Global Environmental Policy

Global Environmental Policy 2012

Graduate School, University of Tokyo

December 03, 2012: Lecture

December 10, 2012: Group Discussion

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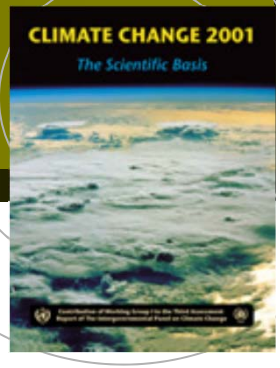
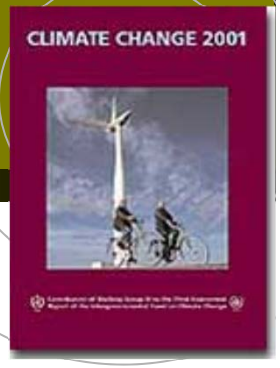
Recent Findings on Climate Change

IPCC 3rd Assessment Report (TAR) Suggestions
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 3rd Assessment Report (TAR) Suggestions
WG3:Mitigation-SPM



- **Earlier actions, including a portfolio of emissions mitigation, technology development and reduction of scientific uncertainty, increase flexibility in moving towards stabilization of atmospheric concentrations of greenhouse gases,**
- **Rapid near-term action would decrease environmental and human risks associated with rapid climatic changes.**

IPCC 4th Assessment Report (AR4)
Direct Observations of Recent Climate Change

- **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.**

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

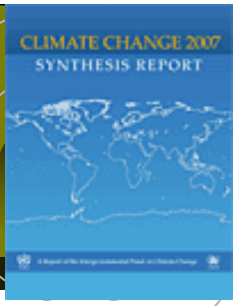
- **Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.**
  - **This is an advance since the TAR's conclusion that "most of the observed warming over the last 50 years is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

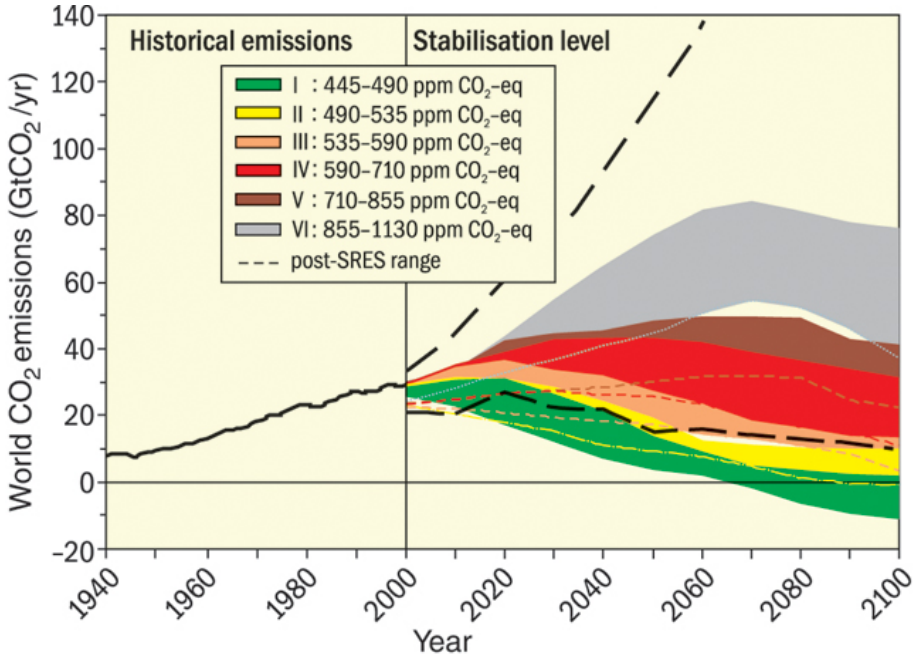
NOTE: ***Virtually certain*** **> 99% probability of occurrence,** ***Extremely likely*** **> 95%,** ***Very likely*** **> 90%,** ***Likely*** **> 66%,** ***More likely than not*** **> 50%,** ***Unlikely*** **< 33%,** ***Very unlikely*** **< 10%,** ***Extremely unlikely*** **< 5%**

