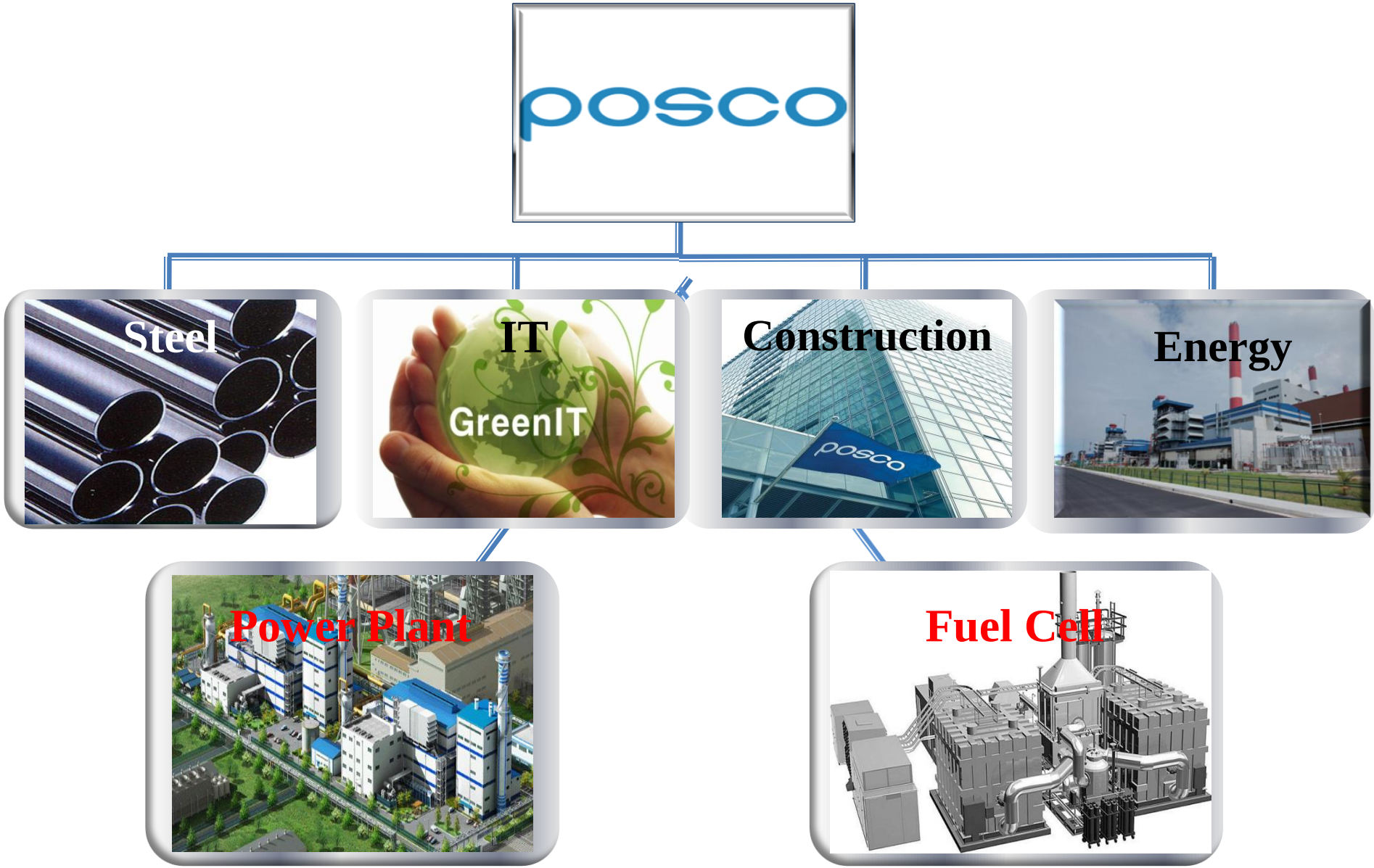
Fuel Cell Power Business Intro.

1. POSCO Power
2. Fuel Cell of POSCO Power
3. Status of Fuel Cell Business
4. Status of the fuel cell Develop.
5. Green Growth Vision

