

**COP23 Side Event**

**Climate and Energy Policies for a Low  
Carbon Future in Asia and Europe**

# Renewable Energy in Korea Low Emission Strategy

- Effect of Mission Innovation on Power Sector

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# Objective



## ■ Background

- 2030 GHG Mitigation Target(-37% vs. BAU by 2030)
- Renewable Energy for Low Emission Energy System  
: 20% of Power Production from Renewable by 2030

## ■ Objective

- Effect of Mission Innovation on Emission and Cost  
in Power Sector

# Mission Innovation



- **PV : Cost of Lower than Coal Technology in 2030**
  - **80% Reduction of System Cost vs. 2010(\$4.3/W→\$0.7)**
    - : **Production cost of ₩70(7cent)/KWh in 2030**
  - **Increase of PV Share in RE(2.7% in 2010 →14.1% in 2035)**
    - : **R&D in Crystalline Silicon Cells and Module Development**

# Mission Innovation



## ■ Off-Shore Wind : Competitiveness of System

- 20% Decline of System Cost(₩1.5bn in 2010→₩1.2 bn in 2025)
  - : 30% Decline of Operating Cost(₩13/Kwh in 2010→₩9.9 in 2030)
  - : R&D in Supply Chain and Domestic Production of Systems
- Increase of Wind Share from 2.6% in 2010 to 18.2% by 2035



## ■ Fuel Cell : Efficiency Improvement

- Efficiency Target of 70% in 2030(47% in 2010)  
: Increase of System Lifetime from 5 years to 10 years in 2025
- 80% Reduction of System Cost in 2030  
: 60% Reduction of Hydrogen Price  
(₩20,000/kg in 2010→₩7,000)
- Increase of Fuel Cell Share in RE to 9.7% in 2029

# Mission Innovation



- **Bio Energy : Competitiveness of System**
  - **Mass Production of Bio-Energy Systems**
  - **(Omni) Production Cost of ₩400/kg in 2030**  
: **Bio Fuel Price of ₩500/liter by 2030**

