



Destination Green

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Korea's Action Plan to Reduce GHG Emissions from International Aviation

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Planning Process



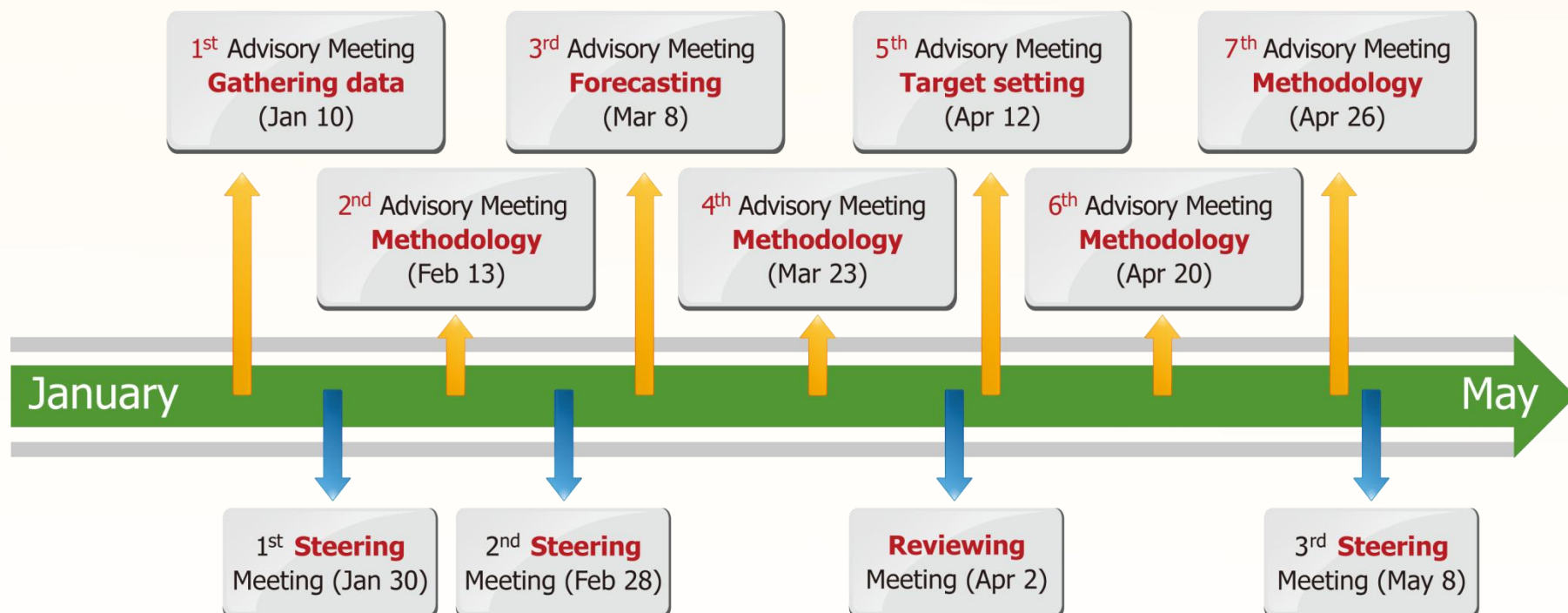
Planning body

- **Taskforce: government, airlines, airport operators, research institute**
 - Gathering data, communicating amongst members
 - Guiding analysis team
 - Reviewing the process and results

- **Analysis team: consultants**
 - Analyzing data and forecasting
 - Establishing the plan

Planning Process

Schedule & Issue of Meeting



Korea's International Aviation

Geographical and economical characteristics

- **The only international transportation mean for passengers**
 - Korea is like an island, blocked by North Korea from the continent
- **Transport mode for exporting IT and high-tech products**
 - Products having big weight in Korea's economy
- **Low efficiency of air routes**
 - Large portion of air spaces are reserved for military use



Korea's International Aviation



World best competitiveness

■ Airlines

- Seven airlines; two large airlines and five LCCs
- Growing based on world best services

