Addressing climate change issues:
An excerpt from Asia/World Energy Outlook 2015

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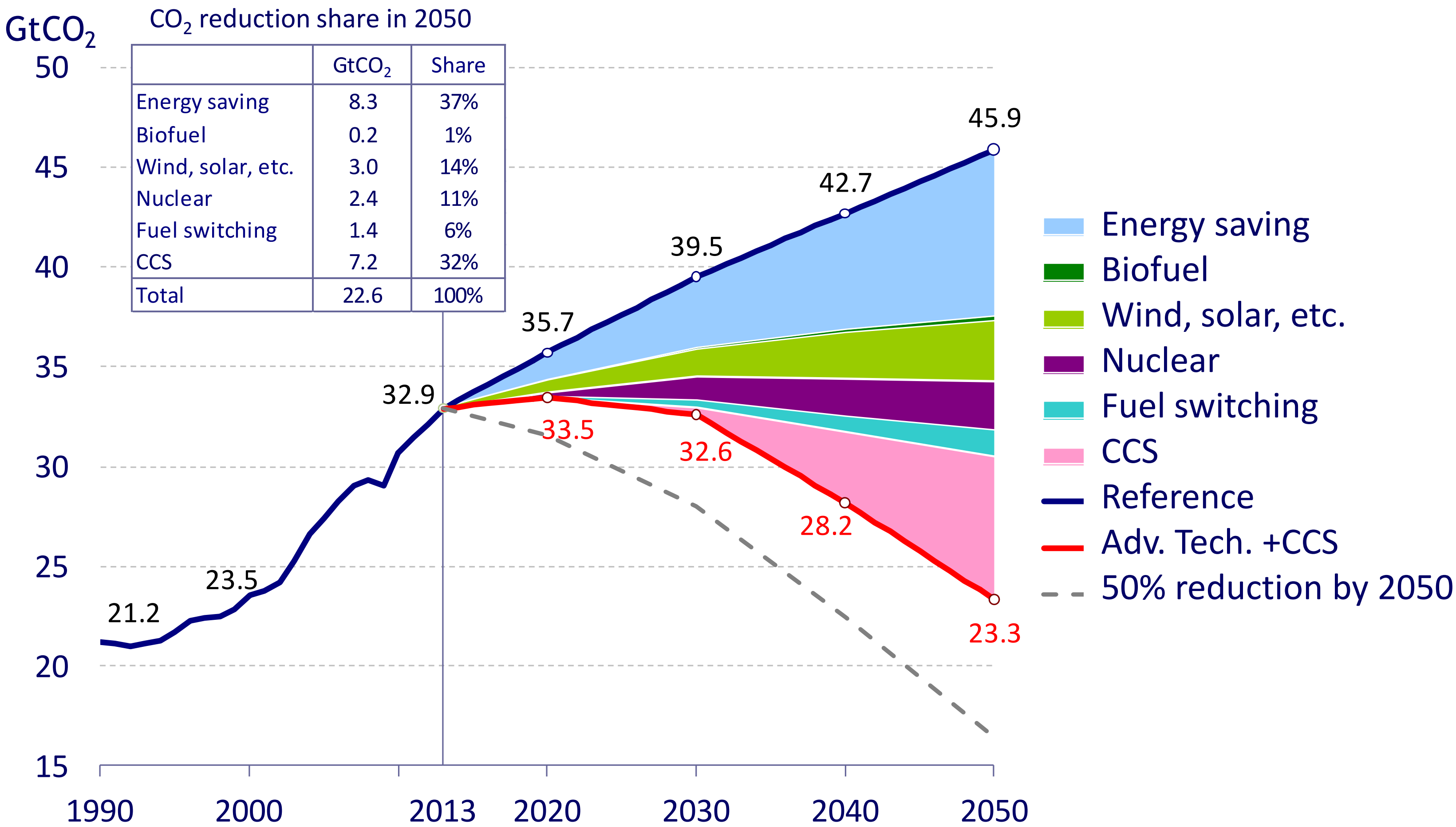
TAGAMI Takahiko
The Institute of Energy Economics, Japan