# Mission Innovation

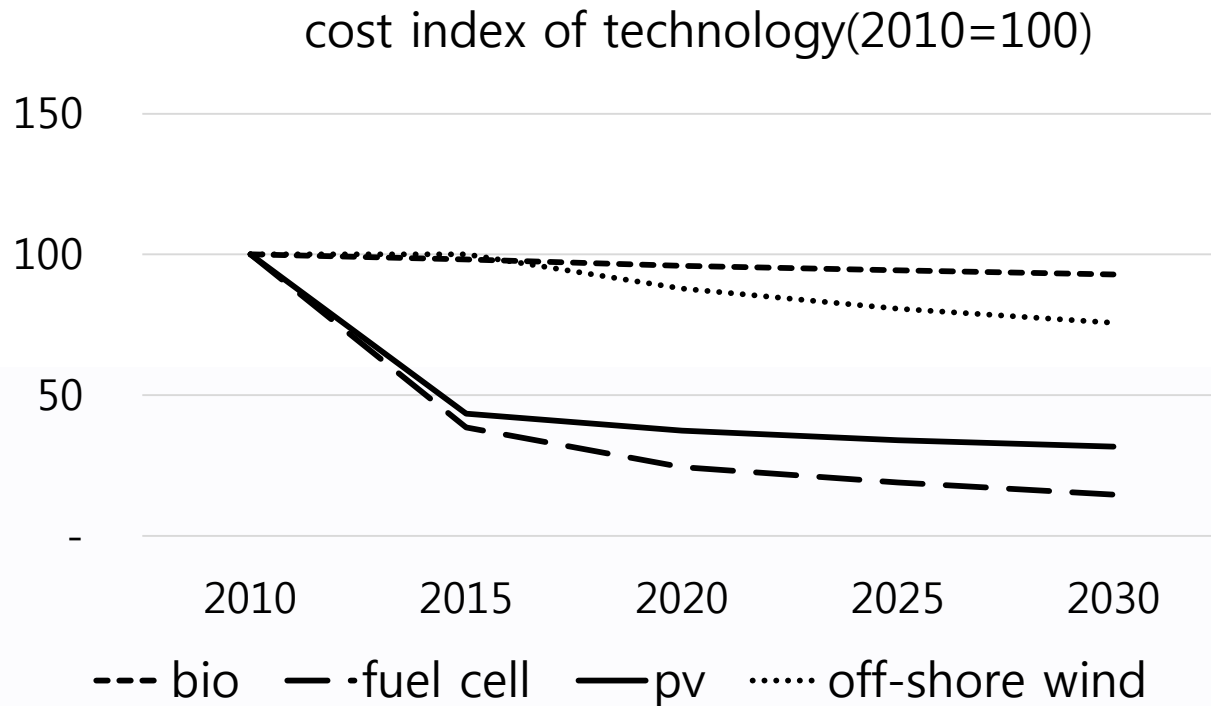


- **Clean Coal : Increase of Dual-fire**
  - **Efficiency Improvement of Current Coal Power Plant**
  - **50% of Dual-Fire share with Biomass in large scale Coal Power Plant by 2030(35% by 2025)**

# Mitigation Scenario



- **Cost Decline of Renewable Technology in Baseline**
  - **Further Decline of Cost in Mitigation Scenario**
  - **Increase of Production Share in Renewable**



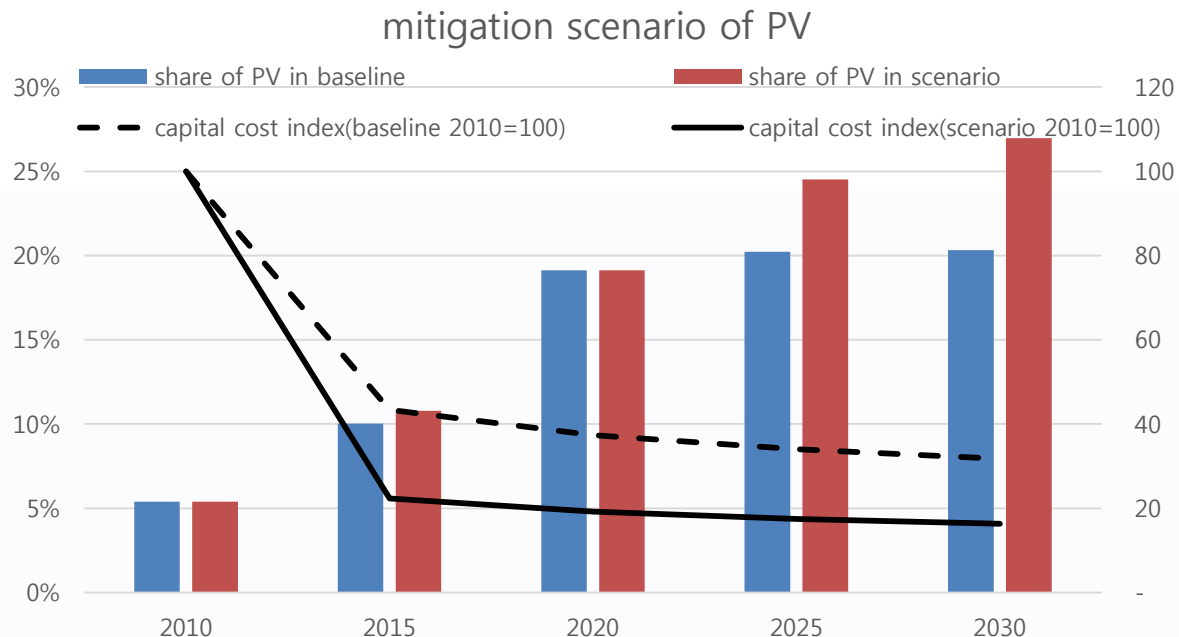


# Mitigation Scenario



## ■ Mitigation Scenario of PV

- **16.3% of Capital Cost in 2030 vs. in 2010**
- **25% Share of RE in PV in 2030**

