# Global Environmental Policy

## Global Environmental Policy 2013

### Graduate School, University of Tokyo

**November 18, 2013: Lecture**

**December 2, 2013: Group Discussion**

**Makoto Akai**

**Fellow Research Scientist, National Institute of Advanced Industrial Science and Technology**

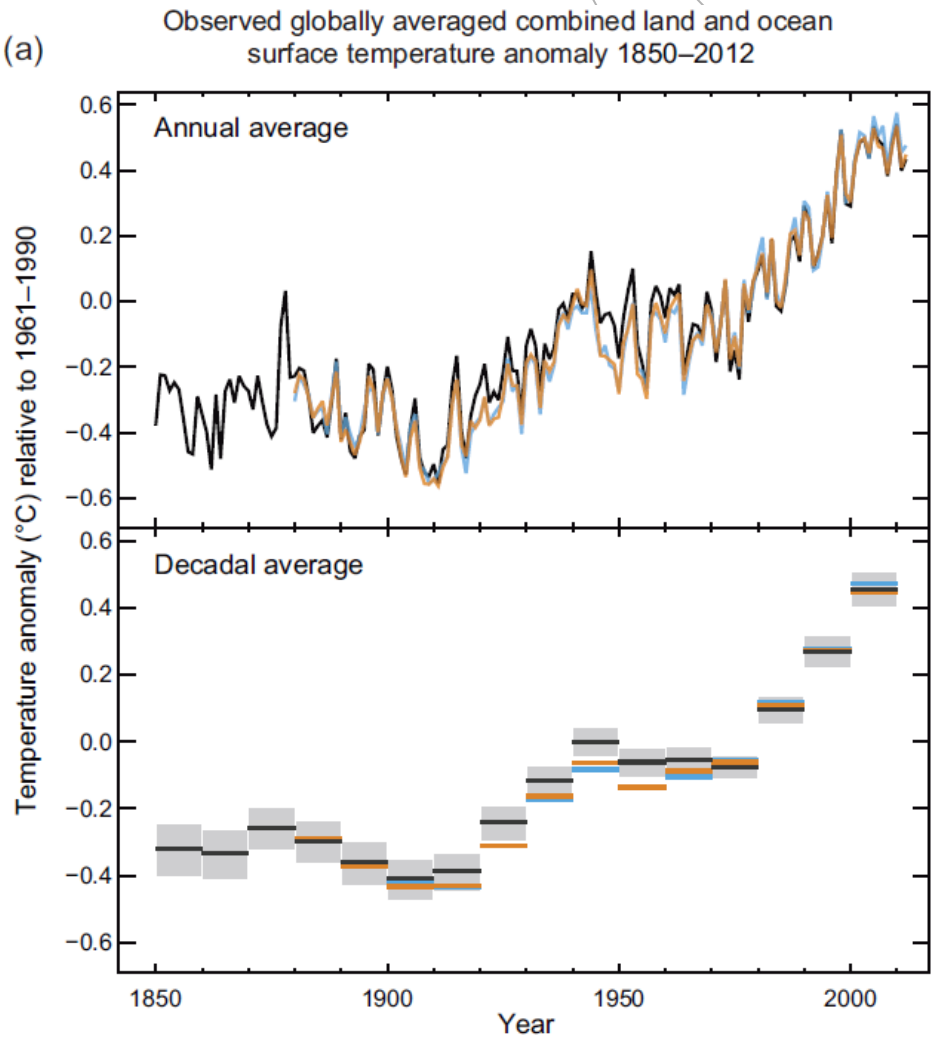
# Recent Findings on Climate Change

## IPCC Assessment Report

## 1st: 1990; 2nd: 1995; 3rd: 2001; 4th: 2007; 5th: 2013

# IPCC 5th Assessment Report (AR5)
# *WG1:The Physical Science Basis-SPM*


- **Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850.**
- **In the Northern Hemisphere, 1983–2012 was *likely* the warmest 30-year period of the last 1400 years (*medium confidence*).**



# IPCC 3rd Assessment Report (TAR)
## *WG1:Scientific Basis-SPM*


- **An increasing body of observations gives a collective picture of a warming world and other changes in the climate system,**
- **There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities,**
- **Human influences will continue to change atmospheric composition throughout the 21st century.**

# IPCC 4th Assessment Report (AR4)
## Understanding and Attributing Climate Change

- **Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.**
  - **This is an advance since the TAR's conclusion that "most of the observed warming over the last 50 years is *likely* to have been due to the increase in greenhouse gas concentrations".**

***NOTE:*** ***Virtually certain*** **> 99% probability of occurrence,** ***Extremely likely*** **> 95%,** ***Very likely*** **> 90%,** ***Likely*** **> 66%,** ***More likely than not*** **> 50%,** ***Unlikely*** **< 33%,** ***Very unlikely*** **< 10%,** ***Extremely unlikely*** **< 5%**

# IPCC 5th Assessment Report (AR5)
# *WG1:The Physical Science Basis-SPM*


- **Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system.**
- **Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. This evidence for human influence has grown since AR4. It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century.**

# Changes in the Climate System

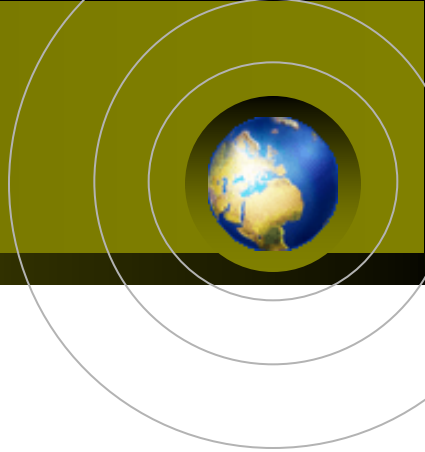
**AR4: Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.**

**AR5: Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.**

# Ocean Acidification

**AR4: Increasing atmospheric carbon dioxide concentrations lead to increasing acidification of the ocean. Projections based on SRES scenarios give reductions in average global surface ocean pH of between 0.14 and 0.35 units over the 21st century, adding to the present decrease of 0.1 units since pre-industrial times.**

**AR5: Climate change will affect carbon cycle processes in a way that will exacerbate the increase of CO2 in the atmosphere (high confidence). Further uptake of carbon by the ocean will increase ocean acidification.**



# The Road to Kyoto And Beyond

# History of Global Warming (1/2)

| | |
|---|---|
| 1827 | French mathematician **Jean-Baptiste Fourier** suggests the existence of an atmospheric mechanism keeping the Earth warmer than it would otherwise be. He likens it to a greenhouse. |
| 1863 | Irish scientist **John Tyndall** publishes a paper describing how atmospheric water vapor could contribute to this mechanism. |
| 1890s | Swedish scientist **Svante Arrhenius** and American P.C. Chamberlain independently investigate the potential problems that could be caused by carbon dioxide ($CO_2$) building up in the atmosphere. They both suggest that burning fossil fuels could lead to global warming, but neither suspect the process might already have started. |
| 1890s - 1940 | Average surface air temperatures increase by about 0.25 C. Some scientists see the American Dust Bowl (a devastating, persistent drought in the 1930s) as a sign of the greenhouse effect at work. |
| 1940 - 1970 | Global temperatures cool by 0.2 C. Scientific interest in global warming declines. Some climatologists predict a new ice age. |

# History of Global Warming (2/2)

| | |
|---|---|
| 1957 | U.S. oceanographer Roger Revelle warns that people are conducting a "large-scale geophysical experiment" on the planet by releasing greenhouse gases. Colleague David Keeling establishes the first continuous monitoring of atmospheric $CO_2$. He rapidly confirms a regular year-on-year rise. |
| 1970s | A series of studies by the U.S. Department of Energy increases concerns about possible long-term effects of global warming. |
| 1979 | First World Climate Conference adopts climate change as major issue and calls on governments "to foresee and prevent potential man-made changes in climate". |
| 1985 | First major international conference on global warming in Villach (Austria) warns that average global temperatures in the first half of the 21$^{st}$ century could rise significantly more than at any other time in human history.<br>Warmest year on record. The 1980s is the warmest decade on record, with seven of the eight warmest years of the century. |
| 1987 | Global temperatures cool by 0.2 C. Scientific interest in global warming declines. Some climatologists predict a new ice age. |

# Road to Kyoto

| | |
|---|---|
| 1988 | •Heat wave in U.S. granary<br>•Testimony by Dr. Hansen<br>•Toronto Conference<br>•Establishment of IPCC |
| 1990 | •IPCC First Assessment Report |
| 1992 | •Earth Summit ⇒UNFCCC |
| 1995 | •COP-1 (Berlin) ⇒Berlin Mandate<br>•IPCC Second Assessment Report |
| 1996 | •COP-2 (Geneva) |
| 1997 | •COP-3 (Kyoto) ⇒Kyoto Protocol |

# 1988 - Year of Breaking Out

- **Dr. Hansen testified before the U.S. Senate**
  - **99 percent sure ... the greenhouse effect has been detected and it is changing our climate now.**
- ***World Conference on the Changing Atmosphere: Implications for Global Security (Toronto)* called for 20 % cuts in global $CO_2$ emissions by the year 2005**
- **WMO and UNEP established the Intergovernmental Panel on Climate Change (IPCC).**

# Earth Summit

## UN Conf. on Environment and Development

- **The centerpiece was the ratification of the UNFCCC and was signed by 154 nations.**
- **UNFCCC does not contain binding targets for GHG emission reductions, but recognizes the importance of reducing GHG emissions in order to prevent "dangerous interference" with the climate system.**

# UNFCCC

- Sets an initial target for industrialized countries to reduce their GHG emission to 1990 levels by the year 2000.
- Demanded each industrialized nation to submit national communication on GHG emission inventory, and to provide financial and technical assistance to developing countries for the reporting.
- Came into force on 21 March 1994.

# COP-1

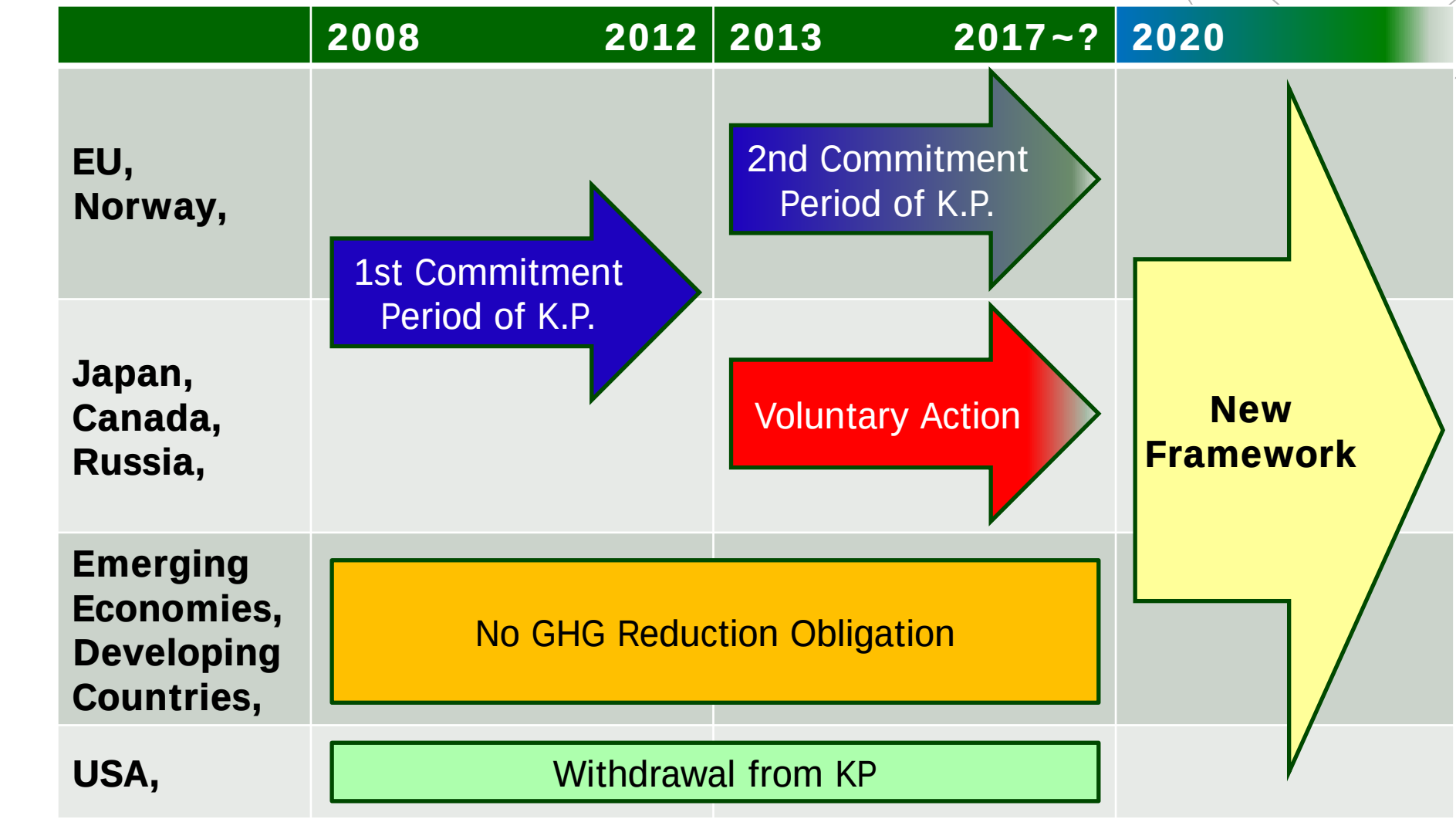
## Conference of the Parties on its First Session

- **Berlin Mandate**
  - **To initiate a process to enable Governments to take appropriate action for the period beyond 2000, including a strengthening of developed country commitments.**
  - **The work should be completed as early as possible so that the results can be adopted at COP-3 in 1997.**
  - **Developing countries are explicitly exempted from these new commitments.**

# Kyoto Protocol to the UNFCCC

- **38 developed countries agreed to reduce their emissions of six GHGs by a total of 5.2% between 2008 and 2012 from 1990 levels**
  - **CO2, CH4, N2O, HFCs, PFCs, SF6**
- **Party quantified emission limitation or reduction commitment include (% reduction):**
  - **Austria (8); Canada (6); Japan (6); Romania (8); Russian Federation (0); Switzerland (8); USA (7); UK (8);**
- **Kyoto Protocol provided the basis for mechanisms to assist Annex I Parties in meeting their targets cost effectively (Kyoto Mechanism) - JI, CDM, ETS**

# Current and Future Framework



# Towards a Deep Reduction of Greenhouse Gas

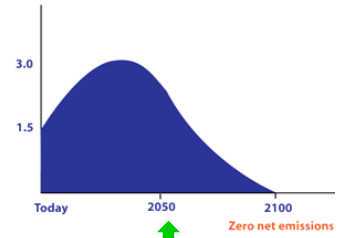
# The Technology Challenge
## Stabilizing Greenhouse Gas Concentrations in the Atmosphere

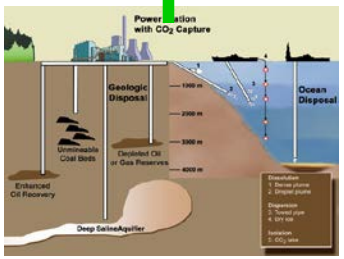
- Improvement of energy efficiency
- Switching to lower carbon fuels, e.g. coal to natural gas
- Use of non carbon fuels, e.g. renewables, nuclear
- Enhancement of natural sinks for $CO_2$, e.g. forestry
- Capture and sequestration of $CO_2$.