Reference Scenario and Advanced Technologies Scenario



CO_2 reduction share in 2050

	$GtCO_2$	Share
Energy saving	8.3	37%
Biofuel	0.2	1%
Wind, solar, etc.	3.0	14%
Nuclear	2.4	11%
Fuel switching	1.4	6%
CCS	7.2	32%
Total	22.6	100%

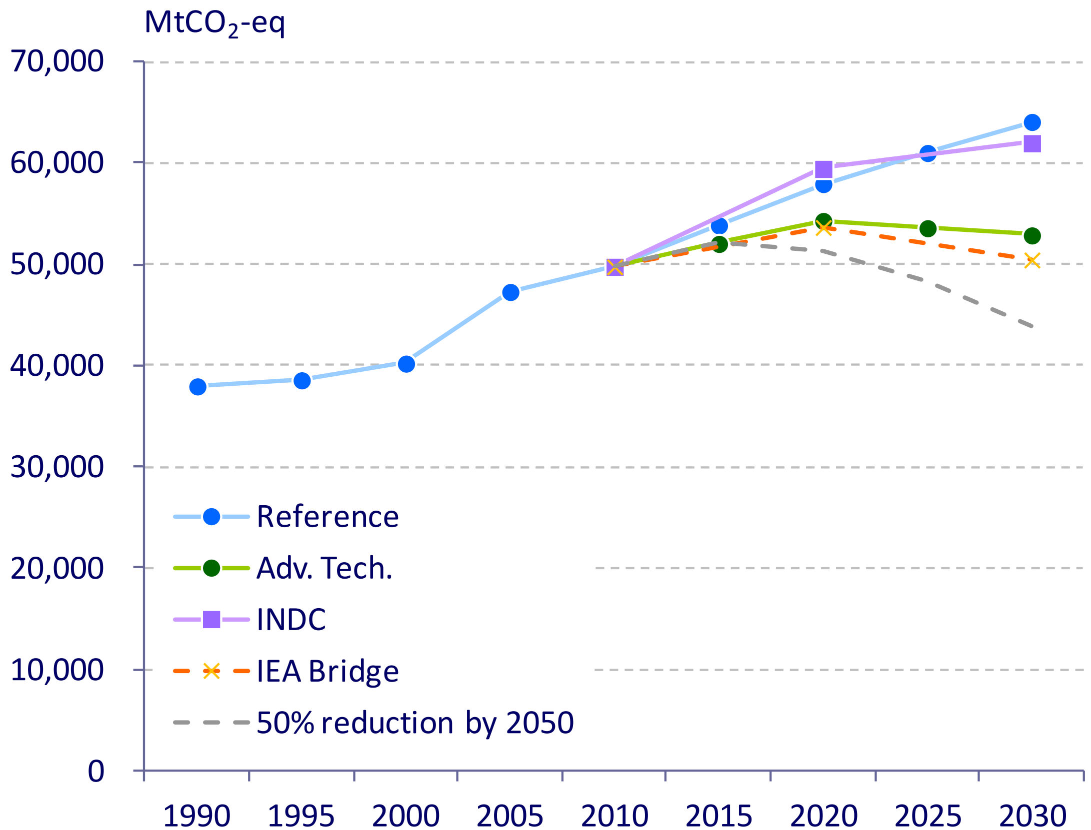
- In the Advanced Technologies Scenario, the global CO_2 emissions are reduced by various technological options, including energy saving, enhancement of power generation efficiency, renewables, nuclear and CCS. Altogether these options contribute to large CO_2 emissions reduction.
- To achieve halving global CO_2 emissions from current levels, additional measures such as innovative technological development and eco-friendly urban development are required in the long-term.