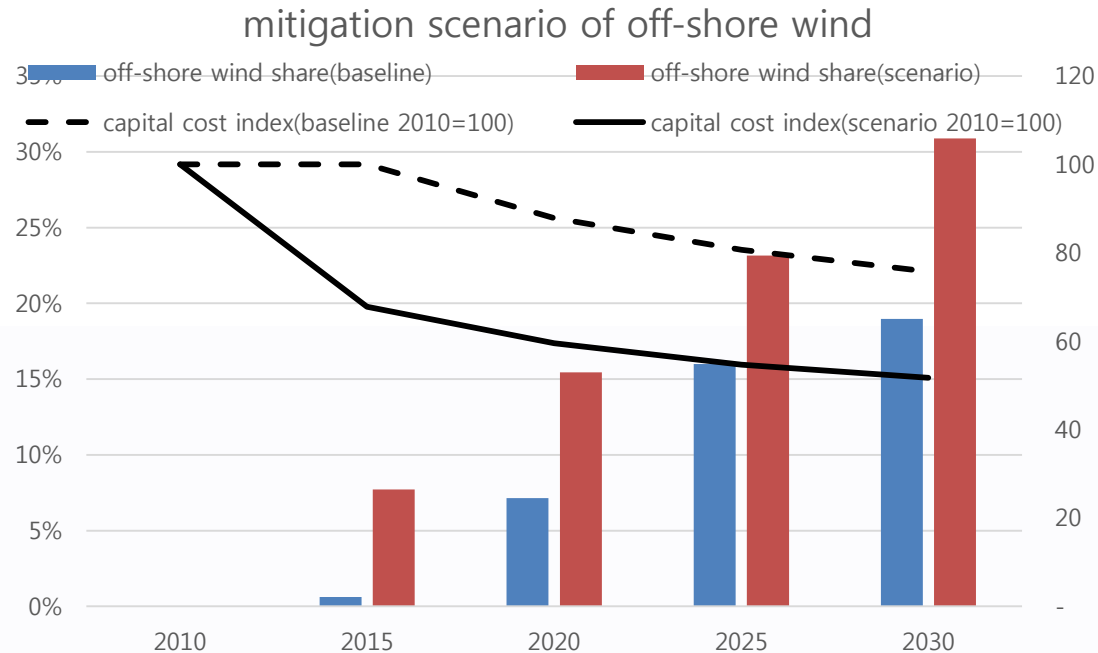


# Mitigation Scenario



## ■ Mitigation Scenario of Off-Shore Wind

- Capital Cost in 2030 is 48% less than Cost in 2010
- : 30% of Off-Shore Wind share in 2030