Infra Structure

posco
POWER | POSCOFuelCell



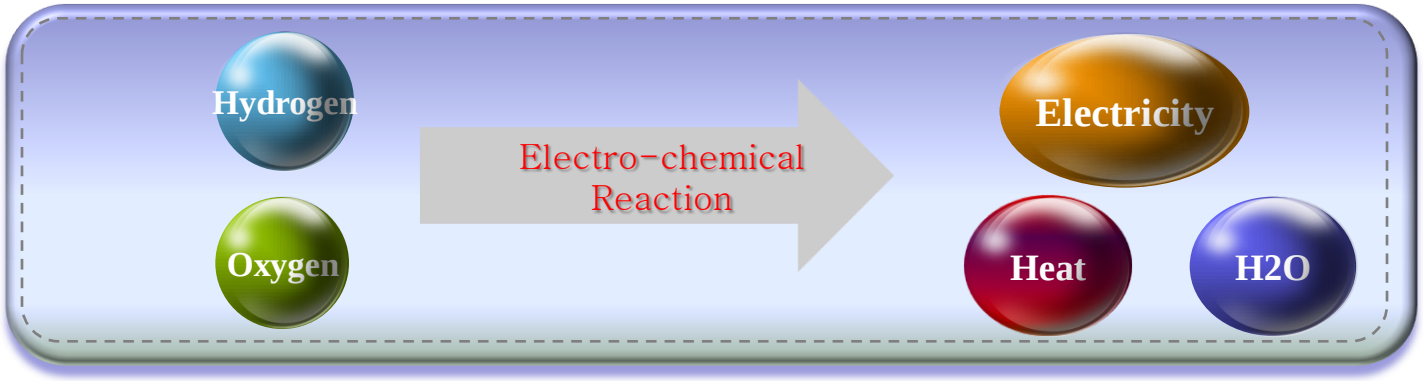
Business Process of Fuel Cell Power

’11. 03	·Completion of the stack manufacturing plant
’10.10	·Completion of the World Largest fuel cell power plant (5.6MW), Phase 1
’10.04	·Began Construct. Of fuel cell stack manufacturing plant with 100MW annual capacity
‘09.05	• MOU for diffusion of urban fuel cell between Seoul and POSCO
‘09.01	• Selected as one of the three Intensive Growth Engines of KOREA
‘08.09	▪ Completion of BOP manufacturing plant
’07.05	▪ Started the SOFC R&D 5yr plan (RIST)
‘03.07	▪ Selected as a Future Growth Engine of POSCO

Intro. Of Fuel Cell 1-5

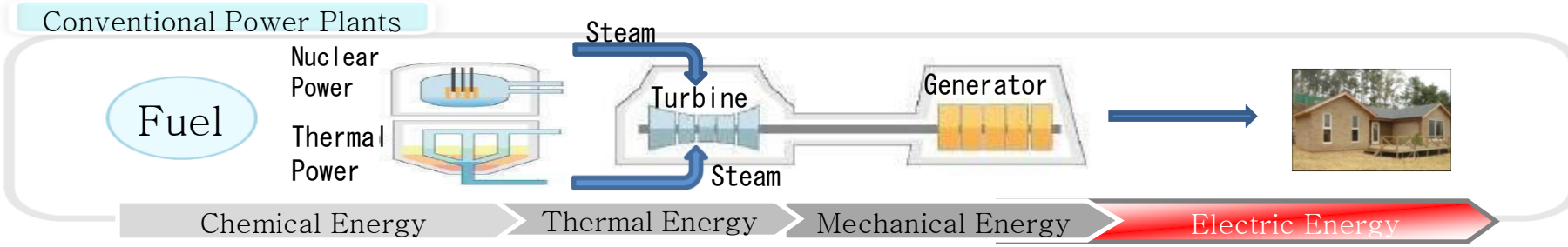
Principle of Fuel Cell

The basic principle is "Counter Reaction of Water Electrolysis"