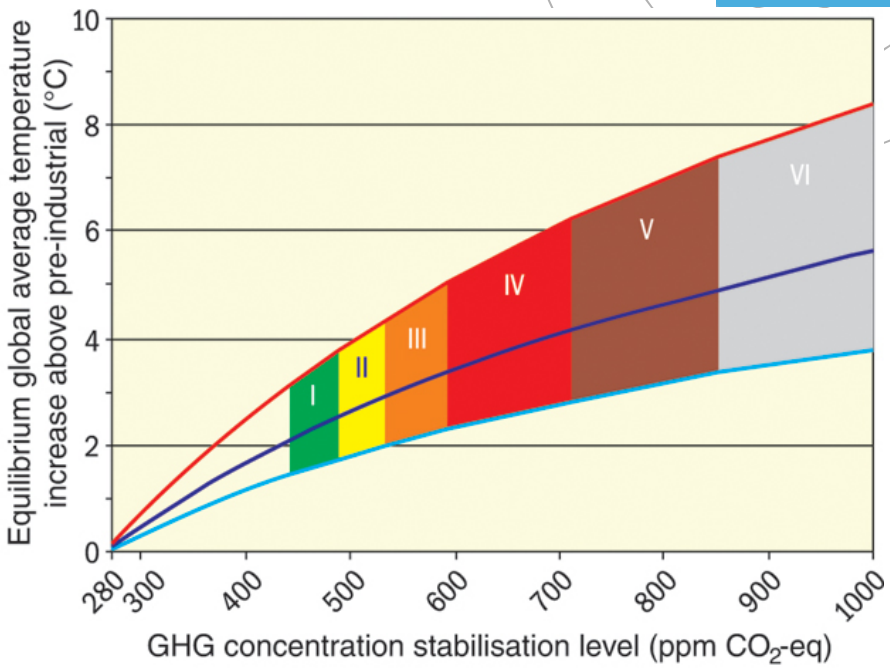
IPCC 4th Assessment Report (AR4)
Projections of Future Changes in Climate

- **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.**

CO_2 Emissions and Equilibrium Temperature Increases for a Range of Stabilisation Levels







- In order to stabilise the concentration of GHGs in the atmosphere, emissions would need to peak and decline thereafter.
- The lower the stabilisation level, the more quickly this peak and decline would need to occur.
- Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilisation levels

The Road to Kyoto

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 21st century could rise significantly more than at any other time in human history. 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 •Testimony by Dr. Hansen •Toronto Conference •Establishment of IPCC
1990	•IPCC First Assessment Report
1992	•Earth Summit ⇒UNFCCC
1995	•COP-1 (Berlin) ⇒Berlin Mandate •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**

Key Decisions - COP 17 / CMP 7 (Nov.-Dec. 2011)

COP: Conference of the Parties to the Convention
CMP: Conference of Parties serving as the meeting of the Parties to the Kyoto Protocol)

- **Green Climate Fund**
  - Countries have already started to pledge to contribute to start-up costs of the fund, meaning it can be made ready in 2012, and at the same time can help developing countries get ready to access the fund, boosting their efforts to establish their own clean energy futures and adapt to existing climate change.
  - A Standing Committee is to keep an overview of climate finance in the context of the UNFCCC and to assist the Conference of the Parties. It will comprise 20 members, represented equally between the developed and developing world.
  - A focussed work programme on long-term finance was agreed, which will contribute to the scaling up of climate change finance going forward and will analyse options for the mobilisation of resources from a variety of sources.
- **Adaptation**
  - The Adaptation Committee, composed of 16 members, will report to the COP on its efforts to improve the coordination of adaptation actions at a global scale.
  - The adaptive capacities above all of the poorest and most vulnerable countries are to be strengthened. National Adaptation Plans will allow developing countries to assess and reduce their vulnerability to climate change.
  - The most vulnerable are to receive better protection against loss and damage caused by extreme weather events related to climate change.

Key Decisions - COP 17 / CMP 7 (Nov.-Dec. 2011)