Hydrogen Fuel Cell Vehicles


Zero Net Emission Buildings


Nuclear Power Generation IV



Carbon ($CO_2$) Sequestration


Renewables: Photovoltaics and Wind


Bio-Fuels and Power

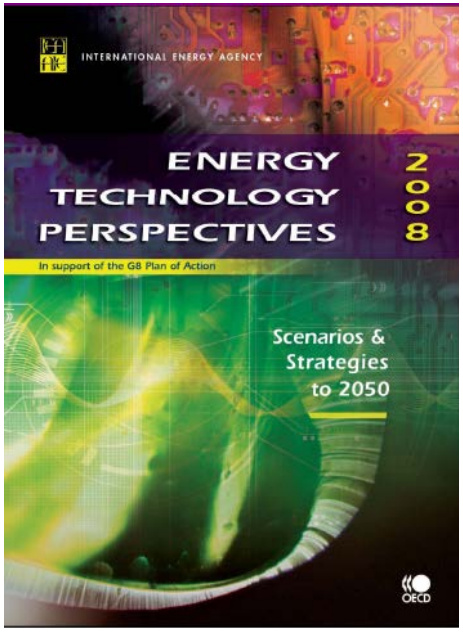

Vision 21: Zero-Emission Power Plant

35

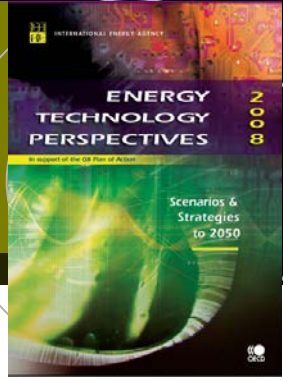


*M. Akai, AIST*

# IEA
# Energy Technology Perspectives 2008

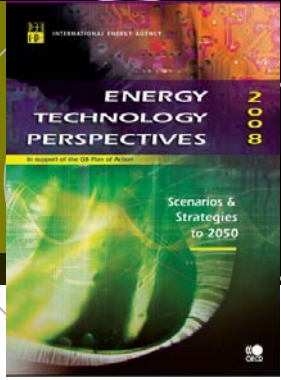


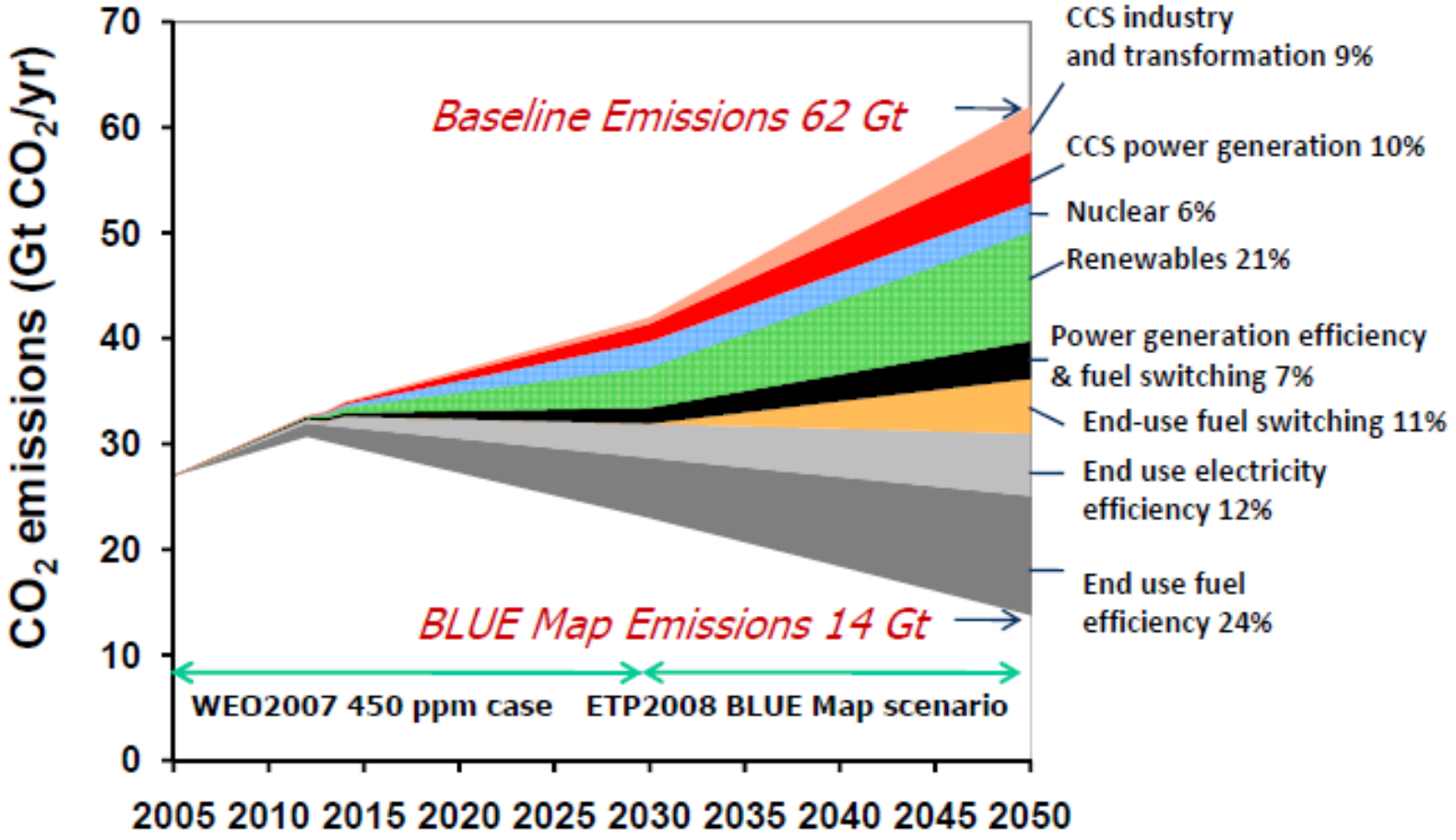
# Scenarios in ETP2008



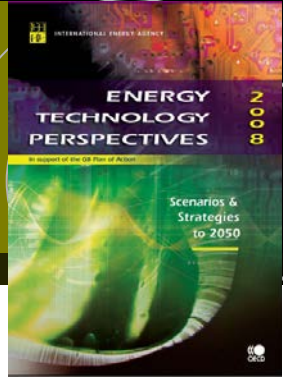

- **ACT Scenarios**
  - **Energy $CO_2$ emissions in 2050 back to the level of 2005**
  - **Revision of ACT as published in ETP2006**
    - **Options with a marginal cost up to \$50/$tCO_2$ – worldwide (+\$20/bbl)**
    - **Cost estimate has doubled from ETP2006**
  - **This implies a significantly adjusted energy system**
- **BLUE Scenario**
  - **-50% energy related $CO_2$ in 2050, compared to 2005**
  - **This could be consistent with 450 ppm (depending on post-2050 emissions)**
  - **Options with a marginal cost of up to \$200/$tCO_2$ needed (+\$80/bbl)**
    - **Significantly higher cost with less optimistic assumptions**
  - **Blue is uncertain, therefore a number of cases needed**
  - **Blue is only possible if the whole world participates fully**
  - **This implies a completely different energy system**

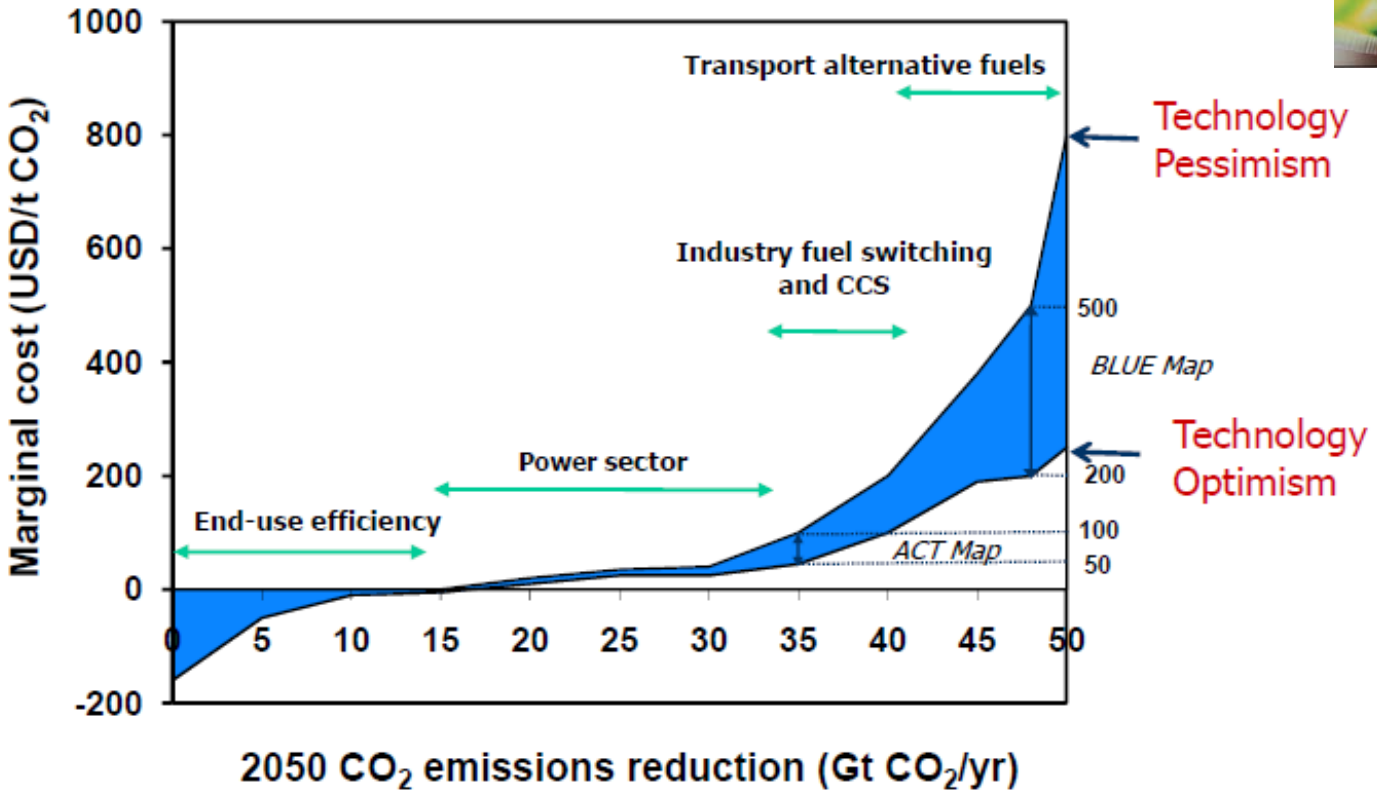
# ETP2008
# $CO_2$ Emission Reduction Scenario



# ETP2008
# Cost of Emissions Reductions




- **To bring emissions back to current levels by 2050 options with a cost up to USD 50 / t are needed.**
- **Reducing emissions by 50 % would require options with a cost up to USD 200 / t (+80 USD / bbl oil) , possibly even up to USD 500 / t $CO_2$**



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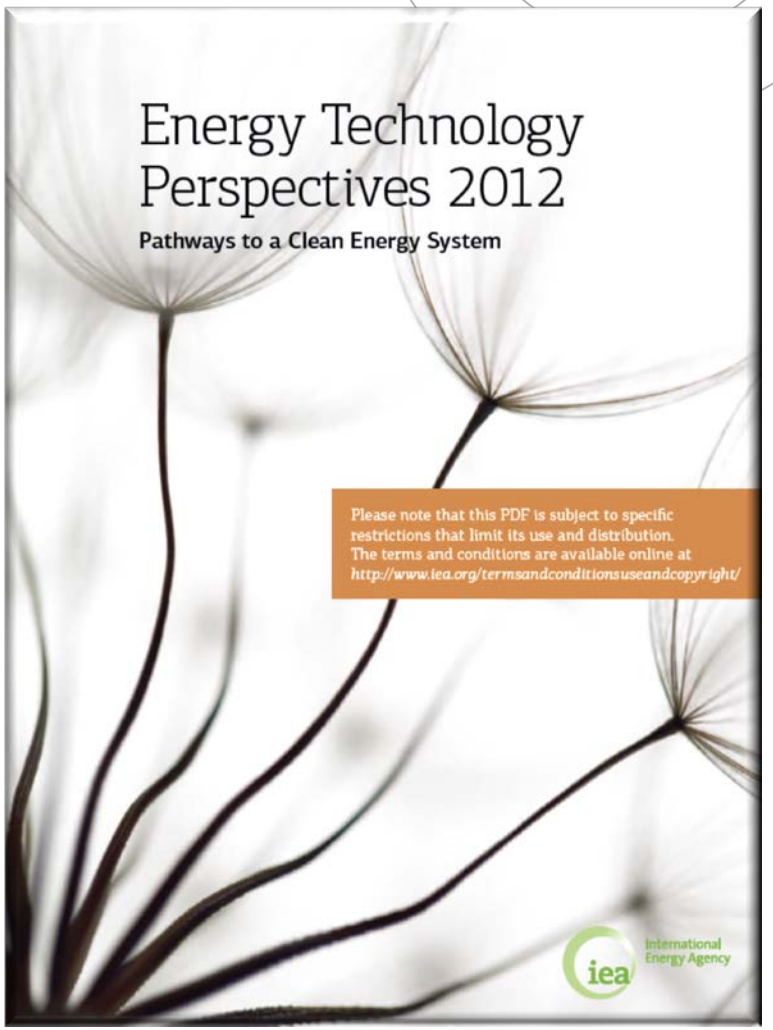
# Energy Technology Perspectives 2012

**Part 1: Vision, Status and Tools for the Transition**
1. The Global Outlook
2. Tracking Clean Energy Progress
3. Policies to Promote Technology Innovation
4. Financing the Clean Energy Revolution

**Part 2: Energy Systems**
5. Heating and Cooling
6. Flexible Electricity Systems
7. Hydrogen

**Part 3: Fossil Fuels and CCS**
8. Coal Technologies
9. Natural Gas Technologies
10. Carbon Capture and Storage Technologies

**Part 4: Scenarios and Technology Roadmaps**
11. Electricity Generation and Fuel Transformation
12. Industry
13. Transport
14. Buildings
15. Technology Roadmaps
16. 2075: Can We Reach Zero Emissions?
17. Regional Spotlights



# ETP 2012 — 3 Scenarios


**2DS**

a vision of a **sustainable** energy system of reduced Greenhouse Gas (GHG) and $CO_2$ emissions

**The 2°C Scenario**

**4DS**

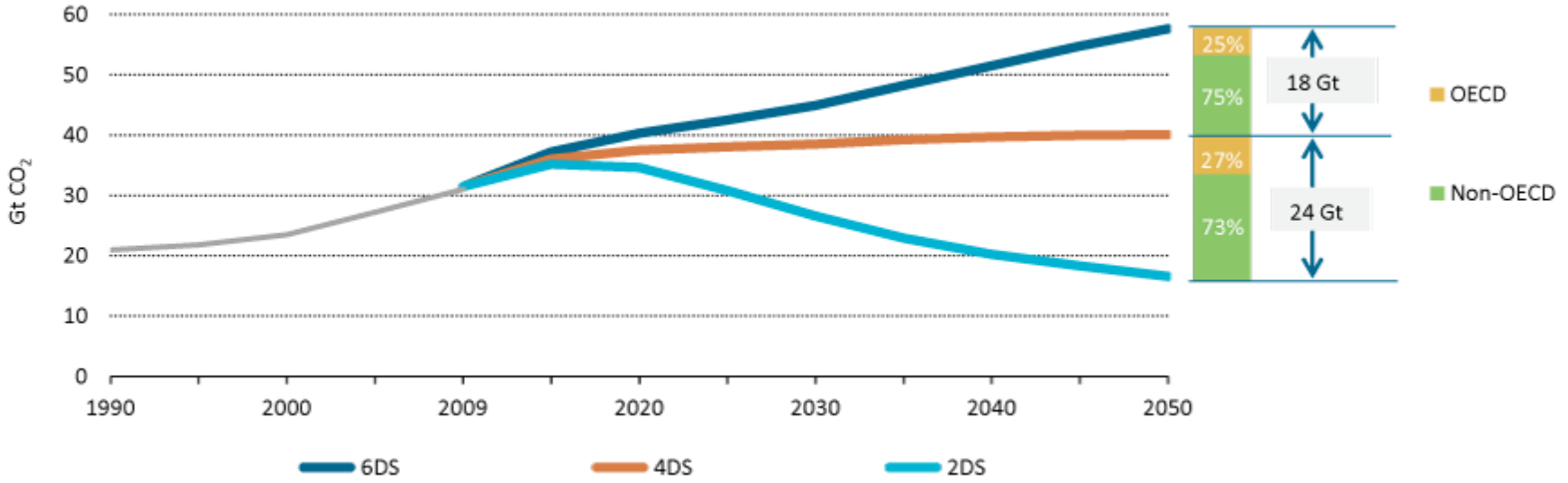
reflecting pledges by countries to cut emissions and boost energy efficiency