■ Airports

- Incheon Airport; winning the **World Best Airport Award** for 7 consecutive years

■ Government

- Ranked as the **world best** in ICAO Universal Safety Oversight Audit Program (USOAP) in 2008



Korea's International Aviation



Korea's Climate Change Response in Aviation

- **2007; Consulting for reduction of GHG emissions from aviation**
- **2008; Constitution of Aviation Climate Change Response Group**
 - Airlines, airport operators, government, research institutes
- **2009; Starting Aviation GHG Database**
- **2010; Voluntary agreement on aviation GHG reduction**
 - Setting fuel efficiency goals for airlines by consultation
 - Airlines: Submitting action plans to the government
 - Government: awarding Green Airline Prize



Korea's International Aviation



Korea's Climate Change Response in Aviation

■ 2011; GHG Target Management

- Setting targets for GHG reduction and managing the implementation
- For large businesses including two large airlines

■ 2015; Emission Trading System

- Replacing GHG Target Management from 2015
- For larger businesses, including large airlines (domestic flights only)



Korea's International Aviation



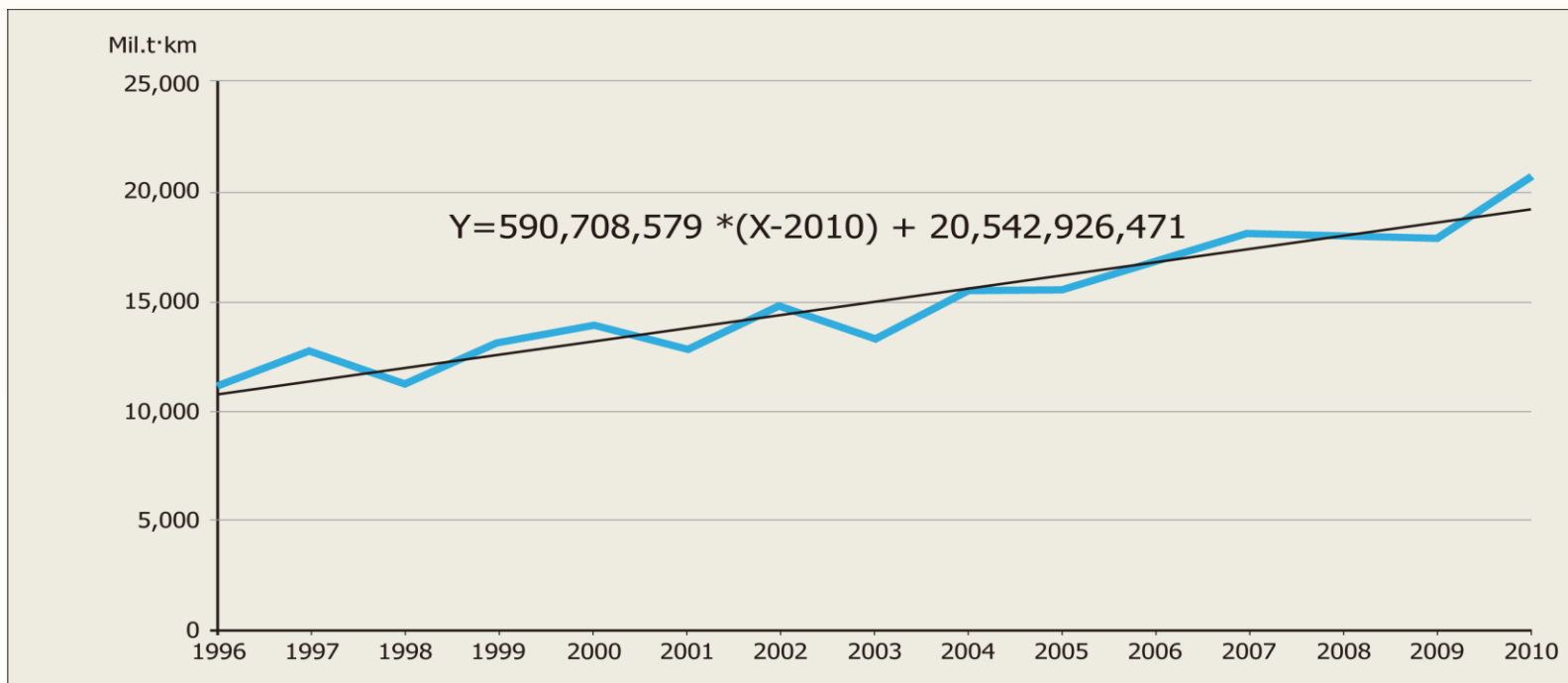
Korea's National Strategy for Low Carbon, Green Growth