COP: Conference of the Parties to the Convention
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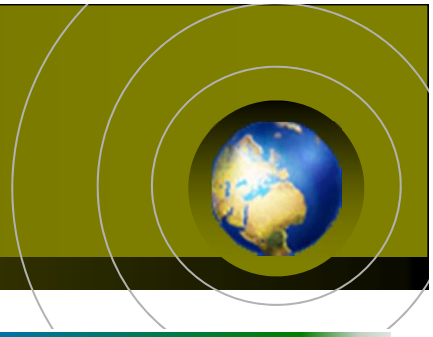
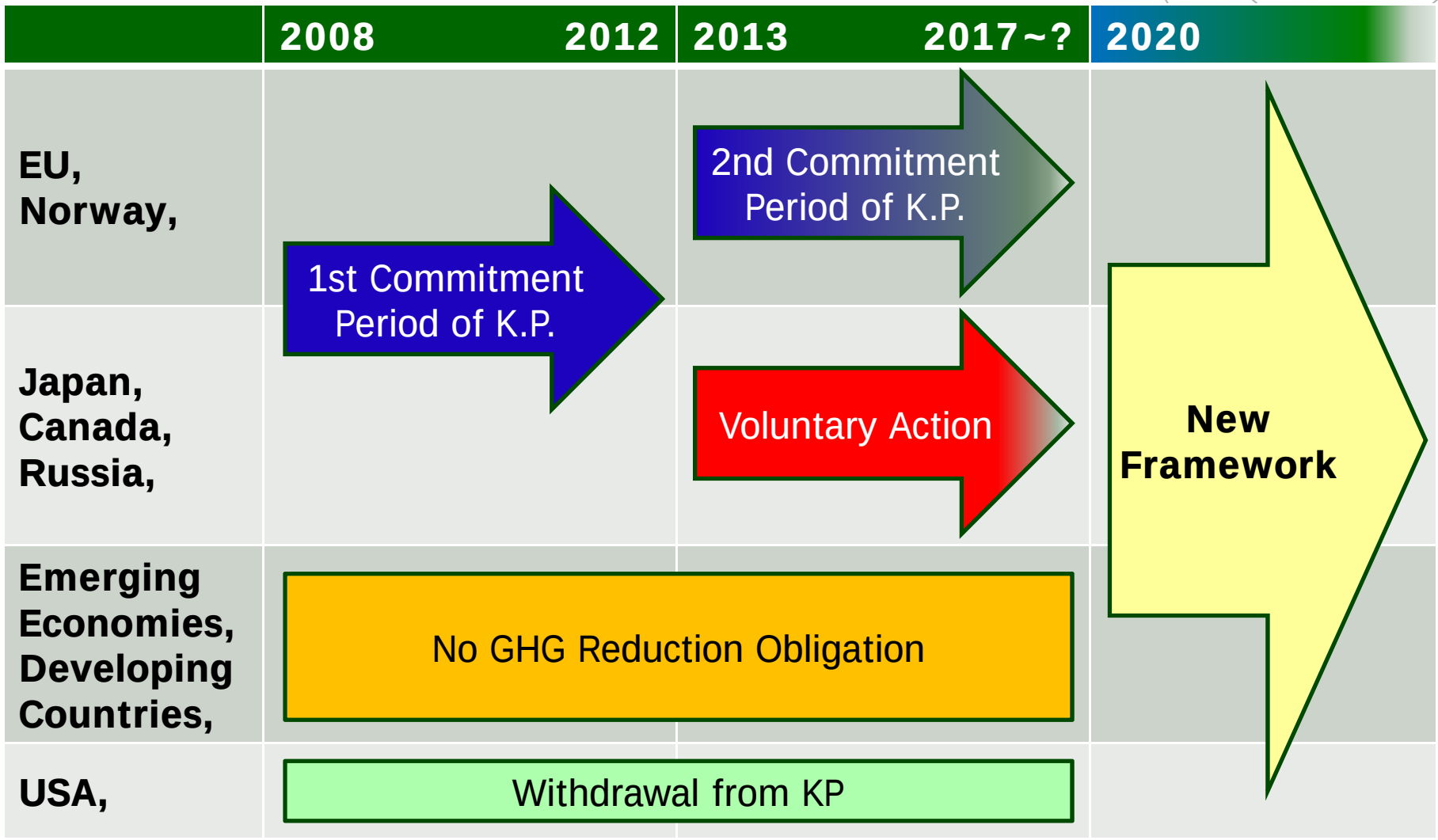
- **Technology**
  - The Technology Mechanism will become fully operational in 2012.
  - The full terms of reference for the operational arm of the Mechanism - the Climate Technology Centre and Network - are agreed, along with a clear procedure to select the host. The UNFCCC secretariat will issue a call for proposals for hosts on 16 January 2012.
- **Support of developing country action**
  - Governments agreed a registry to record developing country mitigation actions that seek financial support and to match these with support. The registry will be a flexible, dynamic, web-based platform.
- **Other key decisions**
  - A forum and work programme on unintended consequences of climate change actions and policies were established.
  - Under the Kyoto Protocols Clean Development Mechanism, governments adopted procedures to allow carbon-capture and storage projects. These guidelines will be reviewed every five years to ensure environmental integrity.
  - Governments agreed to develop a new market-based mechanism to assist developed countries in meeting part of their targets or commitments under the Convention. Details of this will be taken forward in 2012.