**The 4°C Scenario**

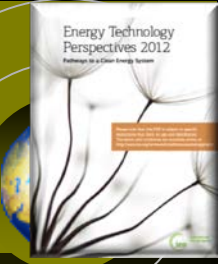
**6DS**

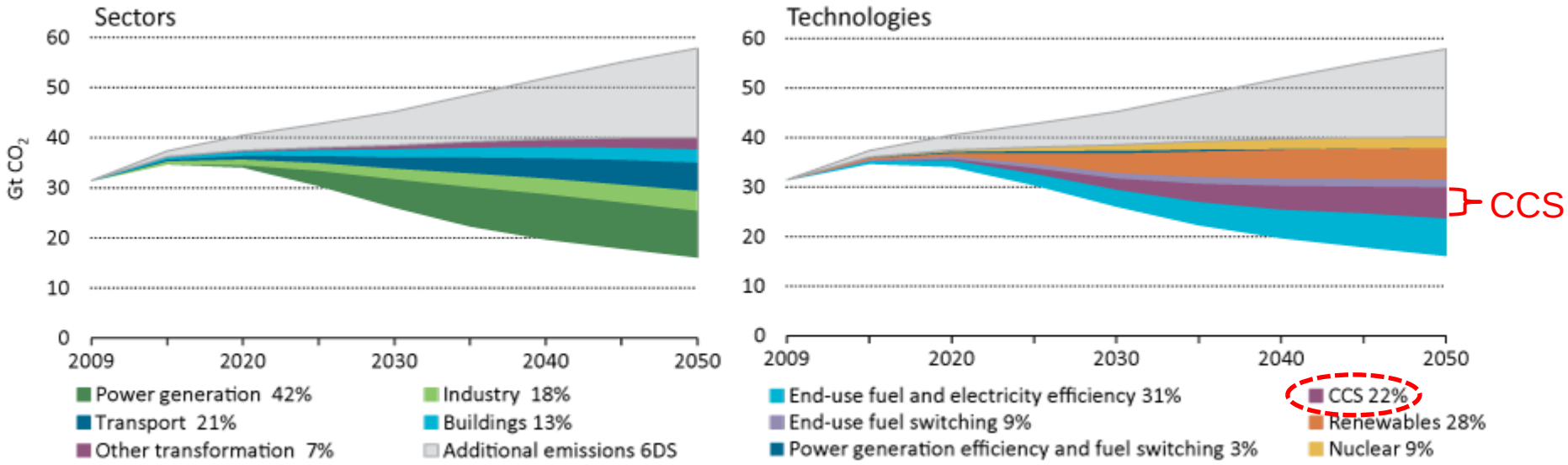
where the world is now heading with potentially **devastating** results

**The 6°C Scenario**

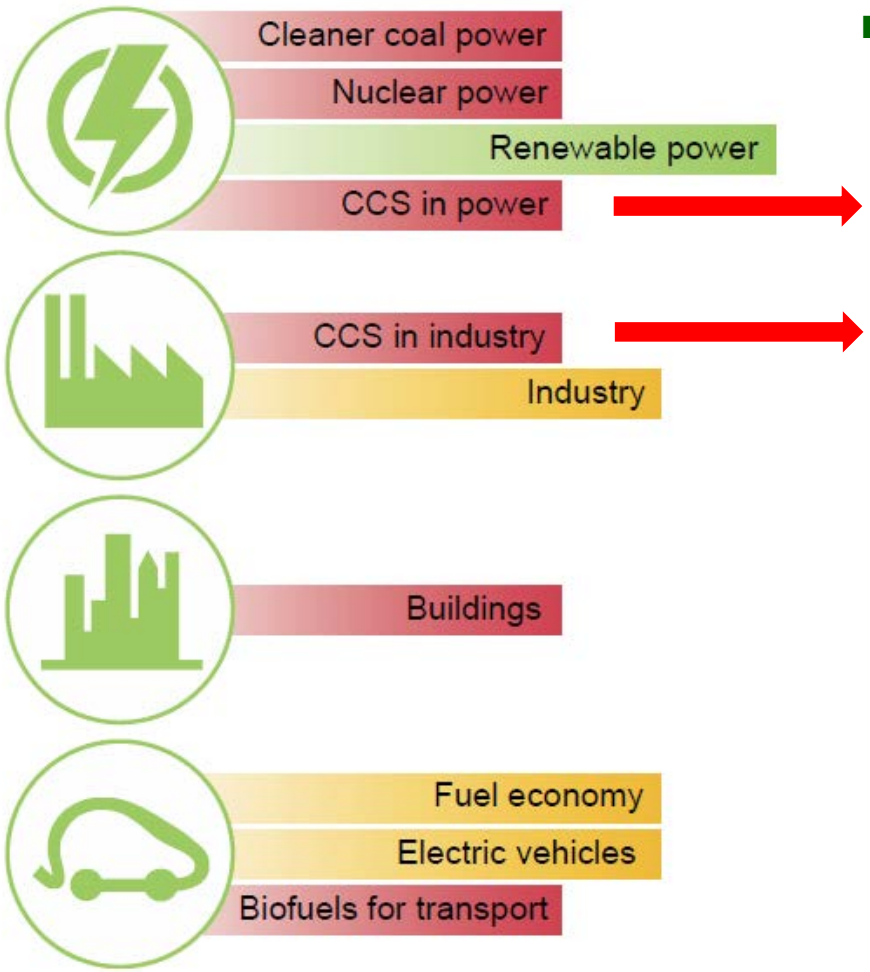


# ETP 2012
# Challenges for 2DS Scenario



# ETP 2012
# Progress in Clean Energy is too Slow


- **Some of the technologies with the largest potential are showing the least progress**
  - **Development and deployment of CCS is seriously off pace to reach 269 Mt/CO2 captured across power and industrial applications in 2020 in the 2DS. This is equivalent to about 120 CCS facilities.**

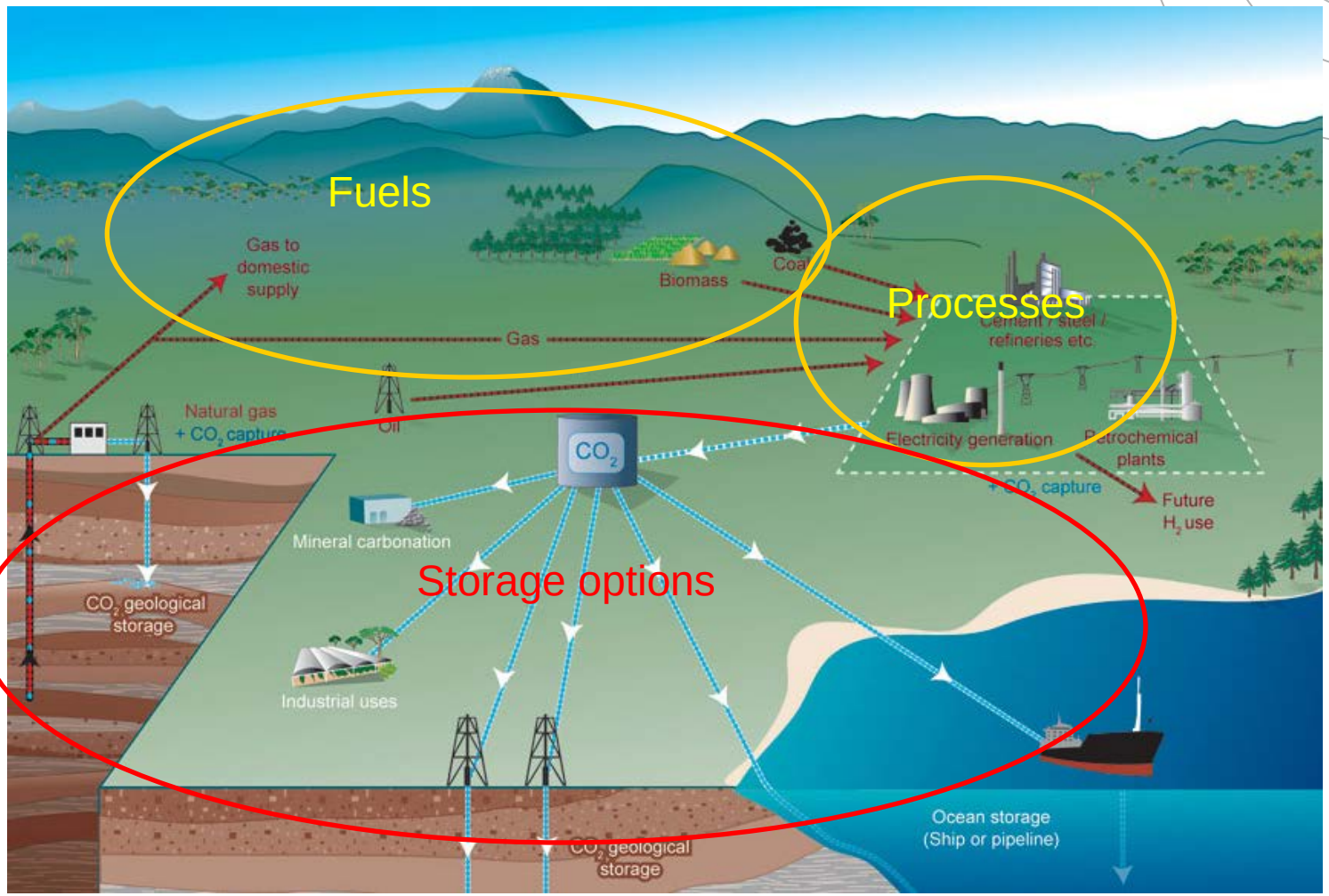
# $CO_2$ Capture and Storage

# or

# $CO_2$ Capture and Sequestration

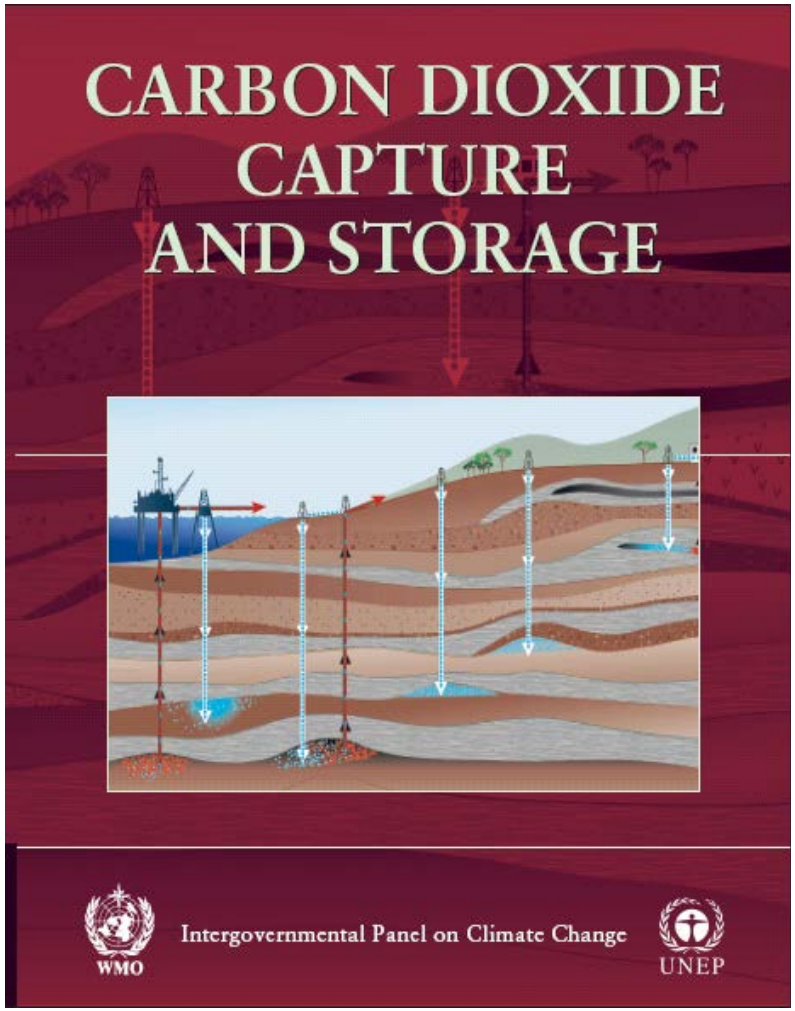
# (CCS)

# $CO_2$ Capture and Storage System

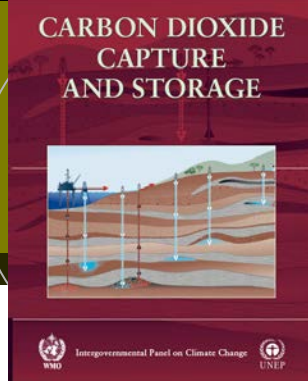



*Source: IPCC SRCCS*

# The IPCC Special Report on Carbon Dioxide Capture and Storage

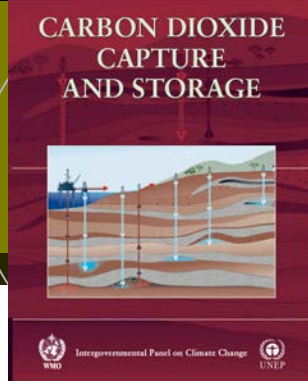


# How Could CCS Play a Role in Mitigating Climate Change?



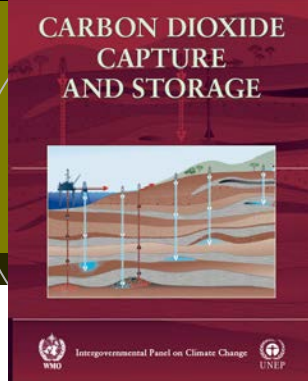

- Part of a portfolio of mitigation options
- Reduce overall mitigation costs
- Increase flexibility in achieving greenhouse gas emission reductions
- Application in developing countries important
- Energy requirements point of attention

# Economic Potential




- **Cost reduction of climate change stabilisation: 30% or more**
- **Most scenario studies: role of CCS increases over the course of the century**
- **Substantial application above CO2 price of 25-30 US$/$tCO_2$**
- **15 to 55% of the cumulative mitigation effort worldwide until 2100, depending on the baseline scenario, stabilisation level (450 - 750 ppmv), cost assumptions**
- **220 - 2,200 $GtCO_2$ cumulatively up to 2100**