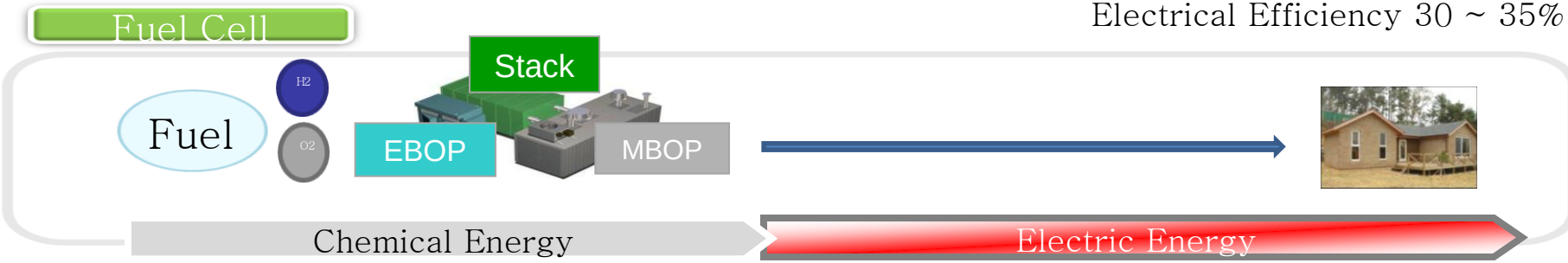


High Efficiency, Eco-Friendly Future Energy System

Comparison to the Existing Electric power Source



Electrical Efficiency 30 ~ 35%



Electrical Efficiency 45 ~ 60%

Intro. Of Fuel Cell 2-5

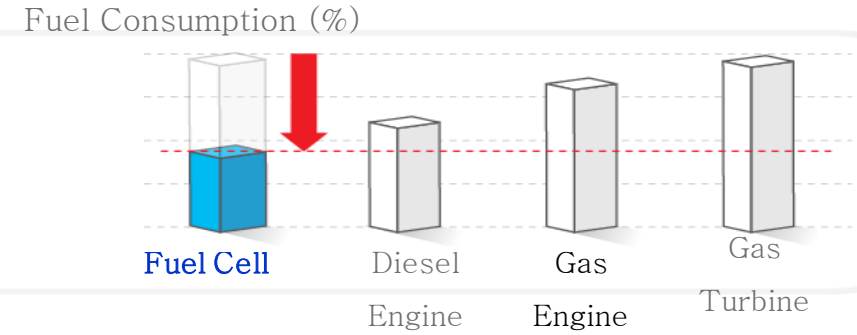
Technical Analysis of Fuel Cell 1-2

1

High Efficiency Saving Fuel

Electrical Efficiency 47%,

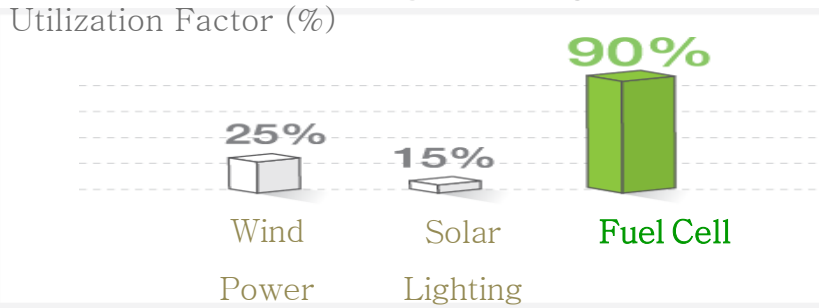
Composite Eff. 60%



2

Reliable for 24/7

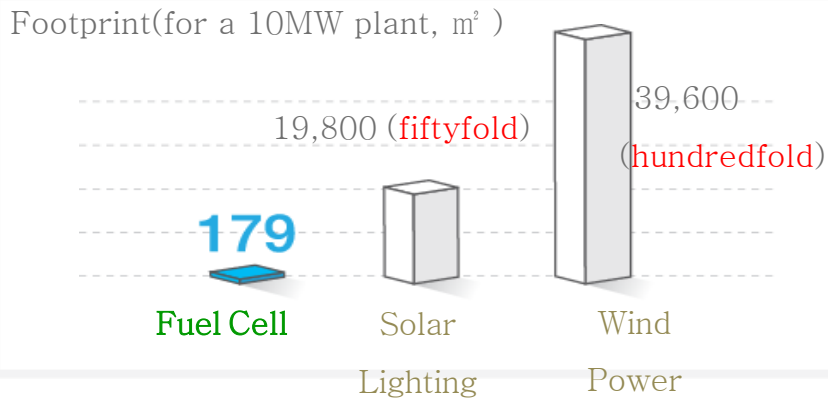
High Utilization Rate, 90%



3

Minimum Footprint

Requires minimum area of installation amongst all the new & renewable energy



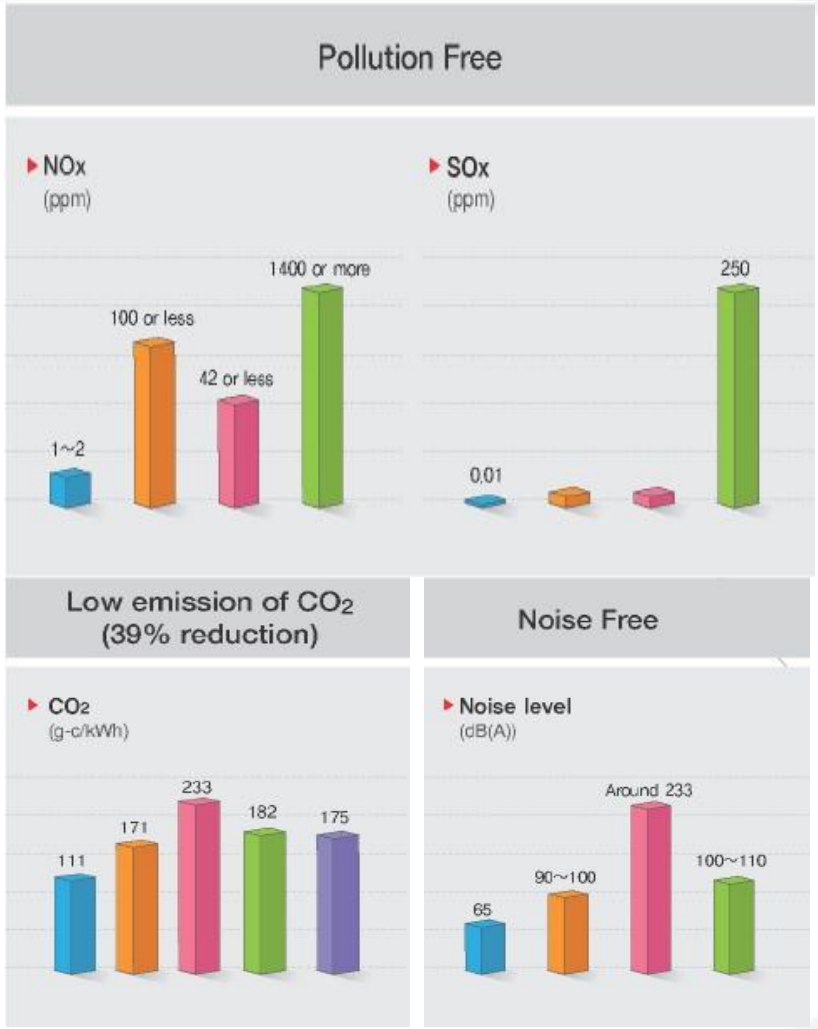
Intro. Of Fuel Cell 3-5

Technical Analysis of Fuel Cell 2-2

4

Eco-Friendly Energy

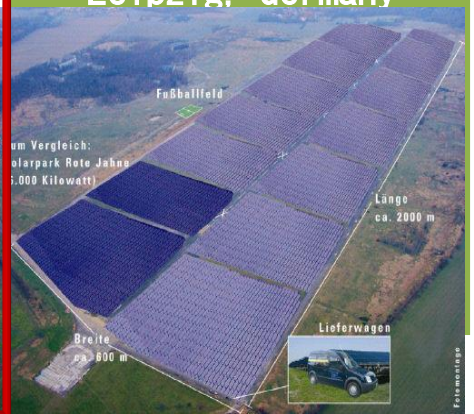
- Polution Free
- CO2 Reduction
- Noise Free (Less than 65dB(A))



Fuel cells
Gas engines
Gas turbines
Diesel

Intro. Of Fuel Cell 4-5

Comparison
to the other electricity supply sources

Class.	Fuel Cell	Solar Lighting	Wind Power	Remarks
Util. Factor	90 %	15%	25%	'as of '08 (KEMCO)