Current and Future Framework

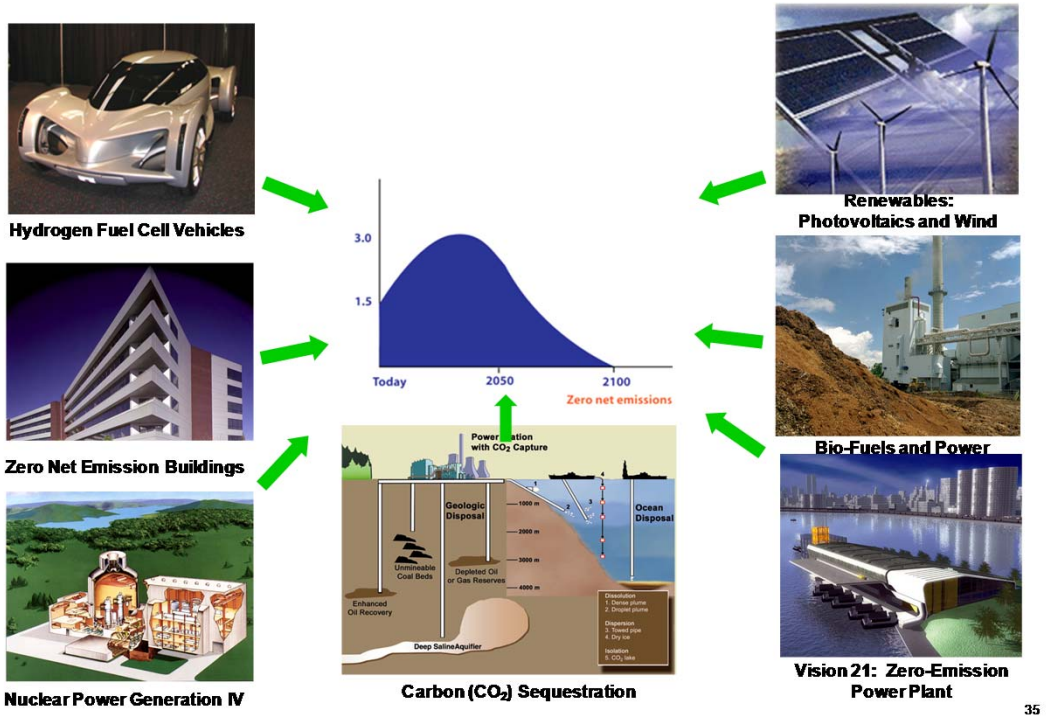




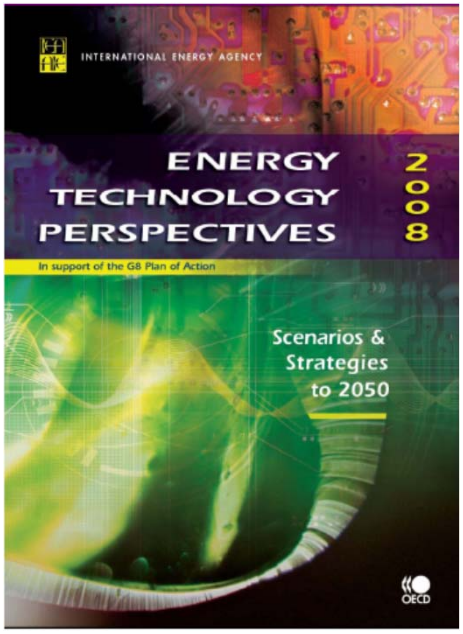
Towards a Deep Reduction of Greenhouse Gas

The Technology Challenge
Stabilizing Greenhouse Gas Concentrations in the Atmosphere

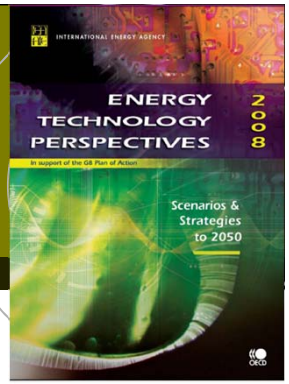
- Improvement of energy efficiency
- Switching to lower carbon fuels, e.g. coal to natural gas
- Use of non carbon fuels, e.g. renewables, nuclear
- Enhancement of natural sinks for CO_2, e.g. forestry
- Capture and sequestration of CO_2.