- **Announced as a National Vision by former administration in 2008**
- **To move away from brown economy to green economy**
 - Mitigation of climate change, GHG emissions
 - Creation of new engines for economic growth in green industry
- **National Emission Reduction Target: 30% below BAU by 2020**
 - In 2011, GHG Target Management
 - In 2015, Emission Trading System

Estimation and Goal

Estimation of future RTK

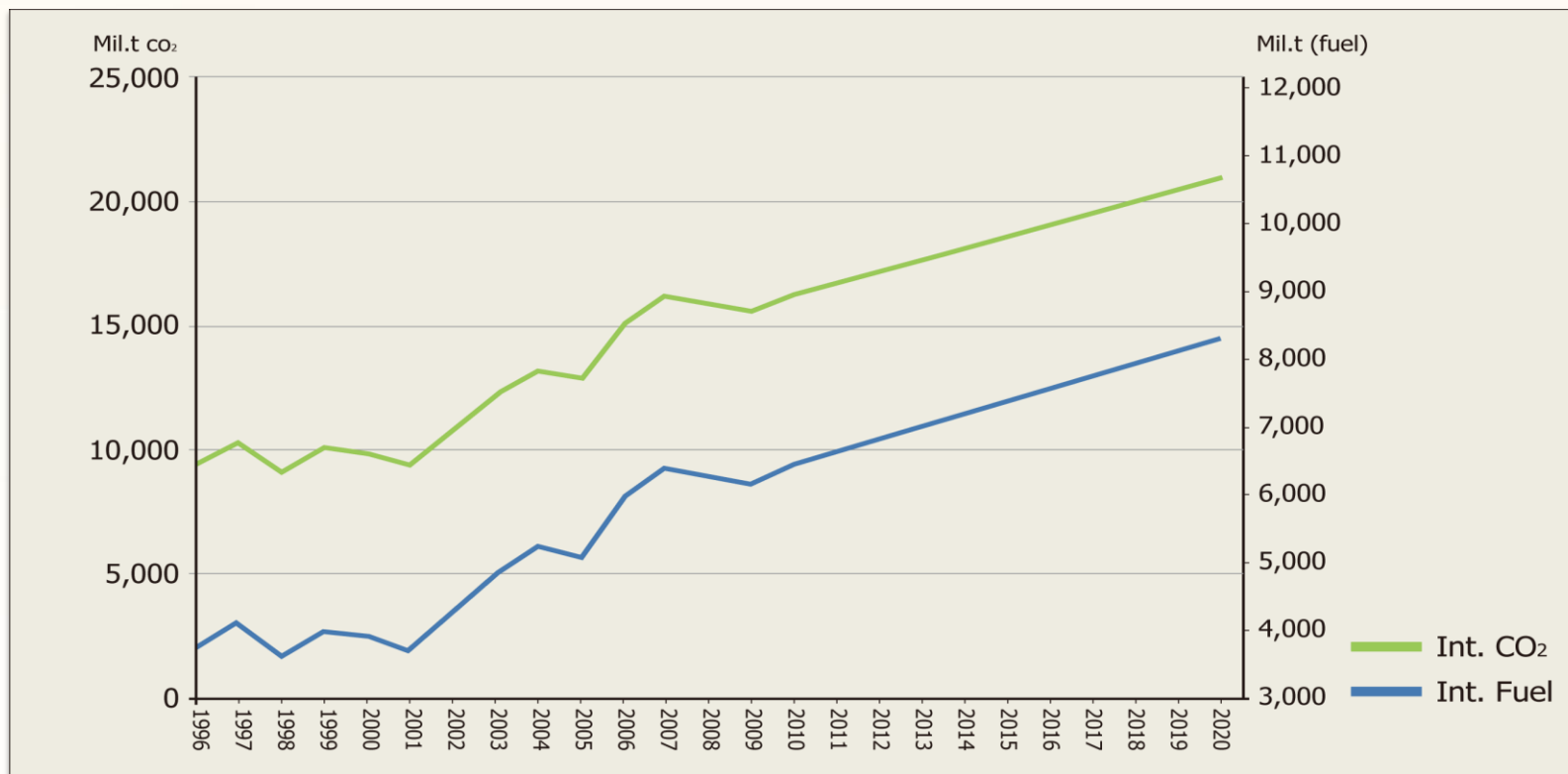
- Based on historical data from 1996 to 2010
- RTK will increase 28.8% by 2020 compared with 2010