Intended Nationally Determined Contributions (INDCs) of major countries

Party	Date of submission	Target type	Reduction target	Base year	Target year	Coverage
EU	Mar 6	Absolute emissions	40%	1990	2030	GHG
United States	Mar 31	Absolute emissions	26～28%	2005	2025	GHG including LULUCF
Russia	Apr 1	Absolute emissions	25～30%	1990	2030	GHG
China	Jun 30	Intensity per GDP	60～65%	2005	2030	CO_2
Japan	Jul 17	Absolute emissions	26%	2013	2030	GHG
Indonesia	Sep 24	Reduction from BAU	29%	BAU	2030	GHG
Brazil	Sep 30	Absolute emissions	37%（43% for 2030）	2005	2025	GHG
India	Oct 1	Intensity per GDP	33～35%	2005	2030	GHG

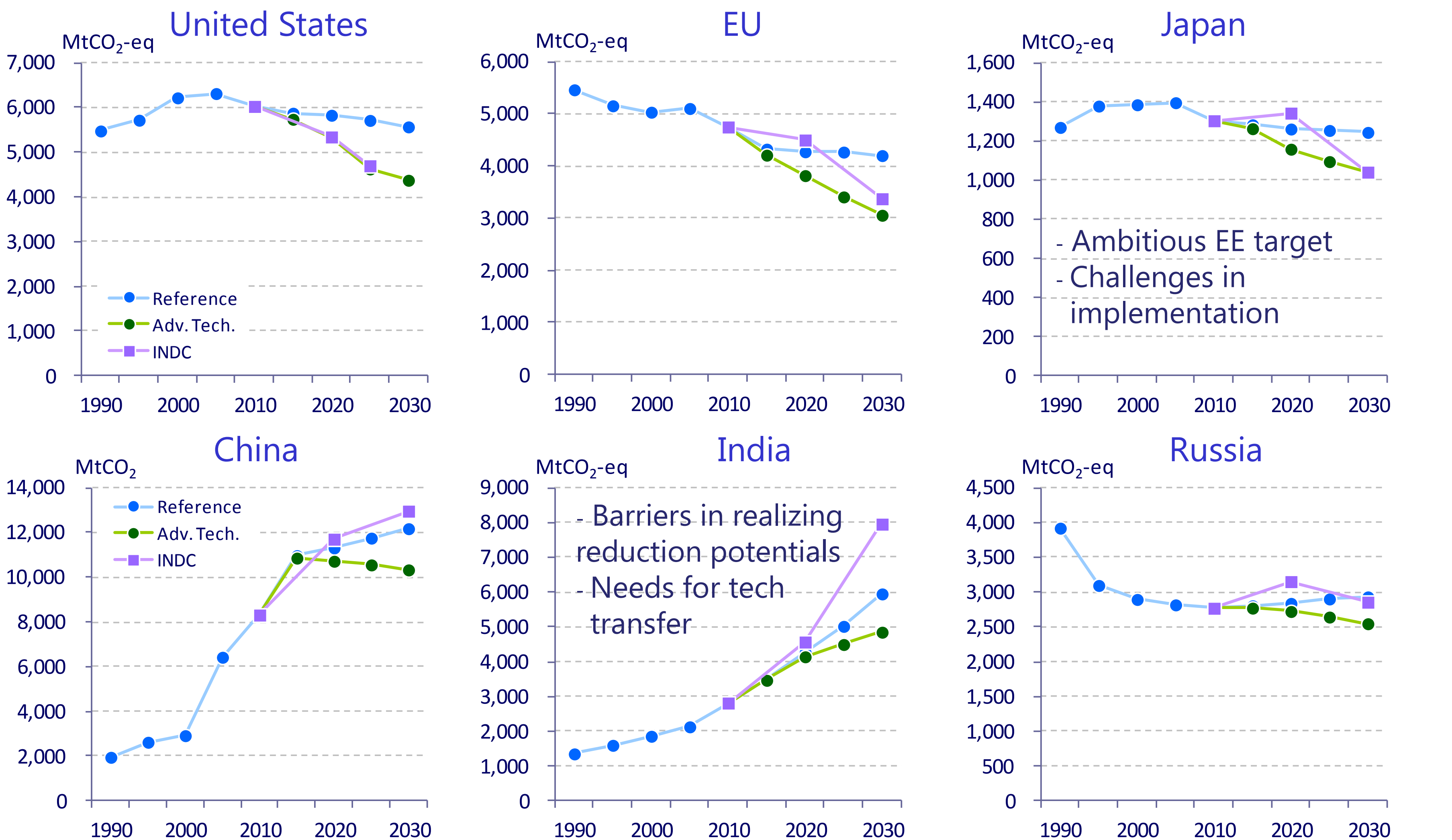
- In advance of the United Nations Climate Change Conference (COP21) in Nov. 2015, the participating countries have submitted the Intended Nationally Determined Contributions (INDCs) which present the post-2020 climate actions each country intends to take.
- By Oct 1st, 117 countries and regions (totaling 144 countries) have submitted their INDCs.
- The 8 major countries and regions shown above cover 65% of global GHG emissions in 2010.