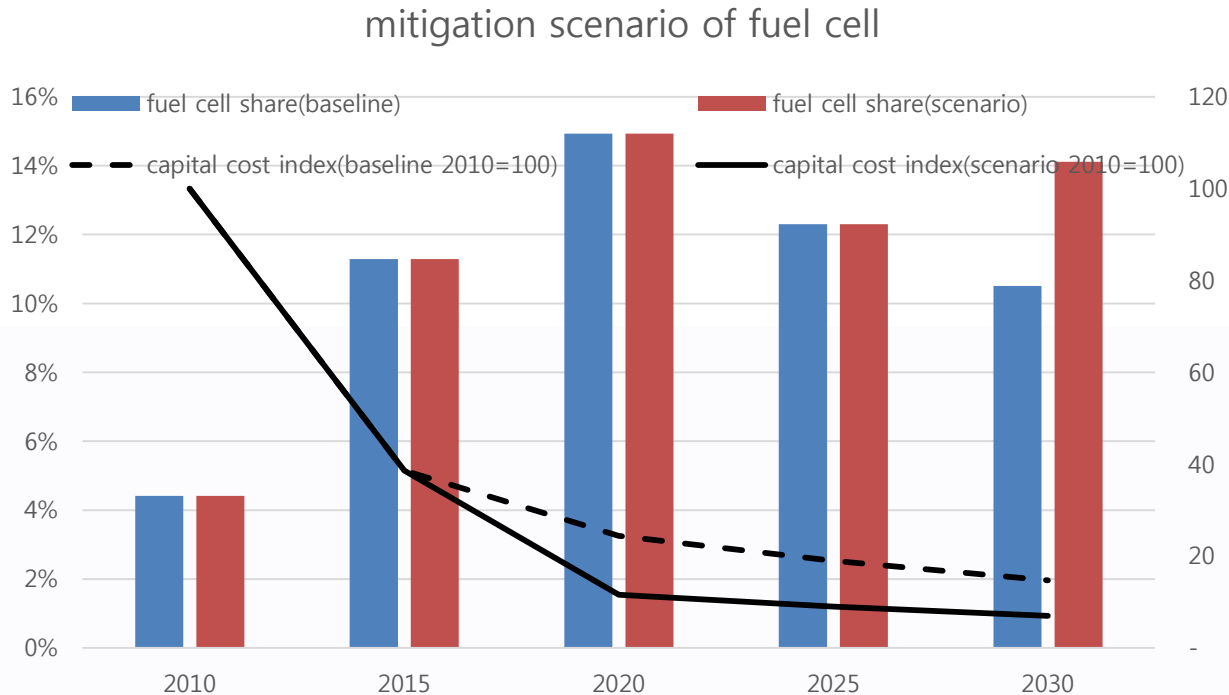


# Mitigation Scenario



## ■ Mitigation Scenario of Fuel Cell

- Capital cost in 2030 is 7% of Cost in 2010
- : 14.1% of Fuel Cell Share in 2030



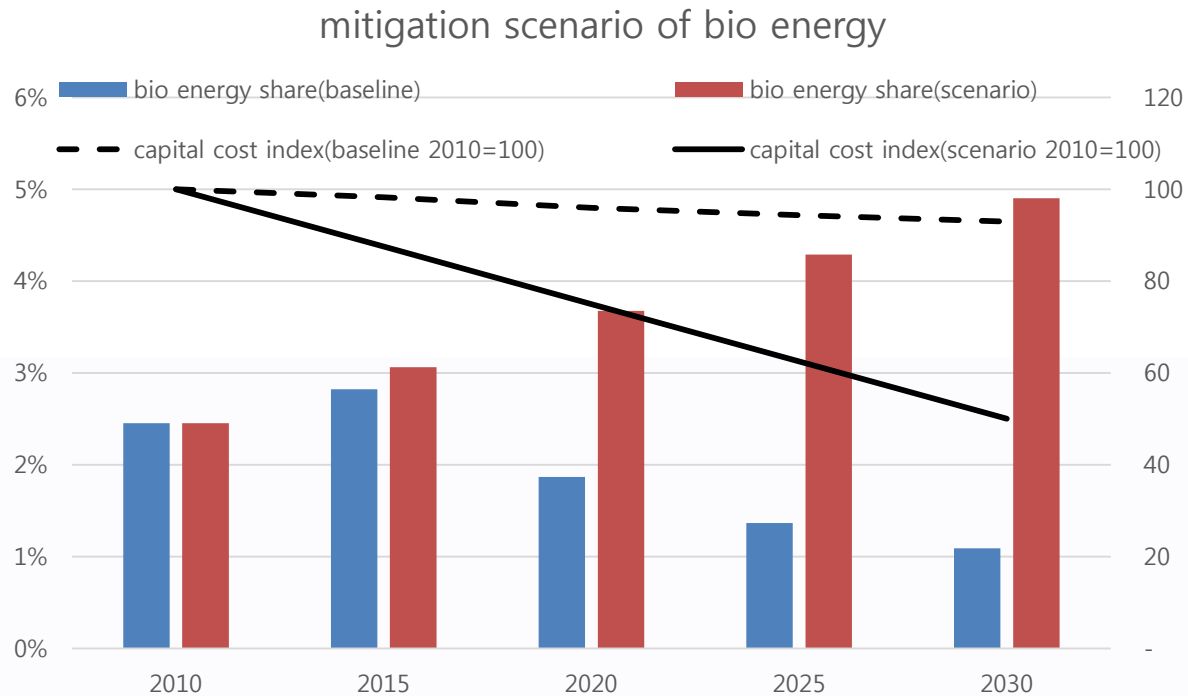
# Mitigation Scenario



## ■ Mitigation Scenario of Bio Energy

- Capital Cost in 2030 is 50% of Cost in 2010

: Bio Energy Share is 4.9% in 2030



# Mitigation Scenario



## ■ Mitigation Scenario of Clean Coal

- Dual Fire of Large Scale Coal Power Plant is 50% in 2030
- : Bio Energy Mix in 3.2GW of Yeong-Heung Coal #1-4