Demanded Area	179m^2	10,000m^2	20,000m^2	Per 1MW
Feature	· Flexible cond. of location · Stable Op. & High Eff. · Simultaneous Production (Electric Power &	· Using Natural Resources · Needs Generating Cost/ · Limited Area	· Using Natural Resources · Limited Area	
Location	· **Small-Scale** · **Possible to utilize By-product Gas**	**Area (Needs much Sunshine)**	**The Up-Country**	
Example	**Taegu TCS1 (5.6MW)** 	**Leipzig, Germany** 	**Long Island offshore, U.S.** 	(Source: '08 Policy Reporting, Korea Environment Institute

Intro. Of Fuel Cell 5-5

Classification

100kW

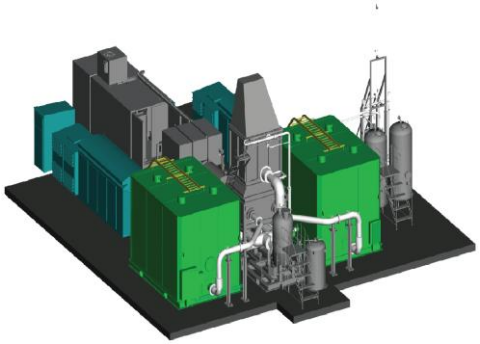
- Install. Area : ≥99m^2
- Output
  : AC100kW
- Application
  : Bldg., Apartment, Park, etc.

1.4MW

- Install. Area : ≥ 490m^2
- Output
  : AC1,400kW
- Application
  : Universities, Manufacturing facilities

2.8MW

- Install. Area : ≥ 990m^2
- Output
  : AC2,800kW
- Application
  : Power Plant, Small Society

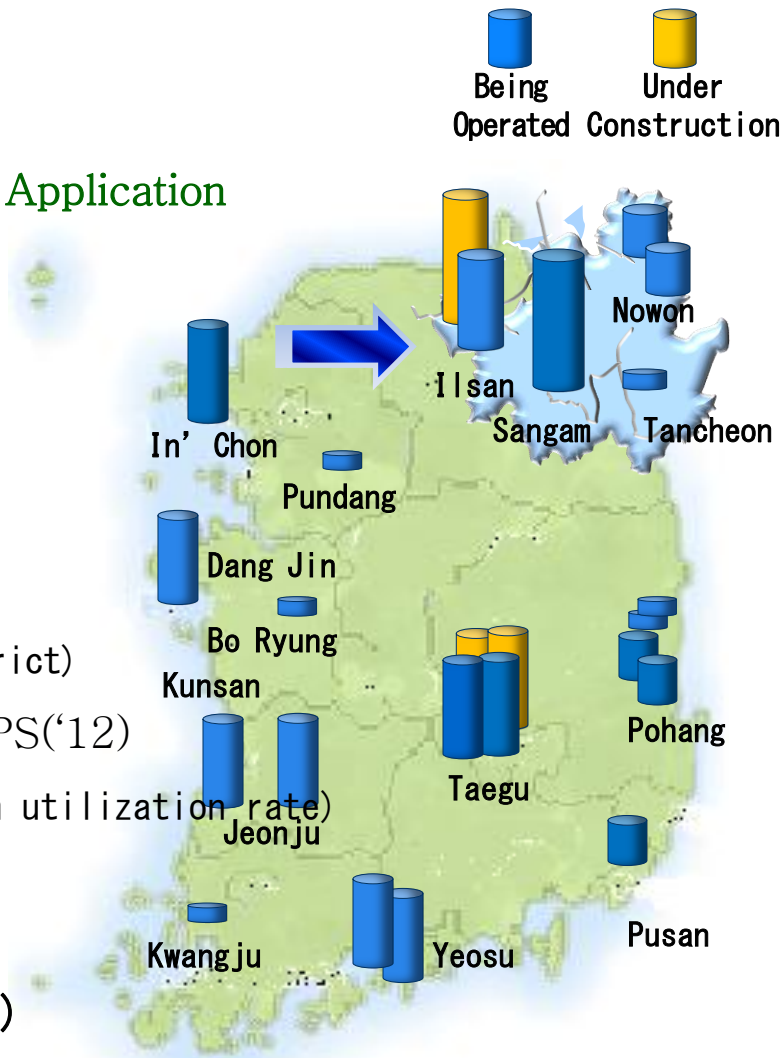


Status of Fuel Cell Business

Domestic Installation Status

Under the Support Policies,
Settled Domestic demand-shaping & First-Hit for Bldg. Application