Comparison of INDCs with the Reference/Adv. Tech. Scenarios



- The future evolution of global GHG emissions suggested by the INDCs of the 8 parties traces a path similar to that of the Reference Scenario. Thus, climate actions based on <u>the INDCs are not sufficient</u> to reach the Advanced Technologies Scenario, being far behind the target of "50% reduction by 2050."

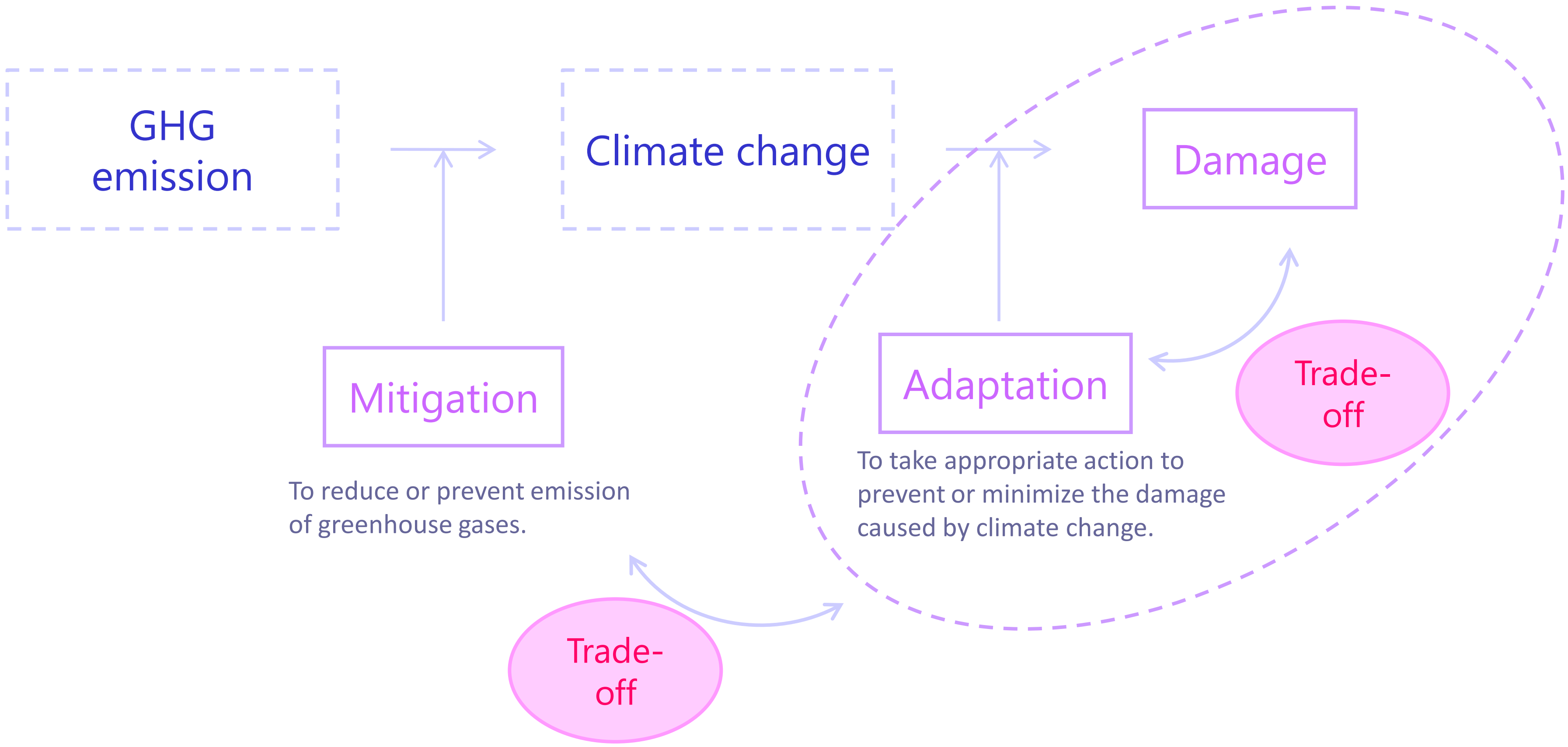
Comparison of INDCs with the Reference/Adv. Tech. Scenarios by country