Estimation and Goal

Estimation of future GHG emissions

- Based on 2010 fuel efficiency; 0.3137 litter/RTK





Estimation and Goal



Reduction Goal: bottom-up approach

- **Selection of reduction measures**
 - 10 measures selected from out of 34 proposed measures
 - Criteria: reduction potential, measurability
- **Reduction estimation by measure at best condition**
 - Based on consultation with relevant agencies
 - Considering historical performance results and future conditions
- **Summation of estimated reductions by measures**



Estimation and Goal



Reduction Goal

- **Improving fuel efficiency 1.3% annually by 2020**
 - Fuel efficiency goal: 0.2752ℓ/RTK in 2020
 - * Korea's fuel efficiency of international aviation: 0.3137ℓ/RTK in 2010

- **To reach Korea's goal, 0.2752ℓ/RTK in 2020**
 - A country with the world's average fuel efficiency has to improve its efficiency by 3.05% annually
 - Requiring much more efforts beyond ICAO's 2.0% target
 - * World's average fuel efficiency in 2010: 0.375ℓ/RTK



Estimation and Goal

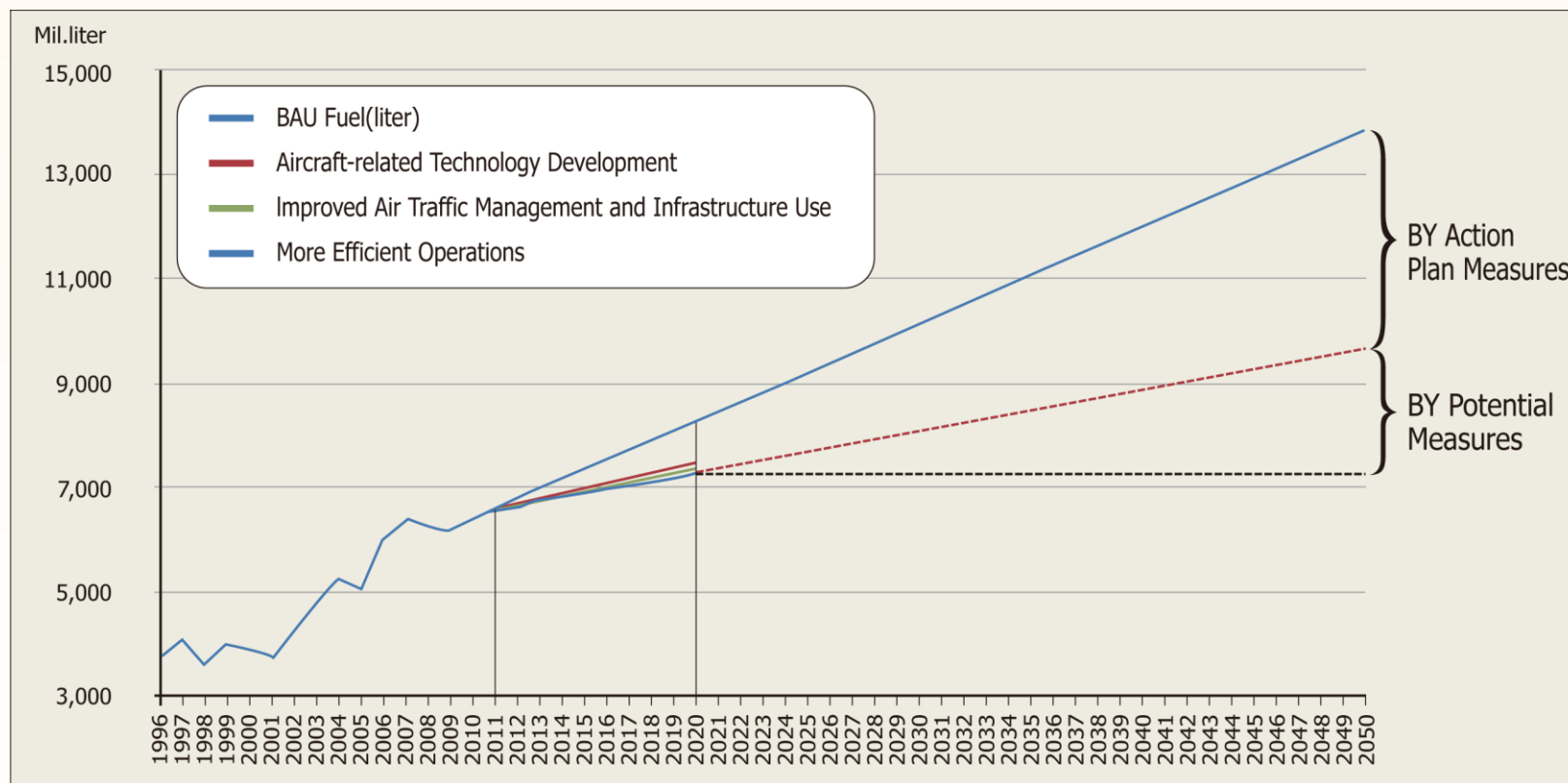


Potential Measures for Mid to Long Term Reduction

- **Active use of biofuel**
 - Under appropriate price and supply
 - To reach the global ambition, Carbon Neutral Growth from 2020