- **Under** Feed-In-Tariff: Domestic Sales (40MW)
  - Installed Seoul, Pusan, and Taegu (Big-City Centered)
  - Switching to Big Scale Centered (From small scale)
    - Namdong Power Plant : 250kW('06) → 2.4MW('08) → 2.8MW('09) → Multi-MW
  - Parallel-ADG (In case of Pusan Sewage disposal plant)
  - Supply heating together with electric power (Nowon district)
- **On negotiation with targeted companies against** RPS('12)
  - Grand Scale of demand (Owing to High-efficiency, High utilization rate)
  - **Expected install. of 80MW scale for power plants (Appx. 30% RPS market)**
- **Expected gradual expansion (for Bldg. Application)**
  - In operation of the Seoul Pilot Project of fuel cell for Bldg. (Under Seoul's auspices)
  - Expected expansion to private bldg owners (due to Revision of RPS, and Accredited scheme for eco-friendly bldg)



Status of Fuel Cell Business

Overseas Market Penetration

- Security the basis of the entry of Overseas market, based on the Domestic Business Exp.
  - Localization, Establishment of service system, Cost reduction
  - Security of the Operational Competence of business, and Global Network Building up

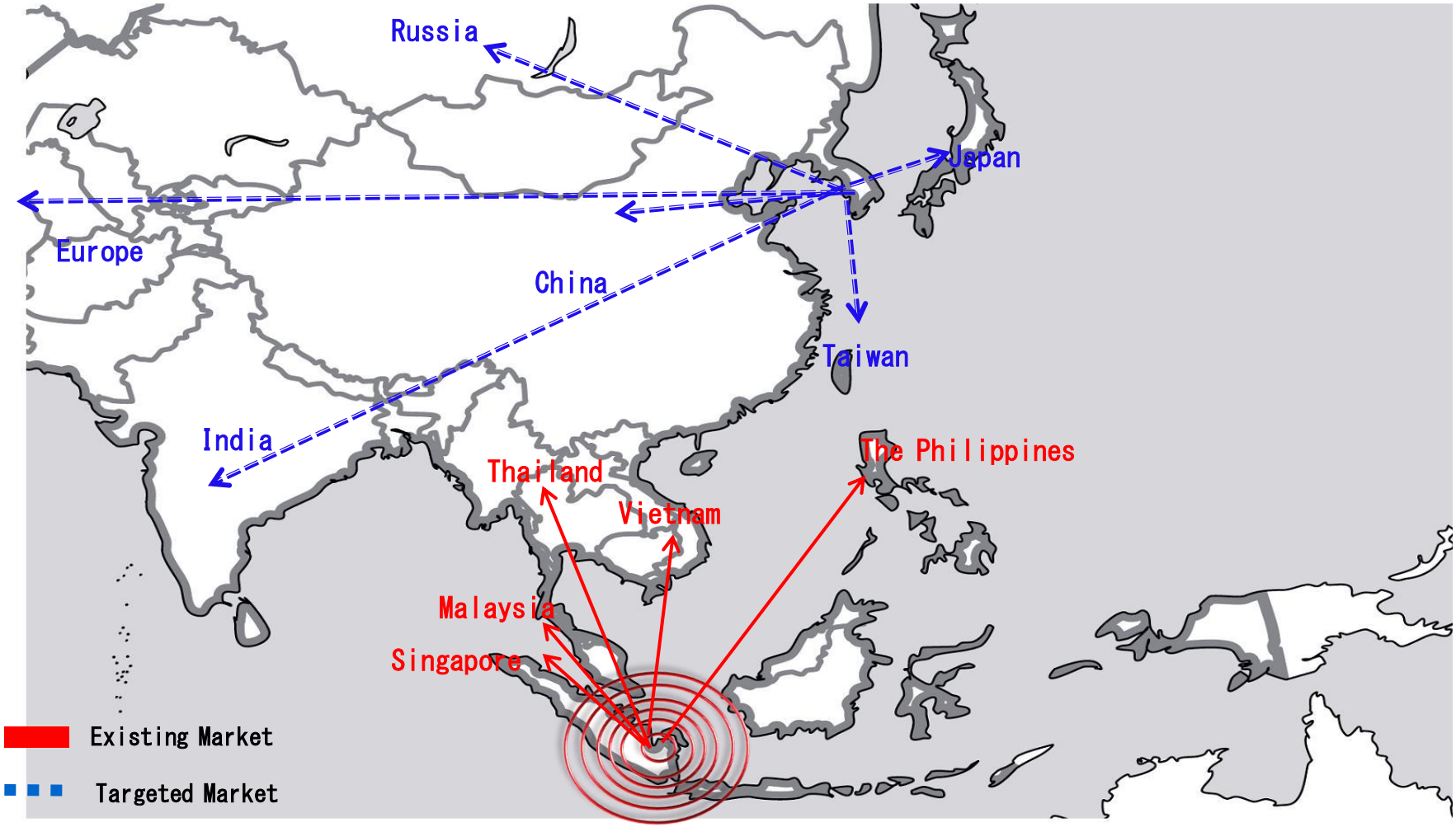
- Expansion of the business to the Global Domain after penetrating into the Southeast-Asia, and the Middle East
  - Development of the markets that require high power rates (including sectors which need low fuel expenses)