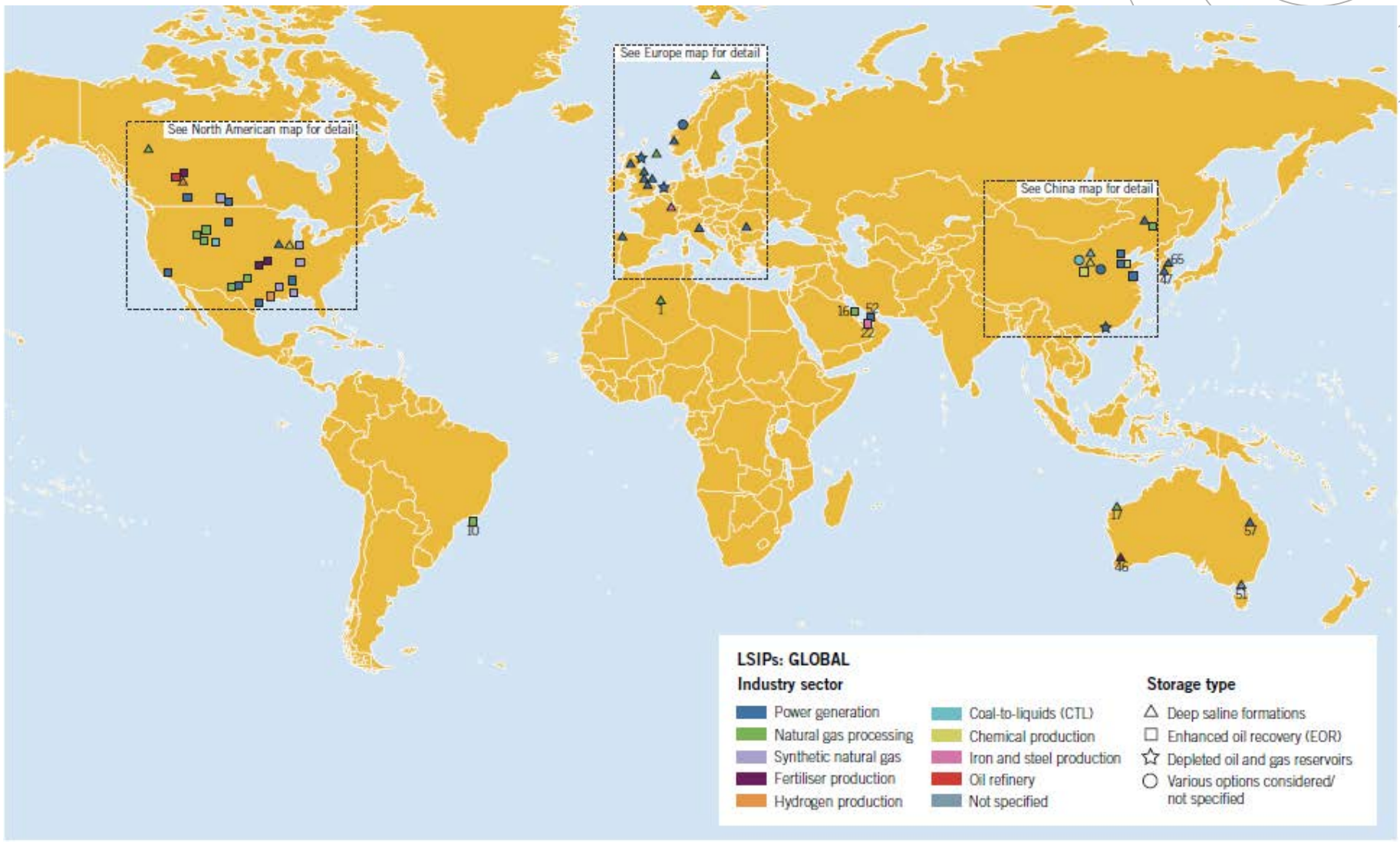
# Storage Potential




- **Geological storage: likely at least about 2,000 $GtCO_2$ in geological formations**
  - *"Likely" is a probability between 66 and 90%.*
  - **Oil/gas fields: 675 - 900 $GtCO_2$**
  - **Saline formations: 1000 - ~ 104 $GtCO_2$**
  - **Coal beds: 3 - 200 $GtCO_2$**
- **Ocean storage: on the order of thousands of $GtCO_2$, depending on environmental constraints**

# Large Scale Integrated Project

## (Global CCS Institute, 2013)



# CCS in G8 Summit

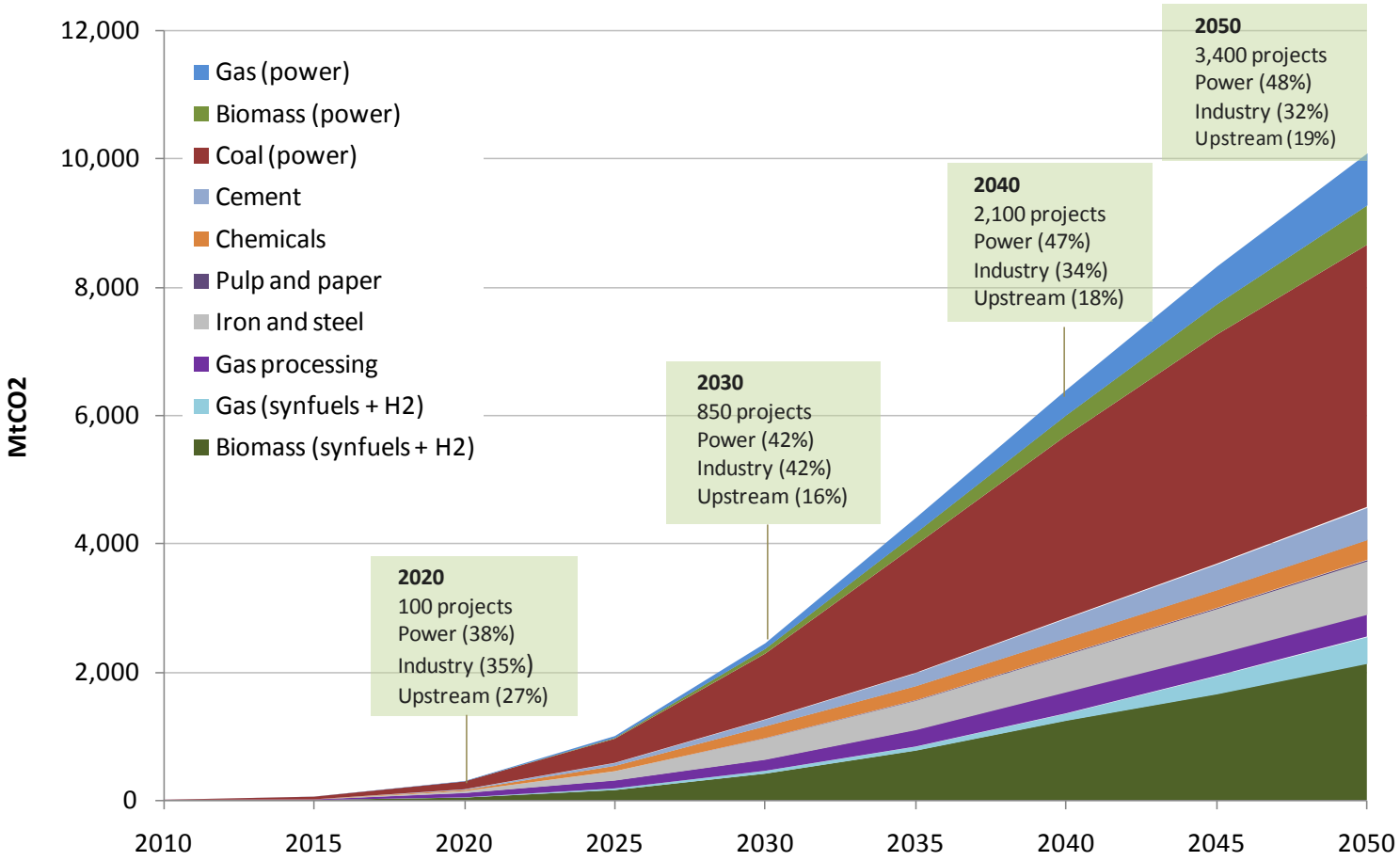
## G8 Hokkaido Toyako Summit Leaders Declaration (8 July 200)

**31. We will establish an international initiative with the support of the IEA to develop roadmaps for innovative technologies and cooperate upon existing and new partnerships, including carbon capture and storage (CCS) and advanced energy technologies. Reaffirming our Heiligendamm commitment to urgently develop, deploy and foster clean energy technologies, we recognize and encourage a wide range of policy instruments such as transparent regulatory frameworks, economic and fiscal incentives, and public/private partnerships to foster private sector investments in new technologies. We strongly support the launching of 20 large-scale CCS demonstration projects globally by 2010, taking into account various national circumstances, with a view to beginning broad deployment of CCS by 2020.**

# IEA CCS Roadmap

## Global Deployment of CCS 2010–50 by Sector


### BLUE Map Scenario (~450 ppm)

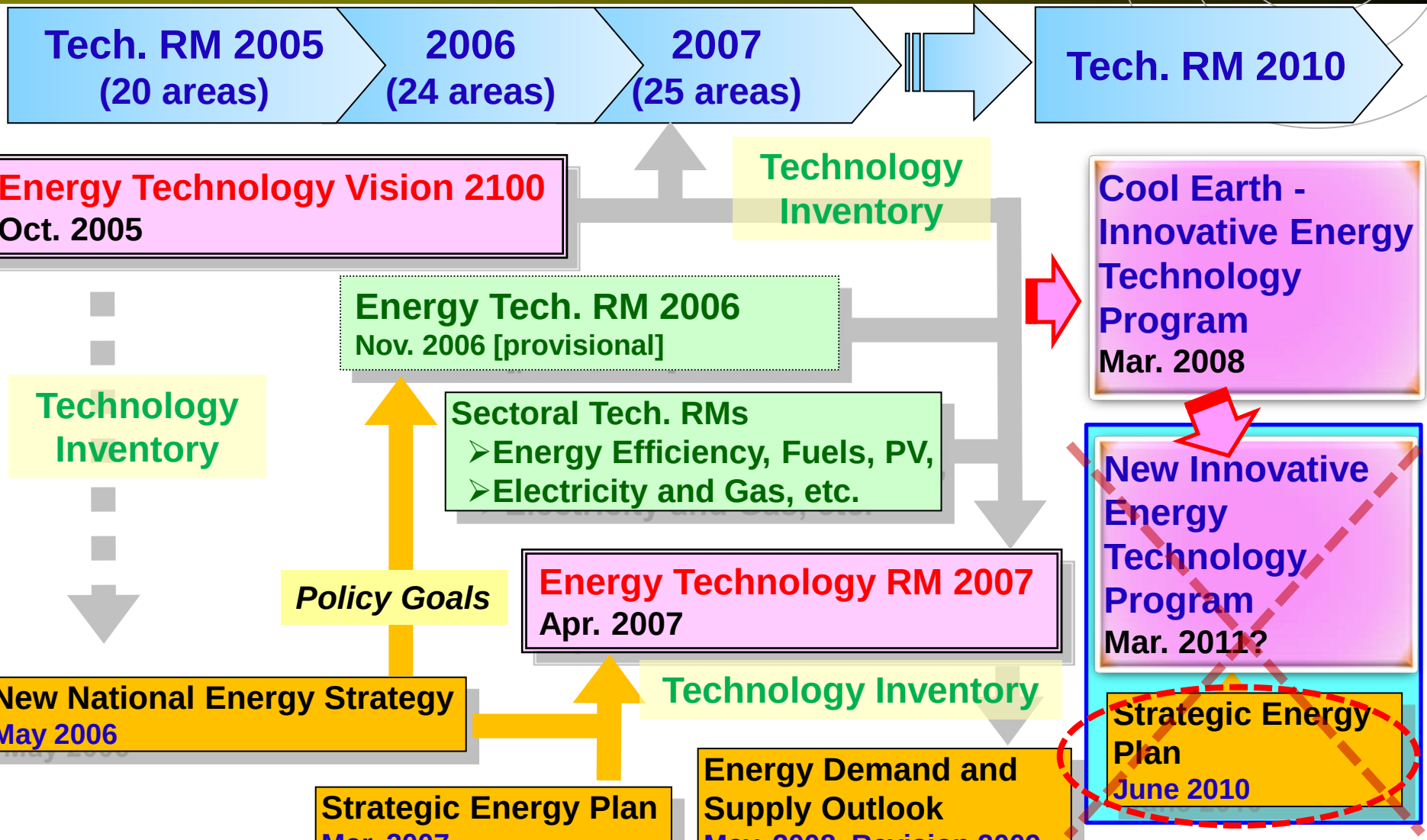





*M. Akai, AIST*

# Recent History of Energy Strategy Development in Japan (METI)

# Development of Energy Policy before 11 March 2011
## *Energy Technology Roadmapping*



# Energy Technology Vision 2100

*Agency for Natural Resources and Energy*

*Ministry of Economy, Trade and Industry*

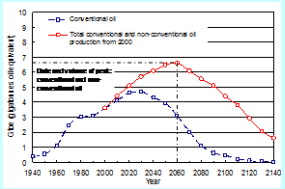
- **An approach to Low Carbon Society from Energy Policy**
- **Purpose**
  - **To establish strategic energy R&D plan by**
    - **identifying technologies and developing technology portfolio to prepare for resource and environmental constraints**
    - **considering optimum R&D resource allocation in METI**
- **Timeframe:**
  - **Vision and Technology roadmap: - 2100**

**⇒http://www.iae.or.jp/2100.html**

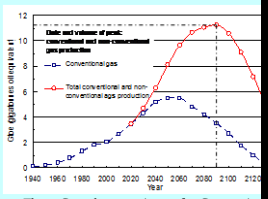
# Assumptions towards 2100

## Resource Constraints

- Although assumption of the future r
  constraints includes high degree of
  uncertainties, the following rigorou
  constraints were assumed as "prep
  - Oil production peak at 2050
  - Gas production peak at 2100




*The Complementarity of Conventional and Non-Conventional Oil Production: giving a Higher and Later Peak to Global Oil Supplies*

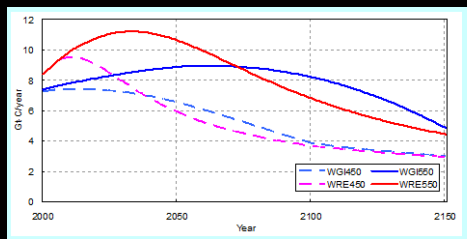



*The Complementarity of Conventio Conventional Gas Production: giving a H Peak to Global Gas Supplies*

**Example of estimates for oil and natural gas production**

## Environmental Constraints

- $CO_2$ emission **intensity** ($CO_2$/GDP) should be improved to stabilize atmospheric $CO_2$ concentration
  - 1/3 in 2050
  - Less than 1/10 in 2100 (further improvement after 2100)




**Global carbon dioxide emission scenario**

**Current GHG Reduction Target of Japan:**

- **-25% in 2020**
- **-80% in 2050**

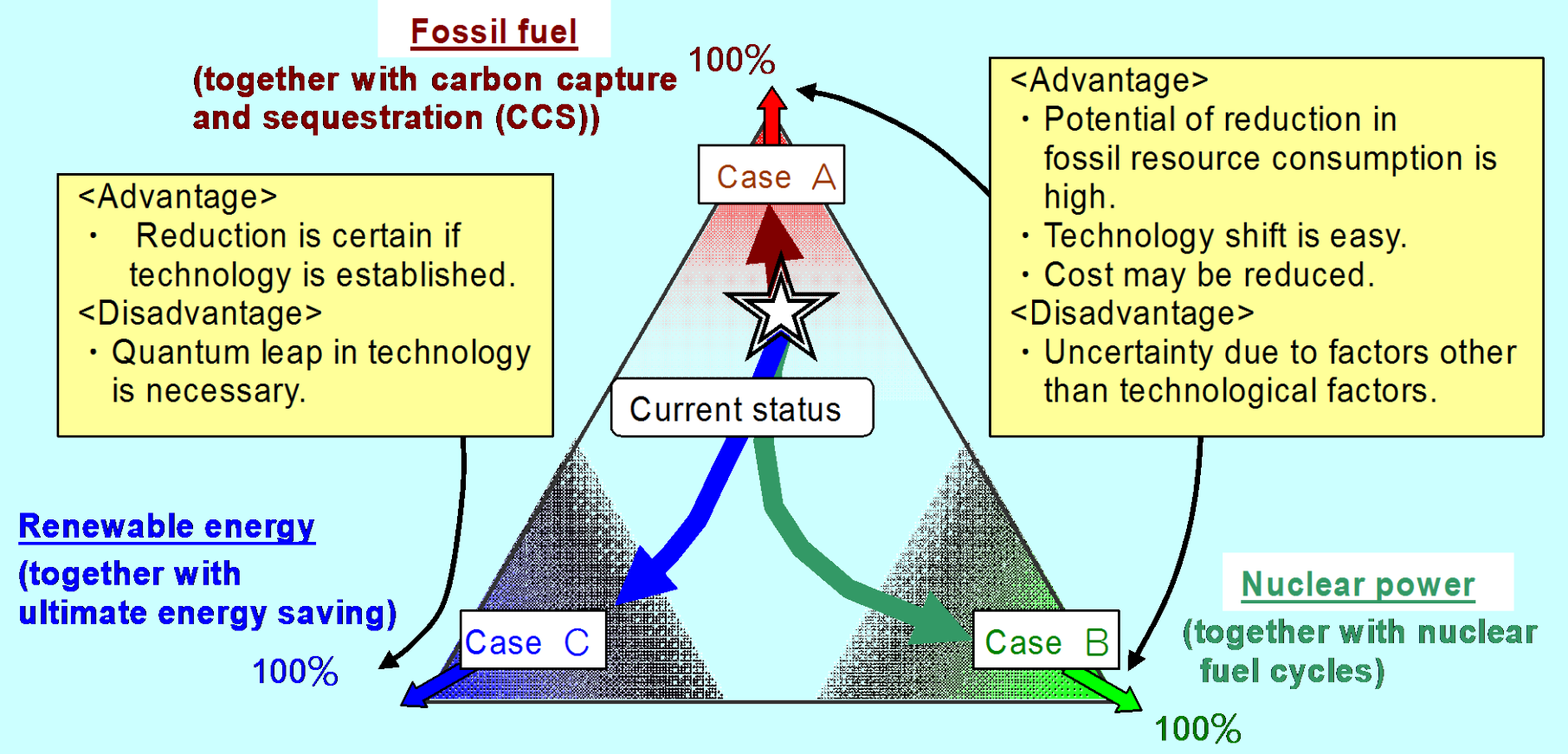
# To Overcome Constraints ---

- **Sector specific consideration**
  - Residential / Commercial
  - Transport
  - Industry
  - Transformation (Elec. & $H_2$ production)
- **Definition of goal in terms of sector or sub-sector specific $CO_2$ emission intensity.**
- **Identification of necessary technologies and their targets**