- **Positive engagement in the ICAO-led Global MBM scheme**
 - Once it is finalized and implemented
- **New technologies**
 - Beyond current capabilities

Estimation and Goal

Fuel Reduction Plan



Reduction Estimation

Reduction measures

■ 10 measures

Type	Reduction Measure
Fleet renewal	1. Replacement of old aircrafts with new
Air traffic management (ATM) and infrastructure improvement	2. Restriction of APU use 3. Performance Based Navigation (PBN) 4. Expanded use of shorter routes
Efficient Operation	5. Reduced Legal Contingency Fuel Ratio 6. Improvement of Cost Index (CI) 7. Single-engine Taxi-in 8. Aircraft Engine Wash 9. Idle Reverse Thrust 10. Use of Lightweight ULDs



Reduction Estimation



Fleet renewal

■ Assumptions

- By 2017, all the planned aircrafts will be delivered
- New aircrafts will be introduced to meet forecasted demand after 2017
- Fleet composition will be similar to the past
- Currently used aircraft will retire after **20 years** of usage

Reduction Estimation

Reduction by fleet renewal

- **Fleet renewal will reduce 10.0% of GHG emissions by 2020**

	2012	2015	2020
Fuel reduction (mil. liter)	114.0	359.8	829.6
CO₂ reduction (1,000 tCO₂)	287.9	908.8	2,095.2
Rate of Reduction	1.67%	4.88%	10.00%