- Indonesia Reference Project
  - Jakarta 300kW Project
    1. Fuel cell Pilot Project in Ancol, Jakarta (Appealed by KOICA)
    2. Supply electric power to Desalination plants ('12~)

- Other East-Asian countries
  - Pilot Project of Fuel Cell Plant utilized bio-gas of Bottling Company (The Philippines)

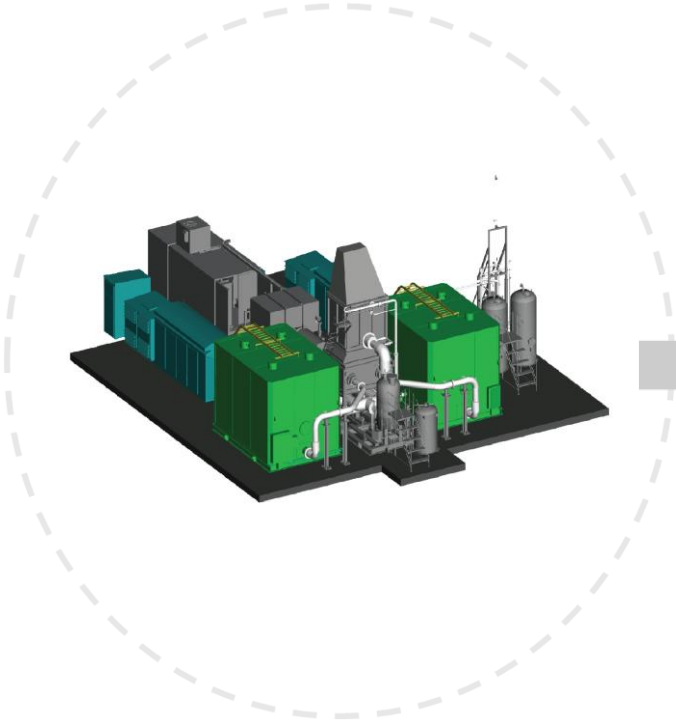
Status of Fuel Cell Business

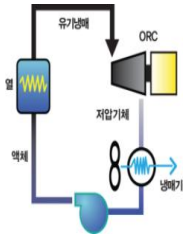
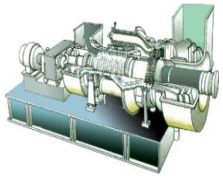
Overseas Market Penetration



Status of the fuel cell Develop.1-5

Convergent products based on MCFC



ORC 53%		Fuel cell + ORC Add. Generation using waste heat recovery
Differential Pressure generation 63%		Fuel cell + Differential pressure generation
Turbine 65%		Fuel cell + Gas Turbine
Carbon Capture 0 CO_2		Fuel cell + Carbon Capture

Status of the fuel cell Develop.2-5

Applied to Various Fields




	Stationary (Stand-alone)	Uninterrupted Power Generation	Vessel Engine	Large-scaled Fuel Cell
Potential customer	Apartment, Univ., Gov. building	IDC, industrial complex	Shipping company	Utility, IPP
Introducing factor	Emission reduction within metropolitan city territory	Countermeasure of electricity failure	'16 MARPOL observance (NOx, carbon tax, etc.)	RPS(renewable portfolio standard) District Heating
R&D field	Compact design, load management	Fast load following	Optimization on marine circumstance, fuel conversion, load following	Mass production, high efficiency by turbine combination
Released	'11	'11	'16	'15

Status of the fuel cell Develop.3-5

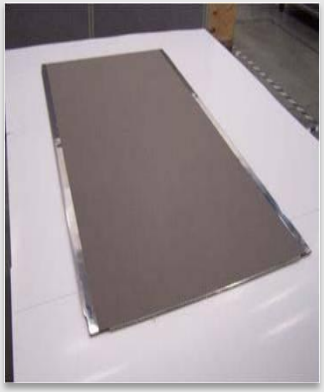
Localization of MCFC

Establishment of MCFC Manufacturing System-in-itself (' 11)
Pursuing of Capacity Diversification of MCFC Fuel Cell

Maintenance (Completed'07)	Construct. ('07 Completed)	BOP ('08 Completed)	Stack ('11 Completed)	Cell







70% Localization

- Construction of BOP Manufacturing plant (Sep.'08)
- Establishment of the Supply Chain foundation & Under the Independent New Model
  - Completed localization (MBOP, 67%), and 100% of EBOP
  - Expected localization of fuel cell for Bldg., Vessel Engine, and Large-Scale Power Plant
- Establishment of the production system in-itself as the completion of the fuel cell power plant (Mar. '10)