Demand sectors and their typical $CO_2$ emission intensity

| | | | | | | |
|---|---|---|---|---|---|---|
| *Industry* | : | t-C/production volume | = | t-C/MJ | × | MJ/production volume |
| *Commercial* | : | t-C/floor space | = | t-C/MJ | × | MJ/floor space |
| *Residential* | : | t-C/household | = | t-C/MJ | × | MJ/household |
| *Transport* | : | t-C/distance | = | t-C/MJ | × | MJ/distance |
| (*Transformation sector*: t-C/MJ) | | | | Conversion efficiency | | Single unit and equipment efficiency |

# Three Extreme Cases and Possible Pathway to Achieve the Goal




- **Cases A & C assume least dependency on energy saving**

# Sketch of Technology Spec. 2100

## Extreme Case-A (Fossil + CCS)

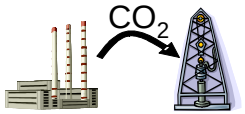
*- Case A assumes a situation where we cannot heavily rely on energy saving.*
*- The increase of the share of electricity and hydrogen is considered.*

** Values are relative to those in 2000, otherwise stated*

**[ Target in the Transformation Sector ]**

**(1) Production of Electricity and Hydrogen**
**About eight times*** the current total amount of electricity generated

Fossil Fuel




$CO_2$ Capture and Sequestration (CCS)

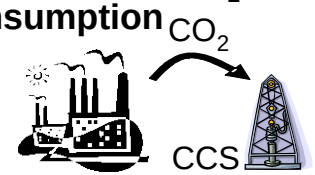
**Supplying with coal fired power plants with CCS**

*Total amount of $CO_2$ captured and sequestered in transformation and industry sector becomes approximately 4.0 billion t-$CO_2$/year.*
*** Additional energy required for the CCS process is not included.*

**Electricity or Hydrogen**

**[ Target in the Industry Sector ]**

**(1) CCS it applied to over 80% of $CO_2$ emissions from fossil fuel consumption**




**(2) Over 65% of the energy demand is supplied by electricity or hydrogen from the transformation sector**

**[ Target in the Transport and Res/Com Sectors ]**

**(1)100% of the energy demand is supplied by electricity or hydrogen**

Transport

Res/Com (Residential)

Res/Com (Commercial)

# Sketch of Technology Spec. 2100
## Extreme Case-B (Nuclear)

*- Case B assumes a situation where we cannot heavily rely on energy saving.*
*- The increase of the share of electricity and hydrogen is considered.*

** Values are relative to those in 2000, otherwise stated*

**[ Target in the Transformation Sector ]**

**(1) Production of Electricity and Hydrogen**
**About eight times*** the current total amount of electricity generated

Nuclear Power

**Supplying by nuclear power**

**Electricity or Hydrogen**

**[ Target in the Industry Sector ]**

**(1) All the energy demand is supplied with electricity or hydrogen with the exception of feedstocks and reductants**

**[ Target in the Transport and Res/Com Sectors ]**

**(1)100% of the energy demand is supplied by electricity or hydrogen**

Transport

Res/Com (Residentila)

Res/Com (Commercial)

# Sketch of Technology Spec. 2100

## Extreme Case-C (Renewable + Ultimate Energy Saving)

** Values are relative to those in 2000, otherwise stated*
*** Per unit utility*

**[ Target in the Transformation Sector ]**

**(1) Production of Electricity and Hydrogen**

**About twice*** of the current total electricity generated

Renewable Energies

**Supplying by renewable energies**

**Electricity, Hydrogen or Biomass**

**[ Target in the Industry Sector ]**

**Energy demand** to be reduced by 70%**

**(1) 50% of the production energy intensity is reduced.**

**(2) Making the rate of material energy regeneration to 80%**

**(3) Improvement of functions such as strength by factor 4**

**[ Target in the Transport Sector ]**

**(1) 70% of the energy demand** is reduced through energy saving and fuel switching.**

Transport

*For automobile, 80% is reduced*

**[ Target in the Res/Com Sector ]**

**(1) Energy demand to be reduced by 80% through energy saving and energy creation.**

Res/Com (Residential)

Res/Com (Commercial)

# Implications on Future Scenario

- **Energy efficiency is the key!**
- **Case-A "Fossil + CCS" would contribute to deep reduction of $CO_2$ and hydrogen economy but might not be a truly sustainable option from the viewpoint of resource depletion.**
- **Nuclear and CCS, especially as a mid-term option, would increase the flexibility of energy supply and demand structure with moderate cost.**

# Cool Earth - Innovative Energy Technology Program

# Cool Earth-
# Innovative Energy Technology Program

**METI developed "Cool Earth - Innovative Energy Technology Program" to address substantial GHG reduction in the long-term through innovative energy technologies RD&D. (March 5, 2008)**

- **Identified 21 key energy technologies to be focused on with high priority.**
- **Formulated technology roadmaps for them, which give RD&D direction and milestones on performance with timelines, and propose further development of global technology roadmaps to monitor global RD&D progress**
- **Strengthen international cooperation to accelerate innovative technology RD&D.**

# 21 Key Innovative Energy Technologies

*Efficiency improvement*

*Decarbonization*

Oil LNG Coal

Nuclear Power Biomass Solar Wind

**Supply side**

**Demand side**

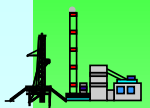
**Cross sectoral**

*Electric Power*

**Efficient coal-fired power plant**

**Efficient LNG-fired power plants**

**CCS**



**Innovative solar power**

**Advanced nuclear power**

**Superconducting power transmission**

*Transport*

**ITS**

**FCV**

**PHEV / EV**

**Biofuel**

*Industry*

**Innovative materials / manufacturing process**

**Steel making process with Hydrogen**

*Residences / Buildings*

**Efficient houses / buildings**

**Efficient lighting**

**Fuel Cell for residential use**

**Efficient Heat pumps**

**Efficient IT devices / networks**

**HEMS / BEMS / Regional EMS**

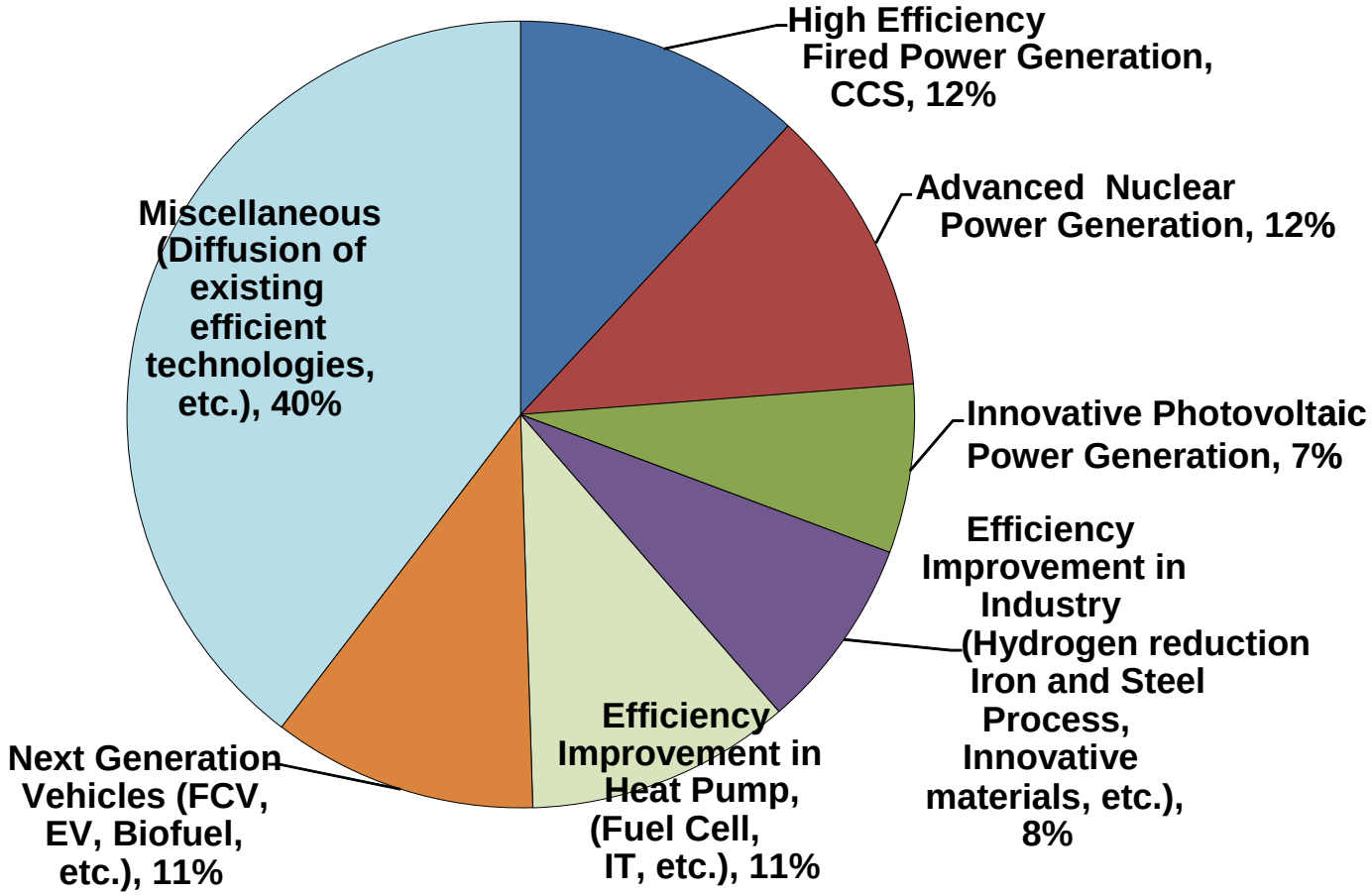
**Power storage**

**Power electronics**

**Hydrogen production / storage / transport**

**CCS (restated)**

# Contribution of Technologies for 50 % Emission Reduction in 2050

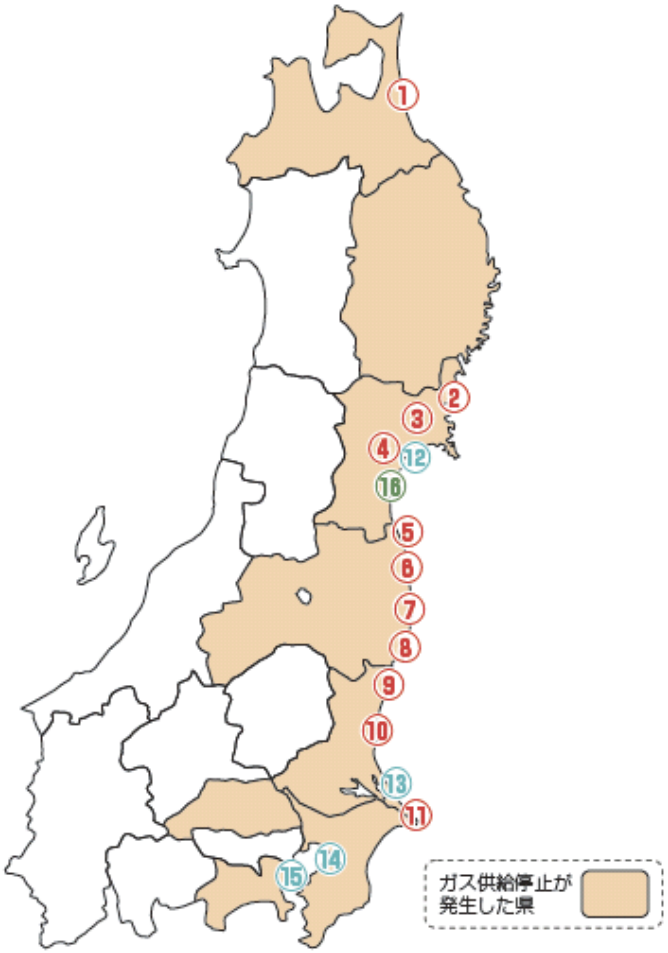



Source: Institute of Applied Energy

- 21 innovative technologies contribute to nearly 60 % of the necessary reductions for the 50 % of emission reduction.
- Technologies for power generation and transportation sectors have relatively large contributions, but it is necessary to address all sectors.

# What Happened after Fukushima Nuclear Accidents

# What Happened to the Energy Supply by the Catastrophic Earthquake and Tsunami? (11 March 2011)




Major installations affected by the earthquake and tsunami

## Damaged Plants

- **Power Stations**
  - **Tohoku Grid**
    - **Fossil**
      **Hachinohe (250MW), Sendai (446MW), Shin-Sendai (350MW), Haramachi (2000MW), Shinchi (2000MW)**
  - **Tokyo Grid**
    - **Fossil**
      **Hirono (3800MW), Hitachi-naka (1000MW), Nakoto (1625MW), Kashima (4400MW), Kahima (1400MW)**
    - **Nuclear**
      **Fukushima-1 (4700MW)**
- **3 Refineries**
- **1 LNG terminal**

**Most of the plants have been retrieved !**

# Shortage of Power Supply

- **March to summer 2011 (affected areas)**
  - **Rotating blackout (March 2011)**
  - **Forced restriction of electricity use to large customers (-15% in Summer 2011).**
  - **Voluntary power saving in households.**
- **2012 (before Summer)**
  - **One out of 54 nuclear power stations is running, but would be stopped for scheduled maintenance within a month.**
    - **⇨ZERO Nuclear**
  - **In Kansai area, where about a half of the electricity had been supplied by nuclear, power shortage up to 20% was anticipated in the summer of 2012.**
    - **⇨Two nuclear power stations were re-started through the controversial decision by the Prime Minister**

# Short- to Mid-term Impacts
## (1 year to 20 years)

- **Possibilities:**
  - **Forced restriction of electricity use**
  - **Rotating blackout**
  - **Unmanageable black-out**
- **Replacing nuclear electricity (1100MW) by fossil will impose about $1B/y of additional fuel cost.**
- **$CO_2$ emission from power sector in 2020 will be 50 to 250 Mton higher compared with BAU if CCS will not be employed.**
  - **Based on a scenario analysis**

# Social Responses to Fukushima Accident

- Sort term (for a week)
  - Mass evacuation
  - Cornering food / water / batteries, etc.
- Mid- to long-term (for a year or …)
  - Long-term evacuation
  - Spreading fear for radiation
    - Based on harmful rumors
    - Voluntary radiation measurement (atmosphpere and food)
  - Choice of energy portfolio

# Innovative Strategy for Energy and the Environment

## Energy and Environment Council

### 24 September 2012

# Process to Develop the Innovative Strategy for Energy and the Environment

**Basic Principles**

**Towards a proposal defining Options for an Strategy for Energy and the Environment**

**December 21, 2011**

**The Energy and Environment Council**

1. Various committees such as the Atomic Energy Commission of Japan, Advisory Committee for Energy and Natural Resources, and the Central Environment Council will develop a draft proposal of options for nuclear energy policy, energy mix and global warming countermeasures by Summer based on the Basic Principles outlined by the Energy and Environment Council.
2. The Energy and Environment Council will summarize proposals based on these studies, and present a unified set of multiple options related to the Strategy for Energy and the Environment.
3. By proposing options and other activities, the government deepen national discussions, to formulate the Innovative Strategy for Energy and the Environment, around this Summer.