- The INDC targets of the United States and Japan are as ambitious as the Advanced Technologies Scenario. The target of EU is also positioned near the ATS.
- The targets of China and India exceed the Reference Scenario in terms of CO_2/GHG emissions.

Note: Japan's 2020 target does not include reduction by nuclear power. China's target is for CO_2, while others are for GHG.

Mitigation, adaptation and damage



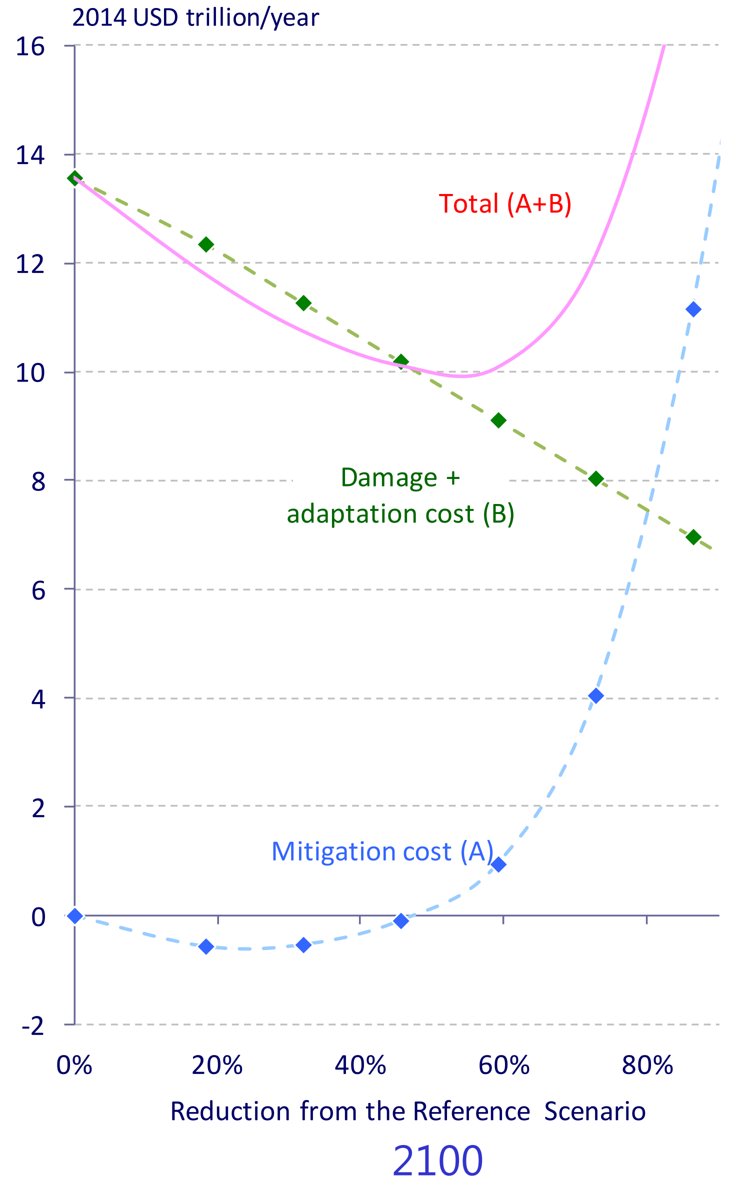
- It is necessary to minimize total cost with a optimal balance among mitigation, adaptation and residual damage.