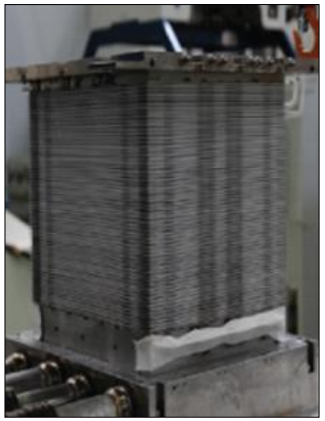
Status of the fuel cell Develop.4-5

SOFC Tech. Development

SOFC (Solid Oxide Fuel Cell) which will be developed by POSCO Power, is a next generation fuel cell power generation system

SOFC Localization Road Map

1kW Stack (2006) → 2kW Stack (2007) → 5kW Stack (2008) → 10kW Stack (2010) → 25kW Stack (2010)



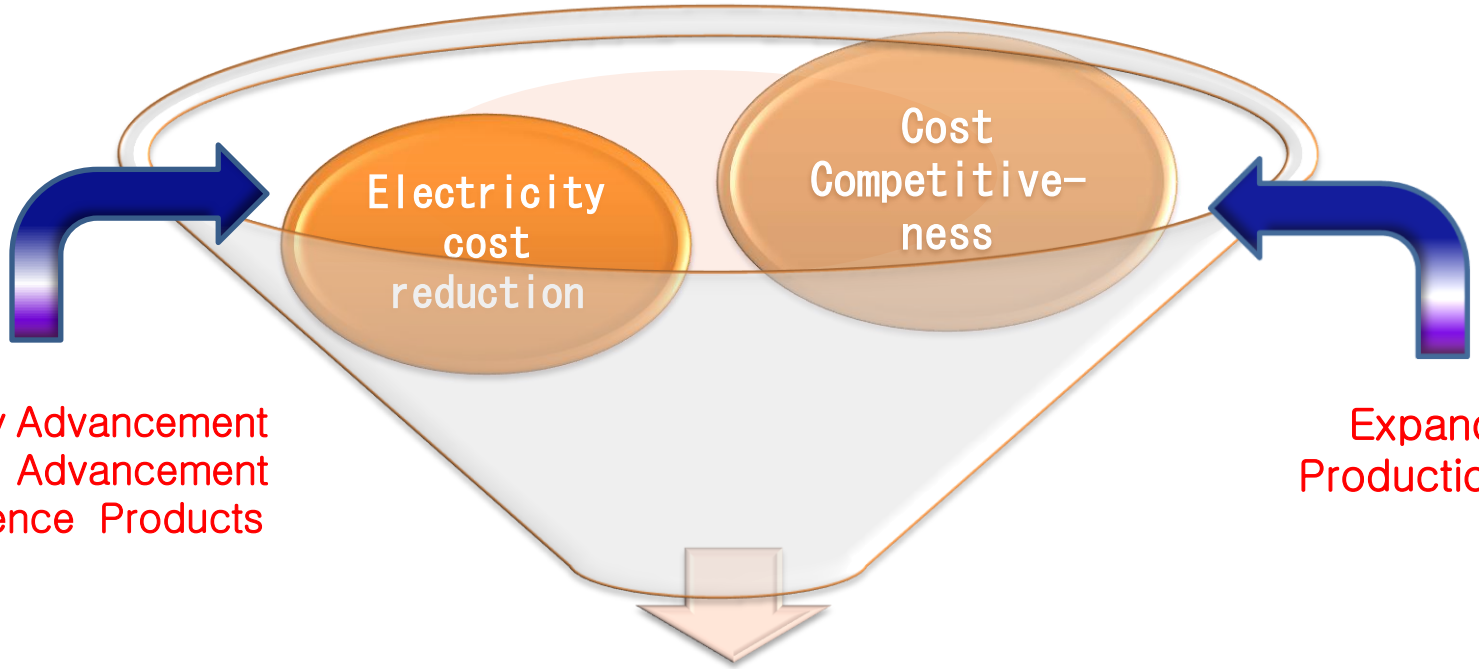
Product mass production & Continuous develop. MW-grade large scale system