# Innovative Strategy for Energy and the Environment

## Overview

1. Realization of a society not dependent on nuclear power

2. Realization of Green Energy Revolution

3. For ensuring stable supply of energy

4. Bold implementation of reform of electric power system
   (Compose the Strategy for the "Reform of Electricity Power Systems (tentative)" by the end of this year)

5. Steady implementation of global warming countermeasures
   (Formulate the "Global Warming Action Plan" for the period from after 2013 by the end of this year)

○ Disclose information in a detailed manner through a process that will sufficiently ensure transparency and review and constantly re-examine them

# Overview

1. Realization of a society not dependent on nuclear power

2. Real… Ener… …e

4. Bold… (Co… Syst… …tem … Power

5. Stea… (For… from… …easures … period

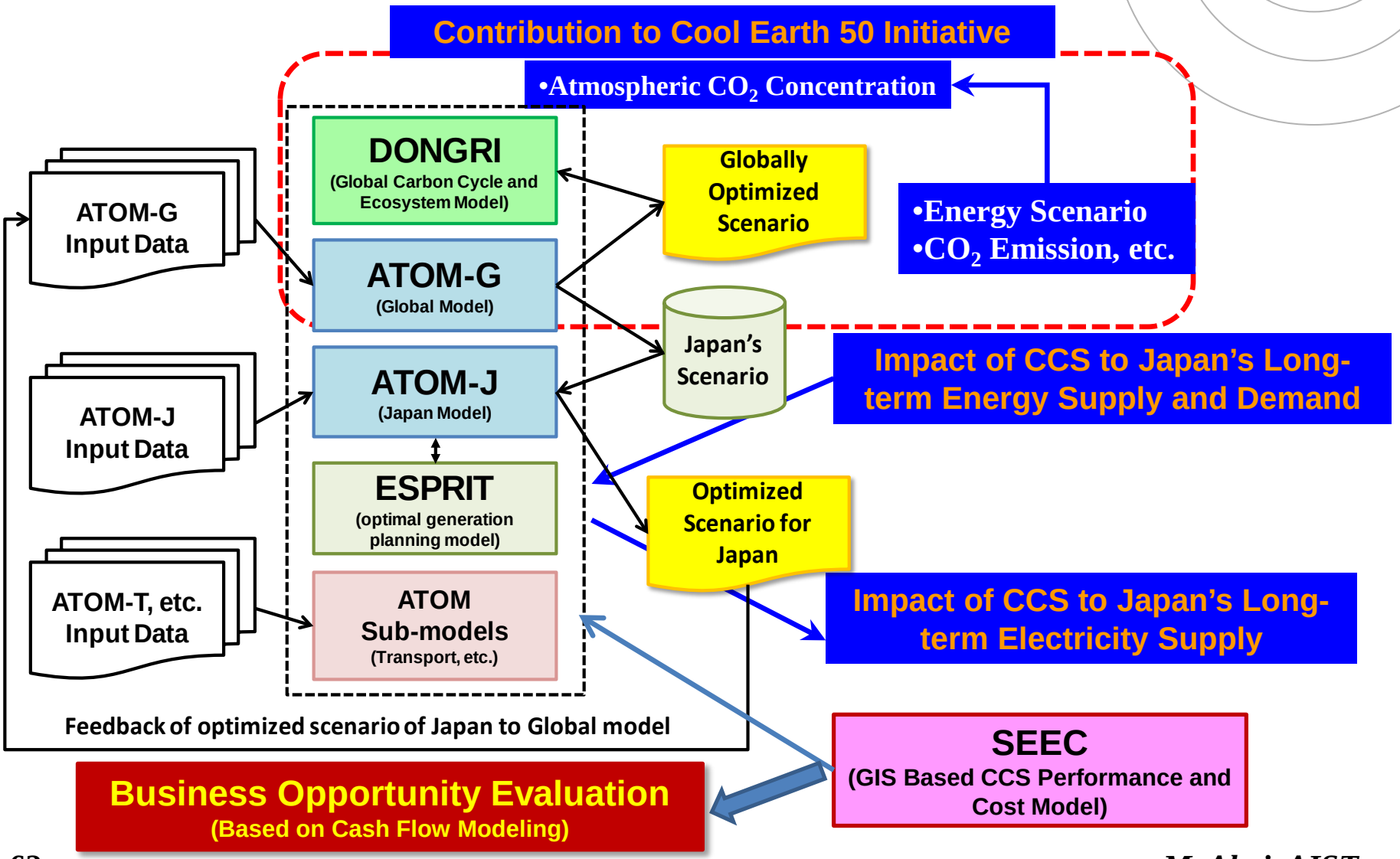
**Abolishment of "Energy and Environment Council"**

- Disclose information in a detailed manner through a process that will sufficiently ensure transparency and review and constantly re-examine them

# Energy Scenario Study

# Energy Scenario Analysis

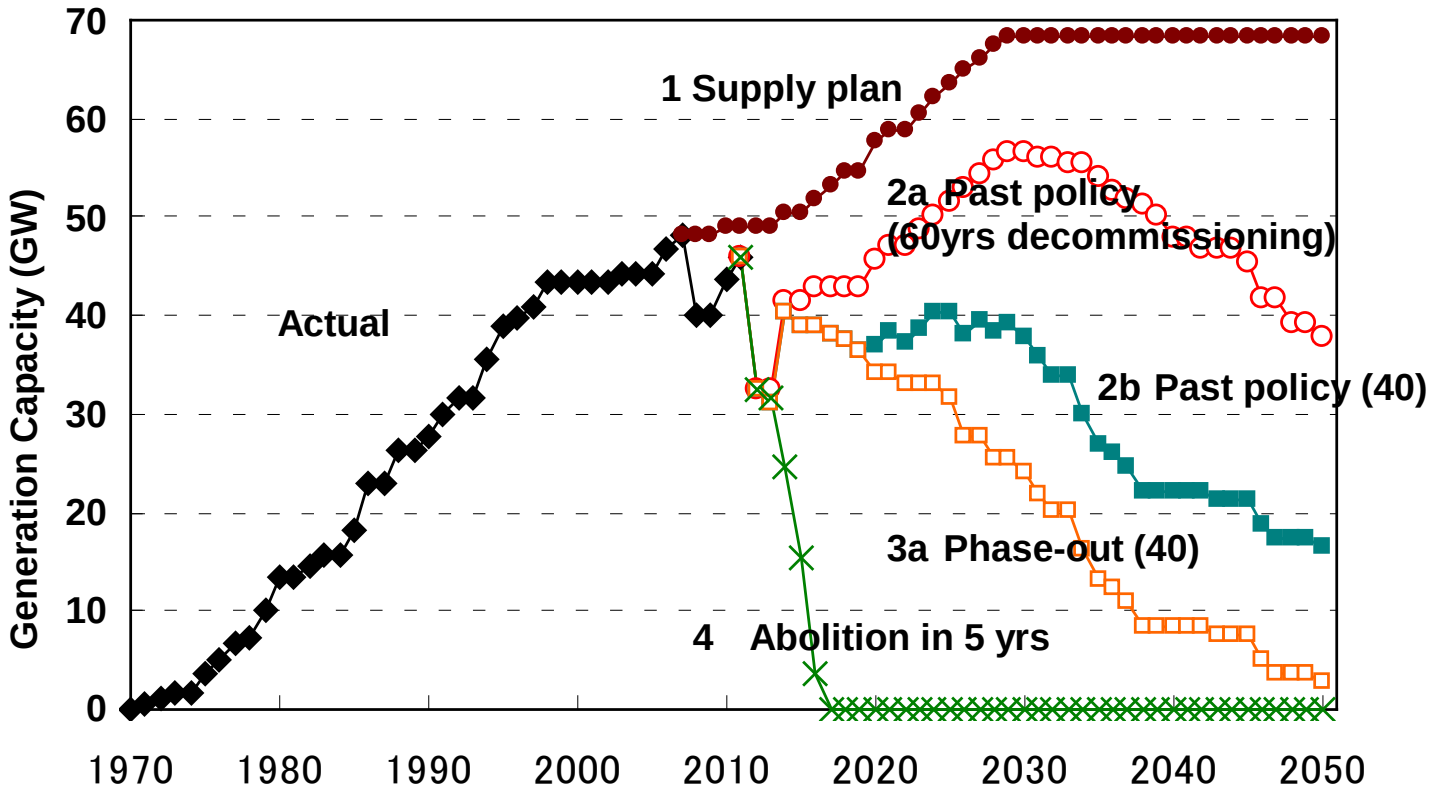
## Economic and Scenario Studies to Appraise Potential Contribution of CCS to Long-term Stabilization Goal