Reduction Estimation

Reduction by ATM and Infrastructure Improvement

Reduction measure	Calculation method
Restriction of APU use	<ul style="list-style-type: none"> First, airline's 2011 restraint rates (%) of using APU by aircraft were surveyed. An appropriate future restraint rate was defined after consultation with relevant agencies. Thus corresponding fuel consumption reduction was estimated
Performance Based Navigation (PBN)	<ul style="list-style-type: none"> Only the implementation of Air Route Double-tracking and CDA were reflected. Air Route Double-tracking: per flight flying time reduction × traffic volume × fuel reduction per flying time CDA: fuel reduction per flight by aircraft type × annual frequency of flight by aircraft type
Expanded use of shorter routes	<ul style="list-style-type: none"> Defining the degrees of development and application of shorter routes in the future by relevant officials and experts.

Reduction Estimation

Reduction by ATM and Infrastructure Improvement

		2012	2015	2020
Fuel reduction (Mil. liter)	Restriction of APU use	12.8	16.0	22.1
	Performance Based Navigation (PBN)	6.2	24.6	61.5
	Expand use of shorter routes	11.7	12.0	12.7
	Total	30.7	52.7	96.2
Rate of fuel reduction (%)	Restriction of APU use	0.19%	0.22%	0.27%
	Performance Based Navigation(PBN)	0.09%	0.33%	0.74%
	Expand use of shorter routes	0.17%	0.16%	0.15%
	Total	0.45%	0.71%	1.16%

Reduction Estimation

Reduction by Efficient Operation

Reduction measure	Calculation method
Reduced Legal Contingency Fuel Ratio	Per flight fuel reduction amount associated with the reduction of contingency fuel ratio from 10% to 5% × annual frequency
Improvement of Cost Index (CI)	
Single-engine Taxi-in	
Aircraft Engine Wash	
Idle Reverse Thrust	
Use of Lightweight ULDs	Airline's 2011 implementation rate (%) of each measure by aircraft were surveyed. An appropriate future rate of implementation was defined by consultation with relevant staffers. Thus corresponding fuel consumption reduction was estimated.

Reduction Estimation

Reduction by Efficient Operation

		2012	2015	2020
Fuel reduction (mil. liter)	Reduced Legal Contingency Fuel Ratio	-	18.0	23.2
	Improvement of Cost Index (CI)	22.3	25.7	33.0
	Single-engine Taxi-in	4.5	6.2	10.0
	Aircraft Engine Wash	9.1	11.8	14.9
	Idle Reverse Thrust	4.1	5.0	6.8
	Use of Lightweight ULDs	1.8	3.0	5.7
	Total	41.9	69.7	93.7

Reduction Estimation

Summary of reduction

Reduction Measure		2012	2015	2020
Fuel reduction (Mil. liter)	Fleet renewal	114.0	359.8	829.6
	ATM and infrastructure improvement	30.7	52.7	96.2
	Efficient operation	41.9	69.7	93.7
	Total	186.5	482.2	1,019.5
Rate of reduction (%)	Fleet renewal	1.67%	4.88%	10.00%
	ATM and Infrastructure improvement	0.45%	0.71%	1.16%
	Efficient operation	0.61%	0.95%	1.13%
	Total	2.74%	6.54%	12.29%

Incompleteness of data and information

■ Fuel efficiency of aircraft

- Fleet renewal: biggest reduction potential (more than 80% of reduction)
- Accurate estimation of reduction for this measure is essential for the plan

➡ **Reasonable assumptions based on real data**

Replacing old aircrafts, 1 year earlier than the assumption (20 years)

- needs 1.4 additional new aircrafts
- reduces 46 million liter fuel, 116,000 tCO₂
- retrieves only 11.8% of investment (CO₂ price = 12 Euro/t)

Incompleteness of data and information

- **Inconsistency of data**

- Different source, different standards for data

➡ **Transformation of data**

- **Difficulty in access to sensitive information**

- Business information and good practices

➡ **Organizing a taskforce as a planning body**

➡ **Efforts for increasing credibility between members of taskforce and other participants**



Thank you very much