Status of the fuel cell Develop.5-5

Advance Development of Fuel Cells

Fuel Diversification

Cost Reduction



- Efficiency Advancement
- Tech. Advancement
- Convergence Products

Expanding Production Line

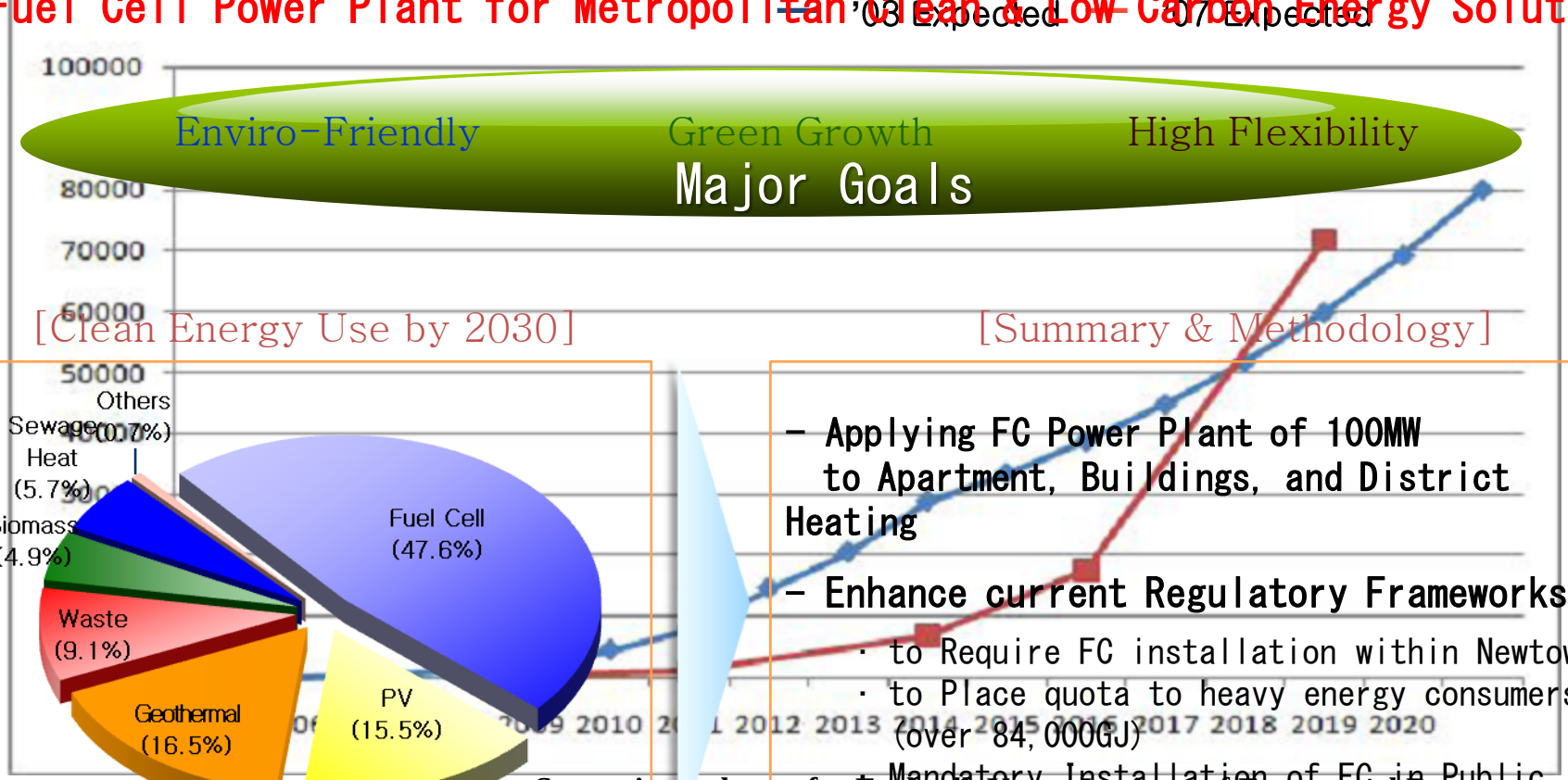
Profit Improvement

Green Growth VISION

Leading Company for Green Growth

No. 1 Total Solution Provider of fuel cell for a Low Carbon Green World

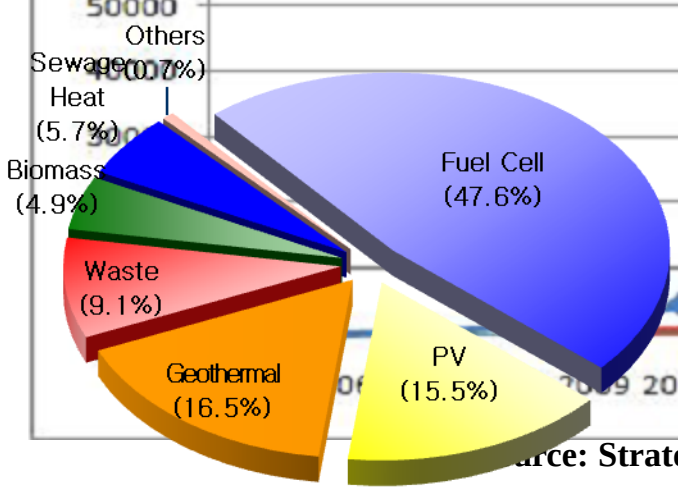
POSCO Power would be the best company to be selected & focused on the Fuel Cell Power Plant for Metropolitan Clean & Low Carbon Energy Solution



Enviro-Friendly | Green Growth | High Flexibility

Major Goals

[Clean Energy Use by 2030]



[Summary & Methodology]

- Applying FC Power Plant of 100MW to Apartment, Buildings, and District Heating
- Enhance current Regulatory Frameworks
  - to Require FC installation within Newtown
  - to Place quota to heavy energy consumers (over 84,000GJ)
  - Mandatory Installation of FC in Public Building

Source: Strategic road map for Fuel cell, Korea Institute of Energy and Resources Technology Evaluation and Planning, 2009)

Green Growth VISION

National Economy Revitalization

posco POWER | POSCOFuelCell

Fostering the industrial instruments of fuel cell, our business areas will achieve CSR, and Betterment Business environ. for SME.