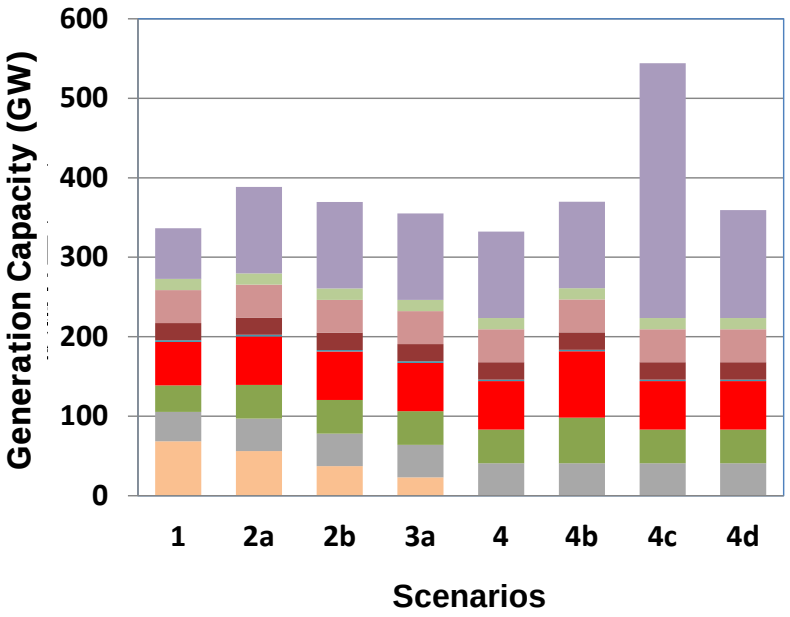


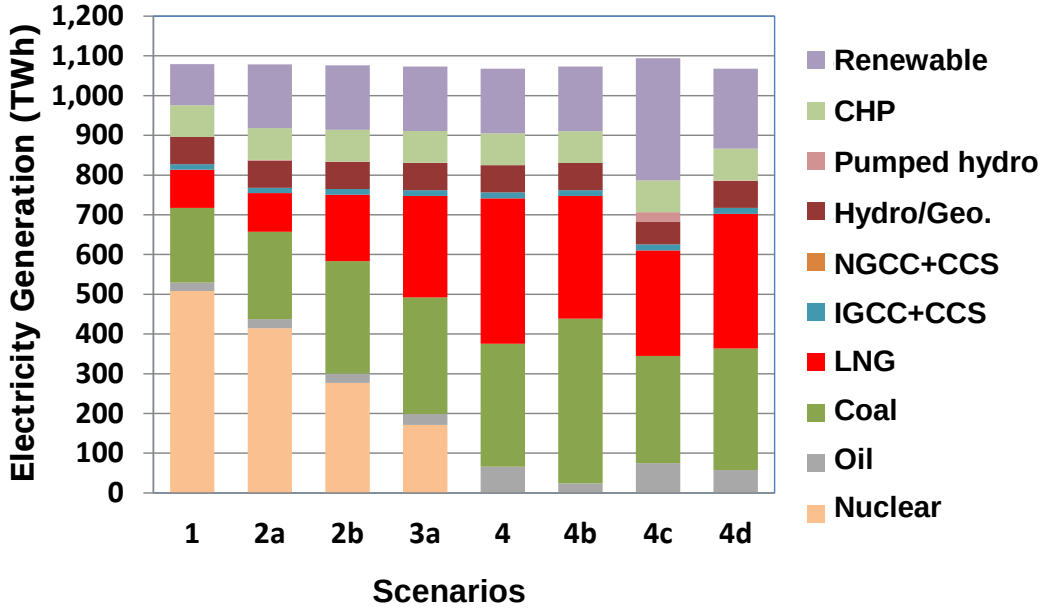

*M. Akai, AIST*

# Nuclear Scenarios

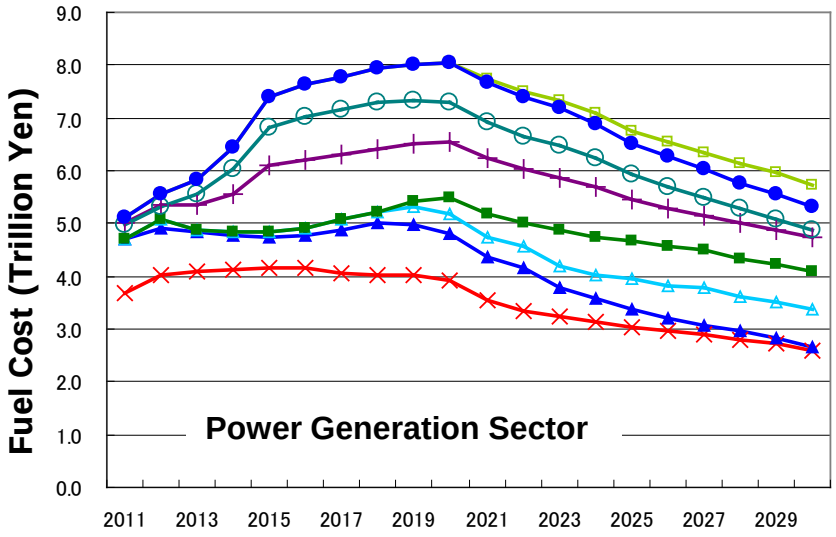


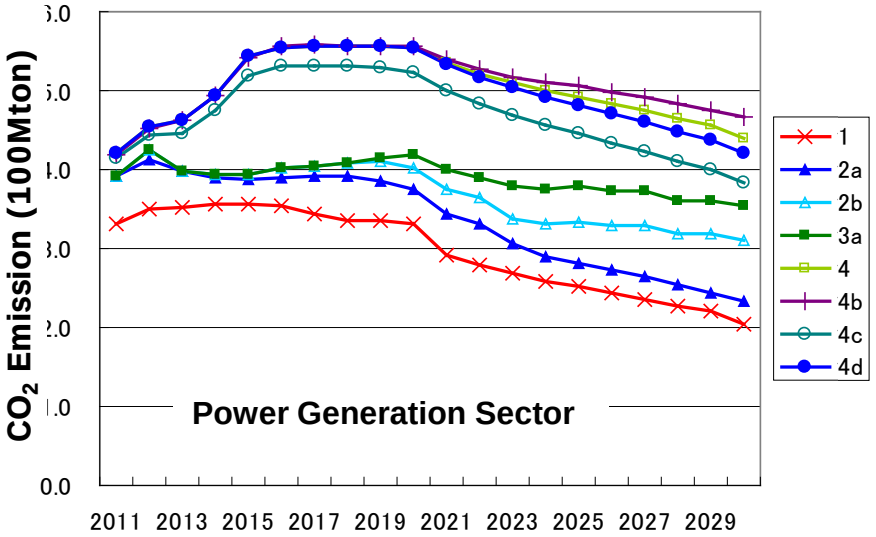
# Electricity Generation in 2030



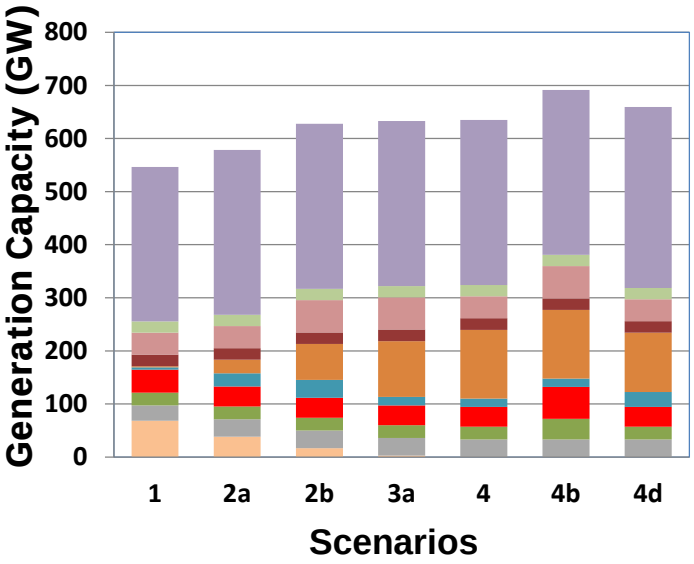



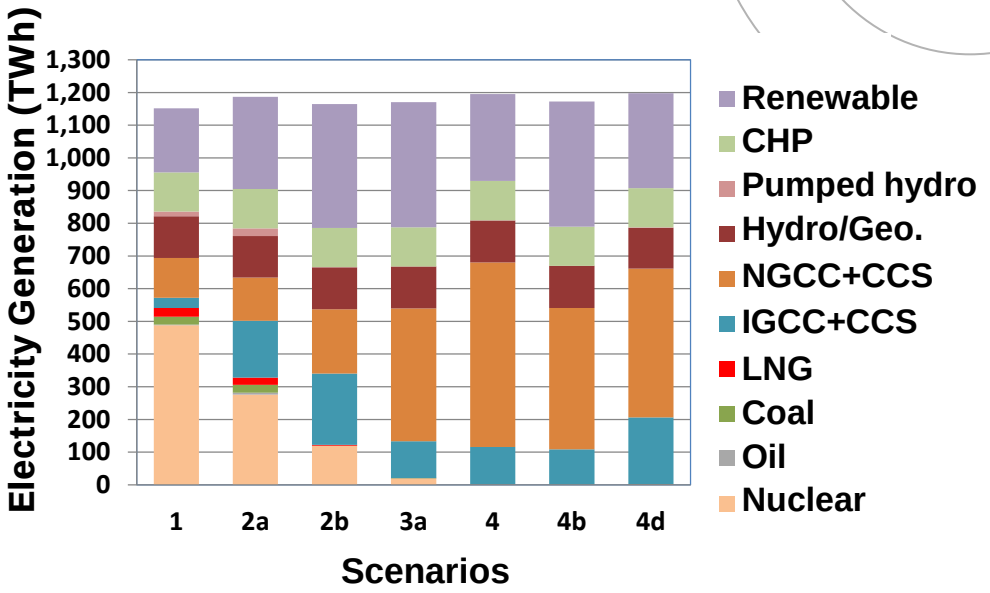
# Fuel Cost and $CO_2$ Emission towards 2030

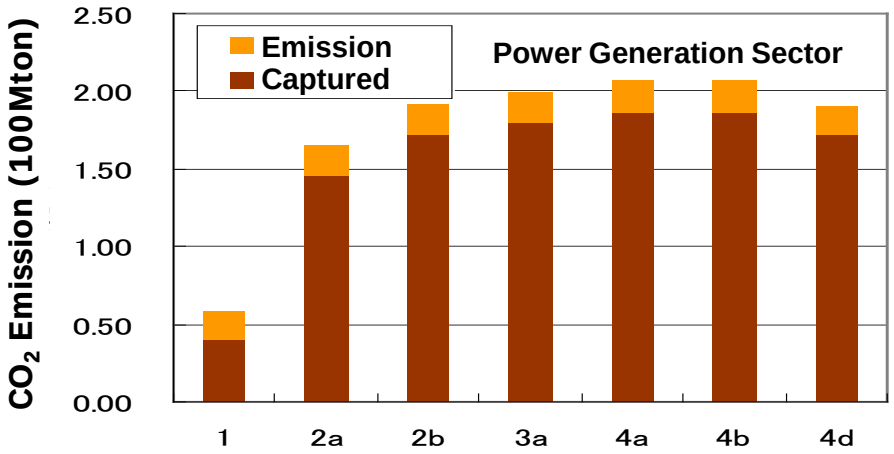


# Electricity Generation and $CO_2$ Emission in 2050 under the Deep Reduction Target: - 80 %



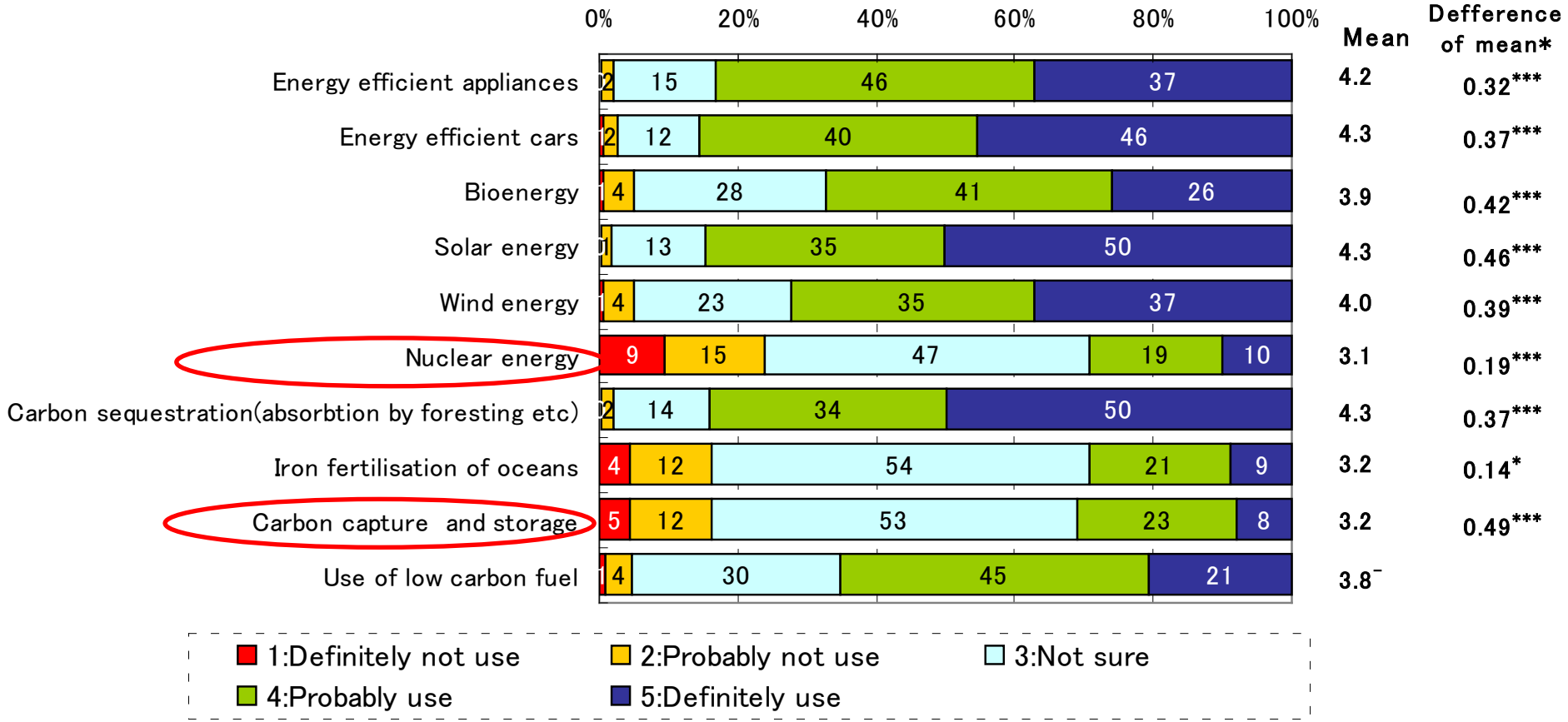



# Public Perception

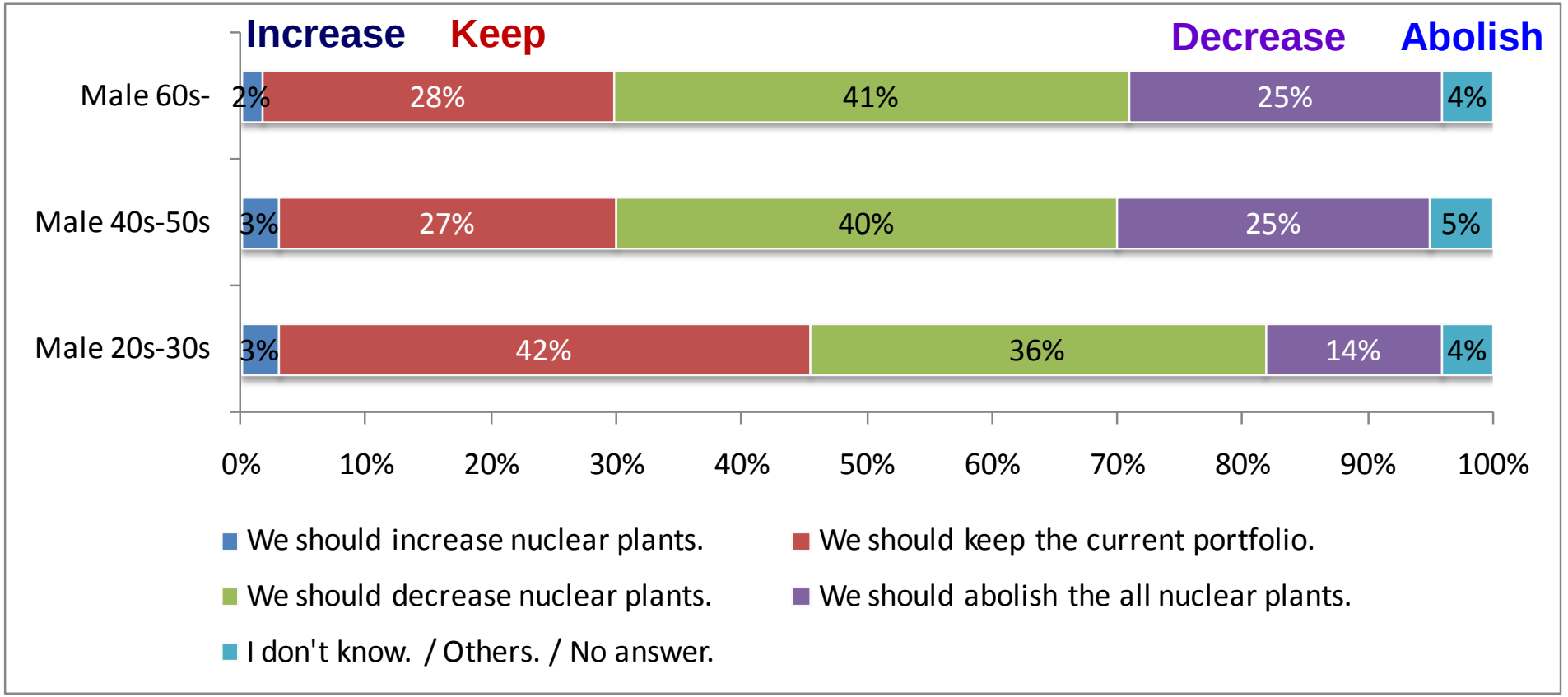
# Nuclear and CCS:
## Similarity in Perception (AIST Study)

- **If you are responsible for climate policy in your country, do you use .....? (2007 survey)**



# Public Opinion on Nuclear
## After Fukushima Accident - Media Survey

- **What should we do about nuclear plants in Japan? (October 2011, each sex)**



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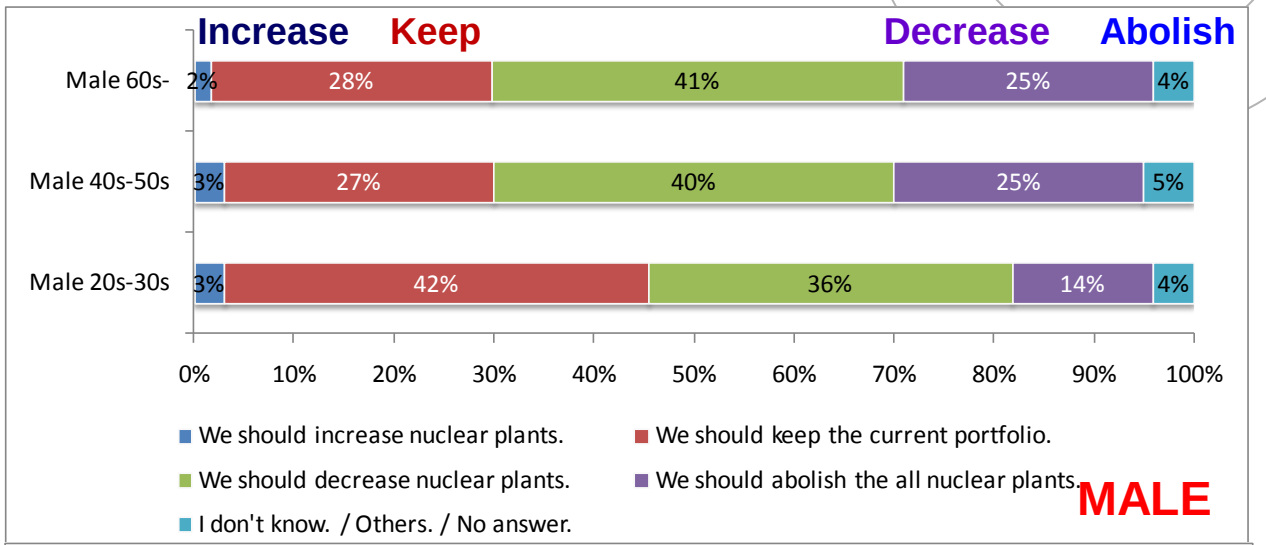
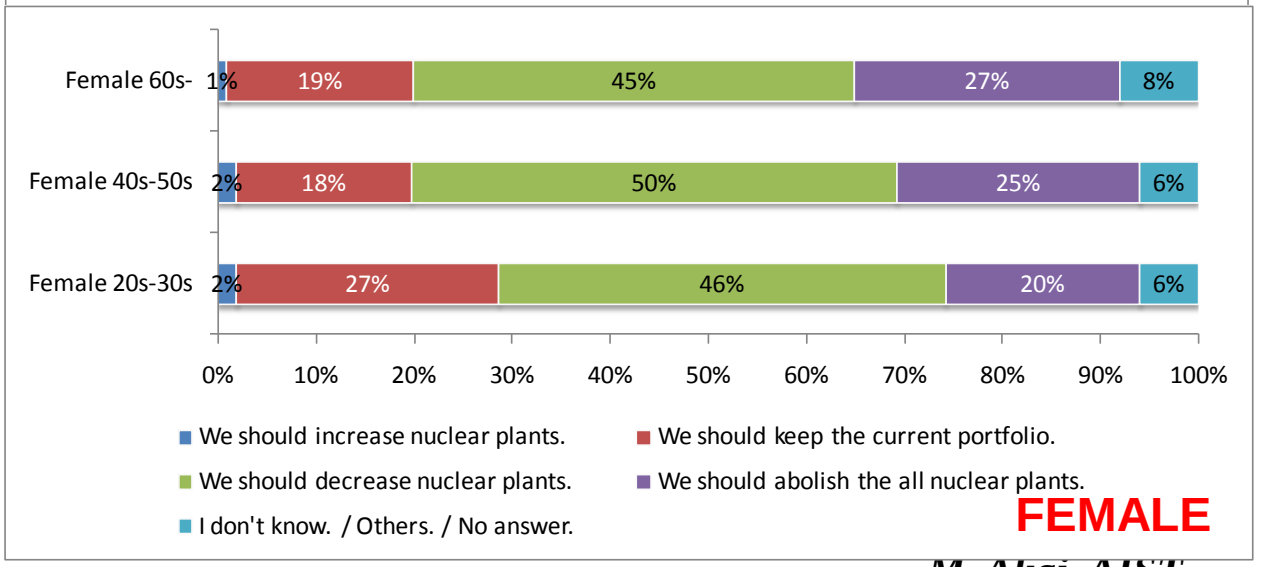
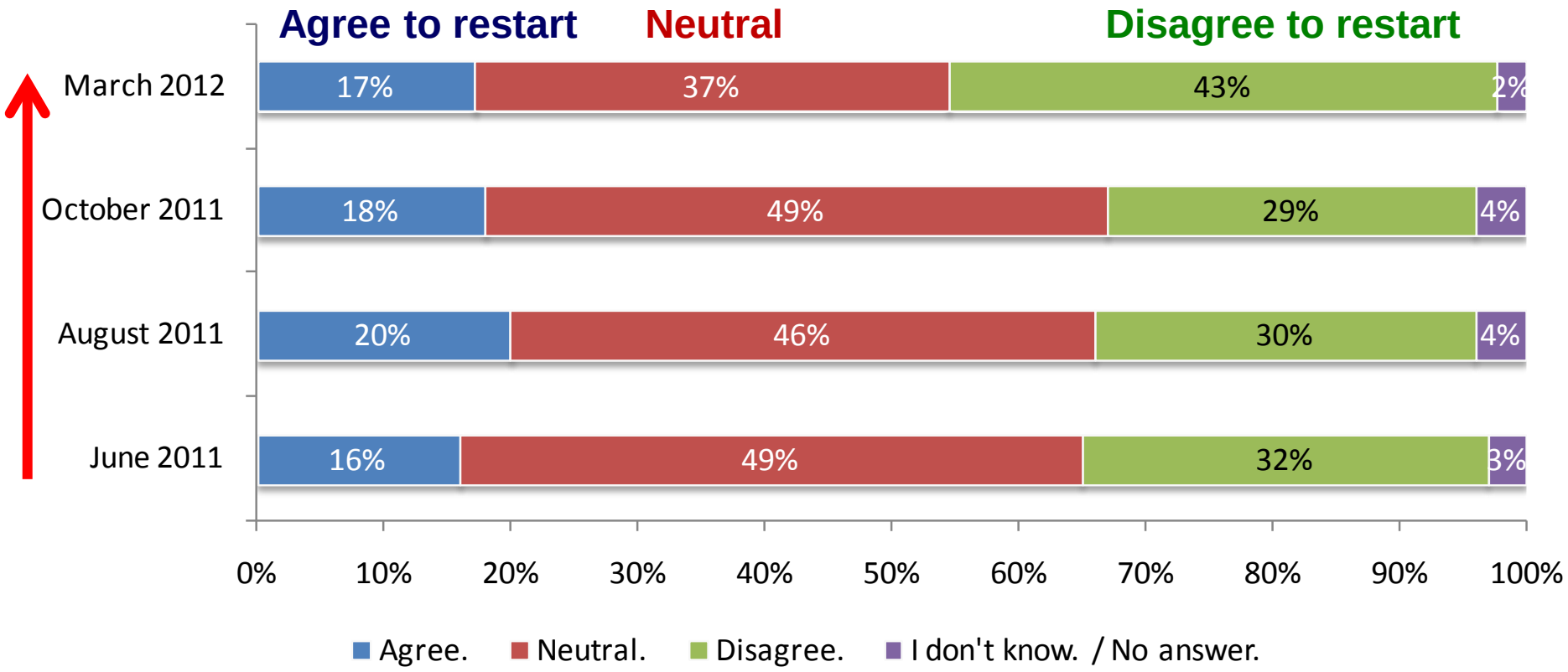