Mitigation vs. adaptation and damage

- Mitigation cost: estimated by IEEJ
- Damage + adaptation cost: calculated using the formula in the DICE 2013R model

- If more stringent mitigation measures are implemented, mitigation costs will increase while "adaptation cost and damage" decrease, and vice versa.

- While uncertainties are still great regarding these cost estimates, there may be some point at which a total of mitigation cost, adaptation cost and residual damage could be minimized between the Reference Scenario and the scenario for halving GHG emissions by 2050.



Conclusion: Addressing climate change issues

- With the climate actions suggested by the INDCs of major countries, it would not be possible to curb GHG emissions to sufficient levels. It is strongly expected that each party tries its best to reduce GHG emissions further.

- On the other hand, international agreement would practically be difficult to achieve the 450 ppm mitigation scenarios category.

- To fill the gap, it is necessary to find a optimal balance between mitigation and adaptation to minimize total cost and residual damage.

- In addition to that, a longer-term perspective, such as innovative technology development, is necessary to realize a drastic emissions reduction beyond 2050.

- Most important is to provide various options other than the 450 ppm mitigation scenarios category.

Innovative technology development towards the future

Technology		Overview and challenges
Limiting CO_2 emissions	**Next generation nuclear power**	Advanced nuclear technologies under development worldwide, including fast breeder reactors, high temperature gas-cooled reactors, molten salt reactors and small modular reactors.
	Nuclear fusion	Unlike the conventional nuclear technologies that exploit the energy released by the fission of heavy nuclei, nuclear fusion makes use of the energy released during the reaction (fusion) of light nuclei. This technology could possibly result in a almost limitless supply of energy, without producing spent fuels as high-level radioactive wastes.
	Space Solar Power System (SSPS)	A system that transmits energy from space-based solar power plants to the ground in the form of microwaves or laser beams. It can generate power stably with almost no influence from the weather. Major challenges are the technology development and cost reduction of mass transportation to space.
Sequestering CO_2	**Carbon Capture and Utilization (CCU)**	Technologies to capture and use carbon dioxide as industrial materials, etc. Large-scale processing of CO_2 is one of the major challenges.
Removing CO_2 in the atmosphere	**Bioenergy and Carbon Capture and Storage (BECCS)**	Technology to capture and store carbon dioxide released by burning biomass. If biomass can be regarded as carbon neutral, this technology makes it possible to achieve negative emissions. The availability and scale of BECCS is uncertain and associated with challenges and risks, e.g. the availability and scale of afforested/reforested land, a competition with food supply.
	Artificial photosynthesis	A photochemical process to convert sunlight, water and carbon dioxide into carbohydrates and oxygen. As with the BECCS technology, it could realize negative emissions. Major challenges include the development of catalysis and the cost to split water into hydrogen and oxygen.

Thank you for your attention.

The Executive Summary, Annexed Tables and full Presentation Material of Asia/World Energy Outlook 2015 are available in English at:

http://eneken.ieej.or.jp/en/whatsnew/421.html

Contact :report@tky.ieej.or.jp