# Effect on Power Sector



- **Switch of Coal to RE in Mitigation Scenario**
  - **Substitute Coal with Renewable Technology**
    - : PV, Fuel Cell, Off-Shore Wind, Bio Energy, Dual Fire
  
- **Analytical Model : TIMES**
  - **Bottom-Up Optimization of Technology**
    - : **Cost Minimization under Energy and Material Constraints**
  - **Change of Cost and GHG Emission in Power Sector**
    - : **Base Year(2010) and Target Year(2030)**
    - : **Cost and Emission of Mitigation Scenario vs. Baseline**

# Effect on Power Sector



- **PV Contribution to Reduction of Emission and Cost**
  - **GHG Reduction of 3,407 ths. tCO<sub>2</sub> vs. Baseline in 2030 (1.2% of GHG Emission in Power Sector)**
  - **Cost Reduction(7.4%, \$-157/tCO<sub>2</sub>) in 2030**

	2030	Average in 2010-2030
Mitigation(ths. tCO <sub>2</sub> )	-3,407(-1.2%)	-1,526(-0.6%)
Cost Reduction(mn.\$)	-533(-7.4%)	-471(-7.0%)
MAC(\$/tCO <sub>2</sub> )	-157	-309

# Effect on Power Sector



## ■ Off-Shore Wind contribution to Emission Reduction

- Reduction of 5,049 ths.tCO<sub>2</sub> in 2030  
(2.0% of GHG Emission in power sector)
- Cost Increase due to Investment(\$7/tCO<sub>2</sub>)

	2030	2010-2030 average
Mitigation(ths. tCO <sub>2</sub> )	-6,049(-2.0%)	-3,883(-1.4%)
Cost Reduction(mn.\$)	44(0.6%)	54(0.9%)
MAC(\$/tCO <sub>2</sub> )	7	14



# Effect on Power Sector



- **Fuel Cell contribution to Reduction of Emission and Cost**
  - **Reduction of 535 ths.tCO<sub>2</sub> in 2030**  
**(0.2% of GHG Emission in Power Sector)**
  - **Cost Reduction of 1.4% in 2030(-\$156/tCO<sub>2</sub>)**

	2030	2010-2030 average
Mitigation(th. tCO <sub>2</sub> )	-535(-0.2%)	-134
Cost Reduction(mn.\$)	-83(-1.4%)	-70(-1.2%)
MAC(\$/tCO <sub>2</sub> )	-156	-523

# Effect on Power Sector



- **Bio Energy contribute to Emission and Cost Reduction**
  - **Reduction of 1,947 ths.tCO<sub>2</sub> in 2030**  
**(0.7% of GHG Emission in Power Sector)**
  - **Cost Reduction of 0.8%(-\$24/tCO<sub>2</sub> in 2030)**

	2030	2010-2030 average
Mitigation(ths. tCO <sub>2</sub> )	-1,947(-0.7%)	-1,219(-0.4%)
Cost Reduction(mn.\$)	-46(-0.8%)	-34(-0.6%)
MAC(\$/tCO <sub>2</sub> )	-24	-28

# Effect on Power Sector



- **Clean Coal contribute to Emission Reduction**
  - **Reduction of 9,352 ths.tCO<sub>2</sub> in 2030**  
**(3.2% of GHG Emission in Power Sector)**
  - **No Information on Cost Reduction**  
**: Cost is dependent on the Price of Bio Energy**

	2030	2010-2030 average
Mitigation(ths. tCO <sub>2</sub> )	-9,352(-3.2%)	-5,864(-2.1%)

# Conclusion



- **Effect on Emission Mitigation and Cost in Power Sector**
  - **Mission Innovation Reduce GHG Emission**
  - **Mission Innovation Reduce Mitigation Cost(Negative MAC)**
  
- **Importance of Renewable in Power Sector**
  - **Role of RE in Power Sector and Low Emission Strategy**
  
- **Contribution of R&D to Economics of RE**
  - **Implementation of Ambitious R&D in Mission Innovation**
  - **Contribution of Carbon Pricing(ETS, RPS) to RE Deployment**