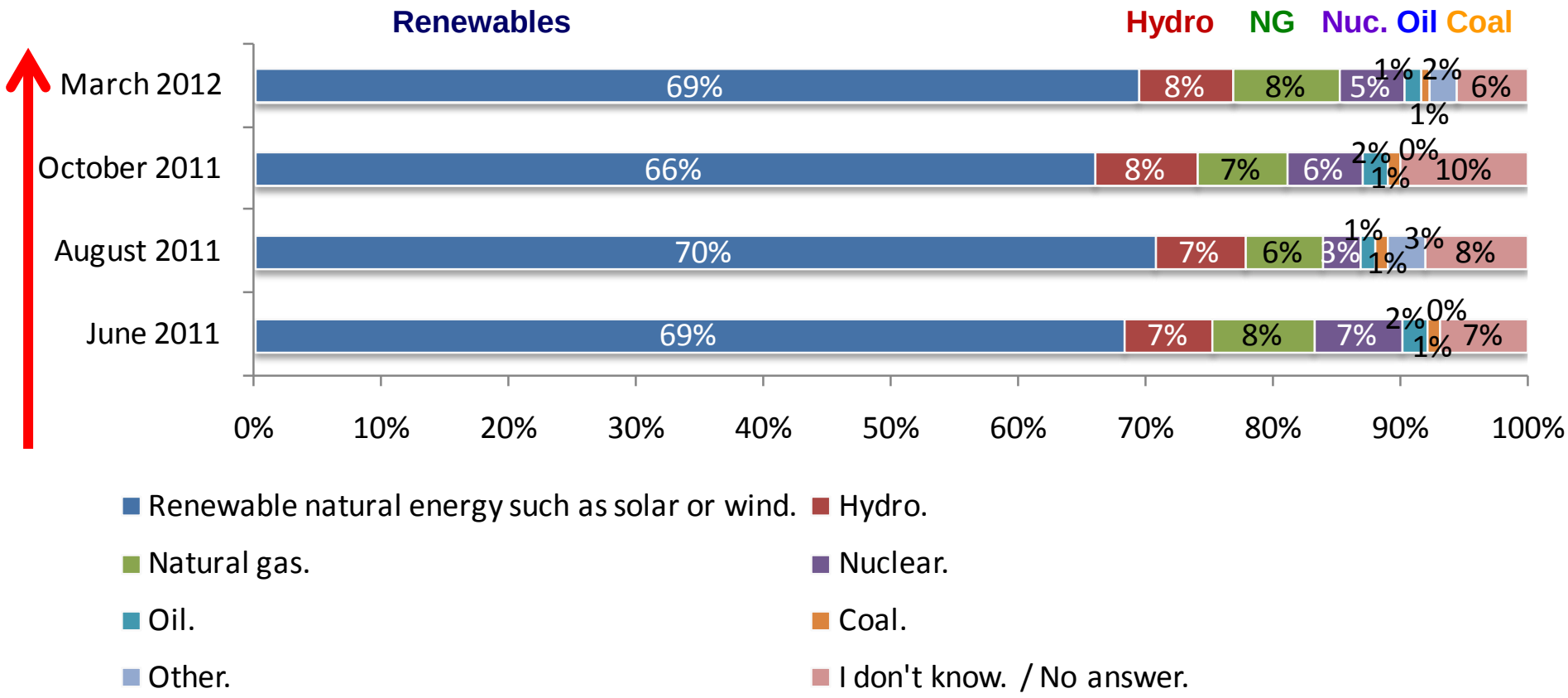
# Public Opinion on Restarting Nuclear

- **Are you agree or disagree about restarting operation of nuclear plants that have shut for periodic inspections or earthquakes?**



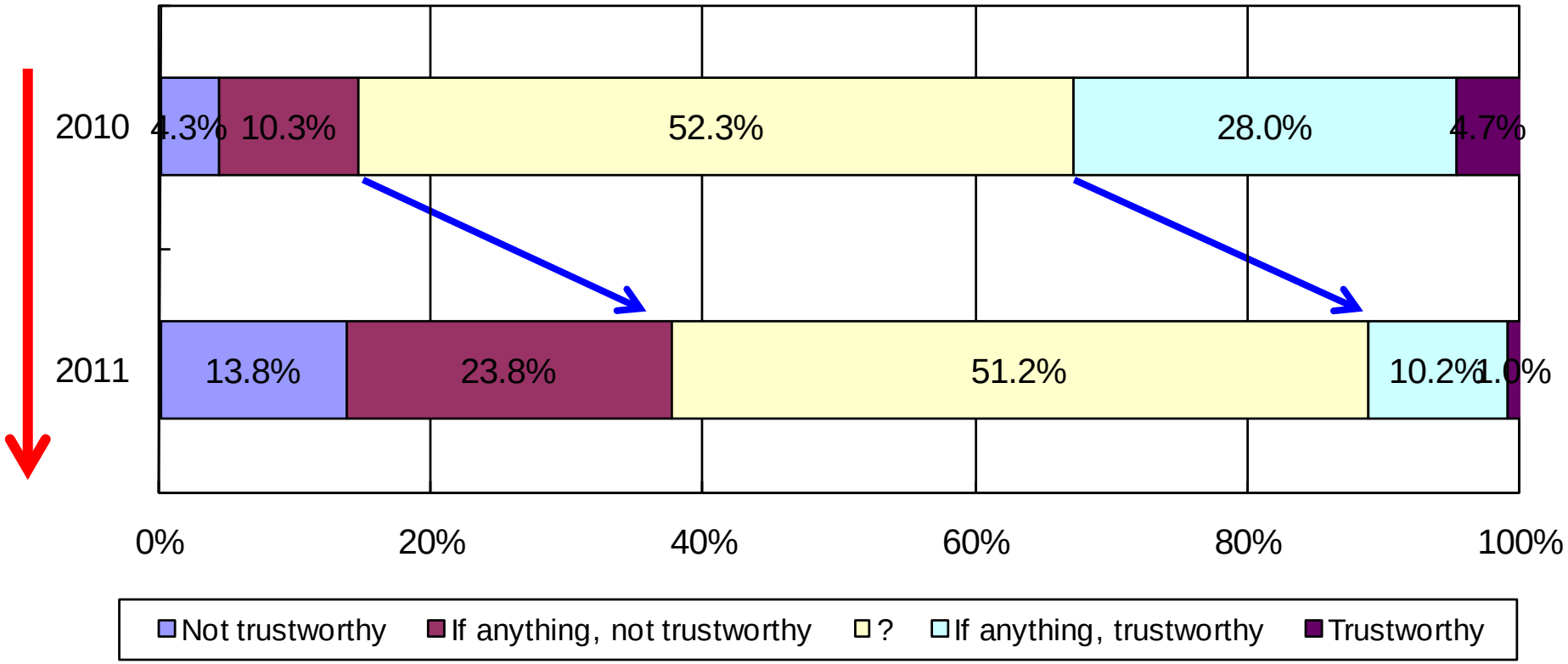
# Public Opinion
## Future Energy Portfolio

- **What kinds of energy sources should we expand more in the future?**



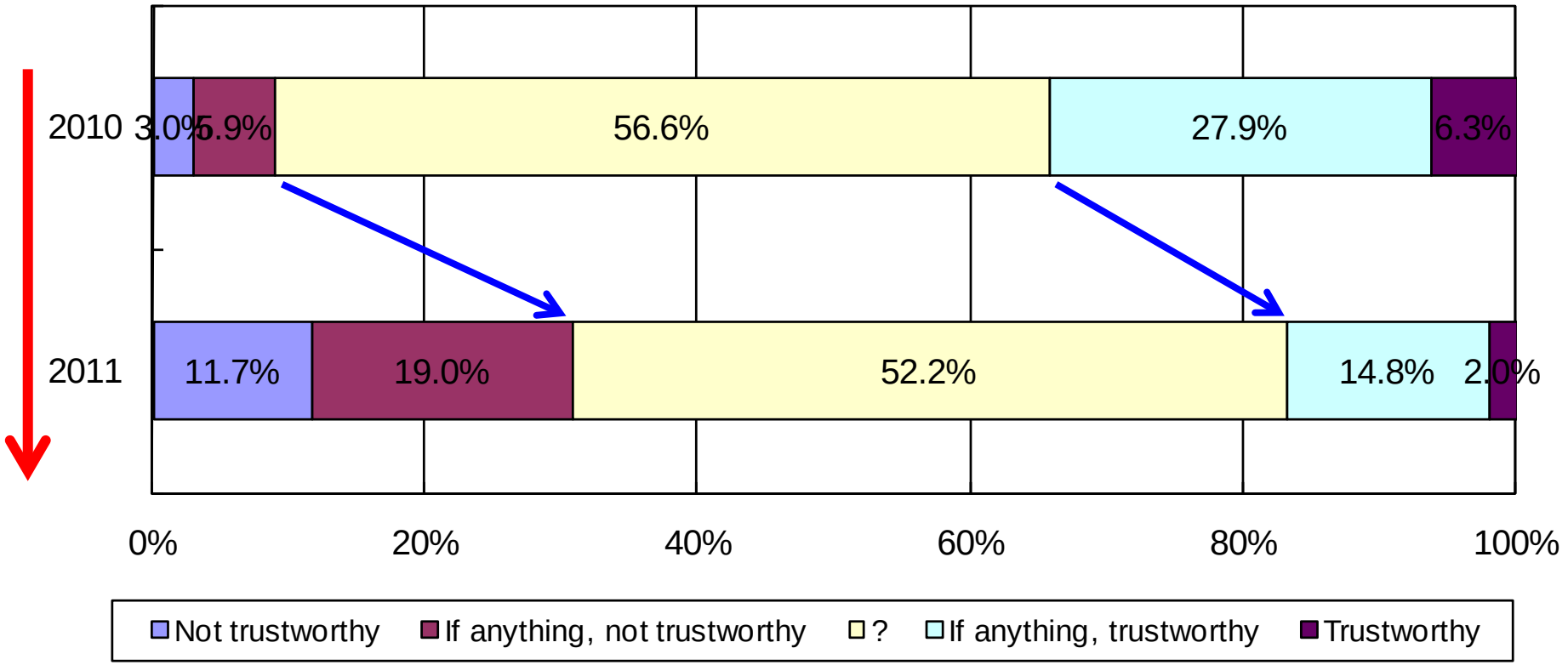
# Public opinion - Losing Trusts
## Governments

- **Trust in local governments and national government (nuclear safety regulators)**



# Public opinion - Losing Trusts
## Experts

- **Trust in nuclear experts and involved parties**



# Rumor, Rumor, Rumor ...

Piece of pine trees suffered in an area far from Fukushima


The Gozan no Okuribi Festival (16 August in Kyoto)

- **A proposal was made to send pieces of pine trees suffered by the tsunami to Kyoto to be burned as a part of a famous farewell bonfire to mourn the victims.**

**BUT**

- **Many of the Kyoto citizens said NO because of unreasonable fear for radiation.**

# Rumor, Rumor, Rumor ...

- **Request to local authorities other than Tohoku area to accept non-radiative debris arisen from the earthquake and tsunami to help the incineration disposal.**
- **Some of the mayors, etc. said YES**

**BUT**

- **Only a little amount of debris has been accepted because of strong / hysteric oppositions of local citizens and non-local public.**

# Energy Portfolio of Japan in a Age of New Myth?

- **Myth of the absolute safety of a Nuclear Power Plant was destroyed with Fukushima accident**
- **Emerging new myth**
  - **Absolute dangerousness of Nuclear Power Plants**
- **Proposed solution for short- to mid-term (~2030, ~2050):**
  - **Fuel switching from Nuclear/Coal to Natural Gas**
  - **Renewables**

# What to Do in Japanese Society?
## Observations

- **Poor knowledge of politicians on energy issues**
- **Emotional discussion on energy portfolio**
  - **Nuclear vs. Renewables**
  - **Promoters of renewables or antinuclear activists try to revenge themselves on electric utilities, policy makers, etc. for long-term indignity by making best use of Fukushima accident.**
  - **Old fashioned skepticism on renewables of electric utilities, etc. to protect against challenge by promoters.**
- **Harmful argument by non-expert "intellectuals"**
  - **General public would be influenced by the opinion of so called "intellectuals" regardless of their expertise**
- **Emerging new myth**
  - **Absolute dangerousness of Nuclear Power Plants**

# What to Do in Japanese Society?
## Impossible Dream?

- Improving energy literacy
  - General public, policy makers, politicians, etc.
- Restoration of the public's confidence on scientists, experts, policymakers, etc.
  - Elimination of pseudointellectuals
- Daily life considering RISK
  - Adverse reaction on the term “Risk”
    - Paraphrasing “risk assessment” as “safety assessment” even by the government.
- Education of media
  - Importance of improving media literacy of recipient

# Thank you!

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