IEA
Energy Technology Perspectives 2008

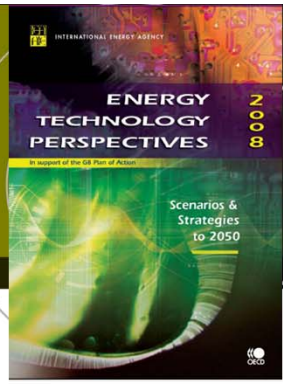


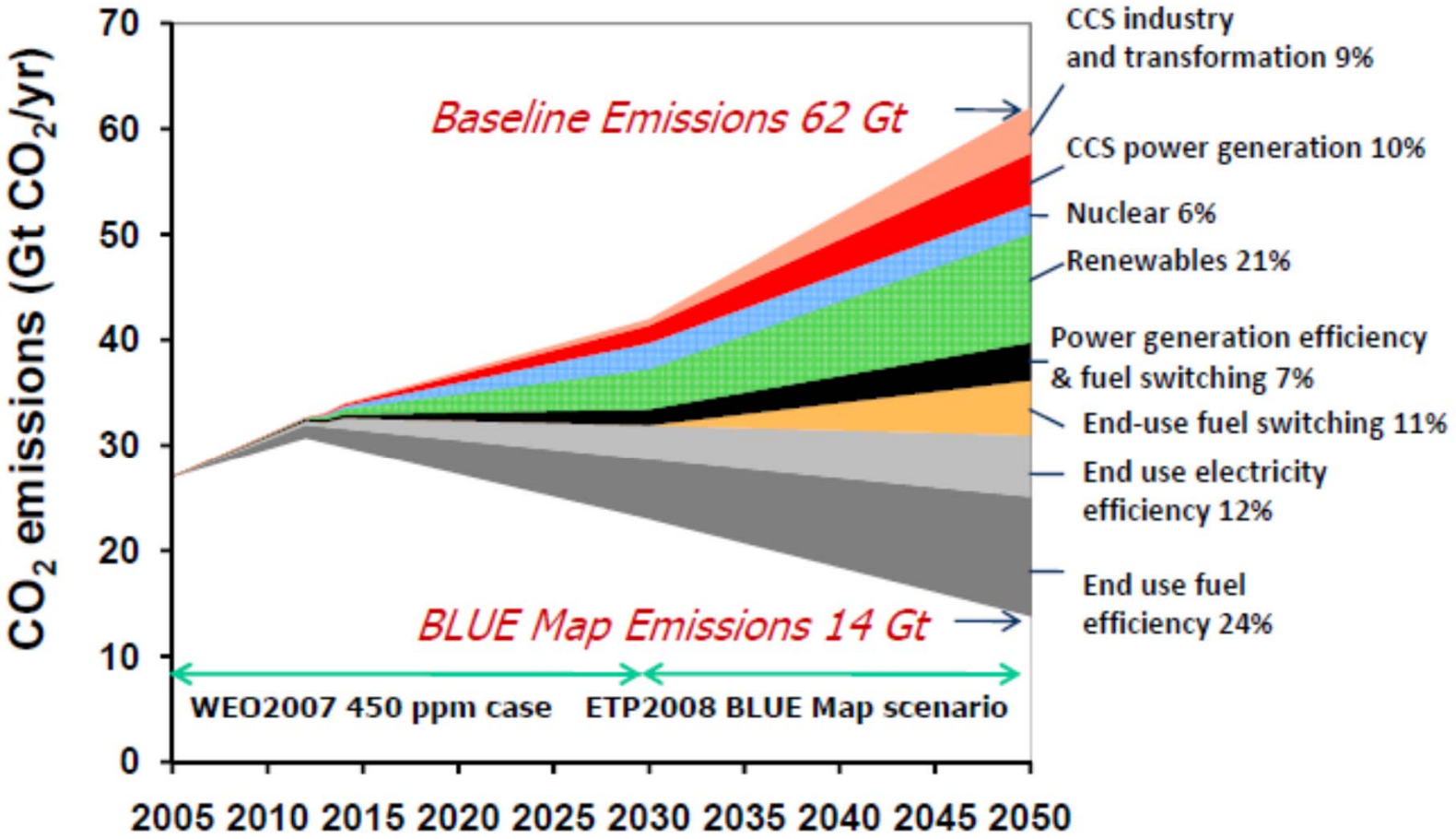
Scenarios in ETP2008



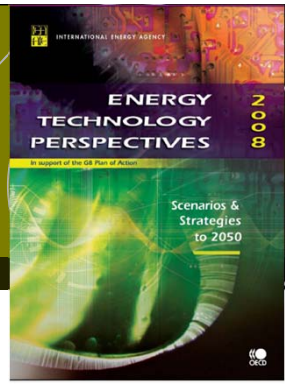
- **ACT Scenarios**
  - **Energy CO_2 emissions in 2050 back to the level of 2005**
  - **Revision of ACT as published in ETP2006**
    - **Options with a marginal cost up to \$50/tCO_2 – worldwide (+\$20/bbl)**
    - **Cost estimate has doubled from ETP2006**
  - **This implies a significantly adjusted 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**

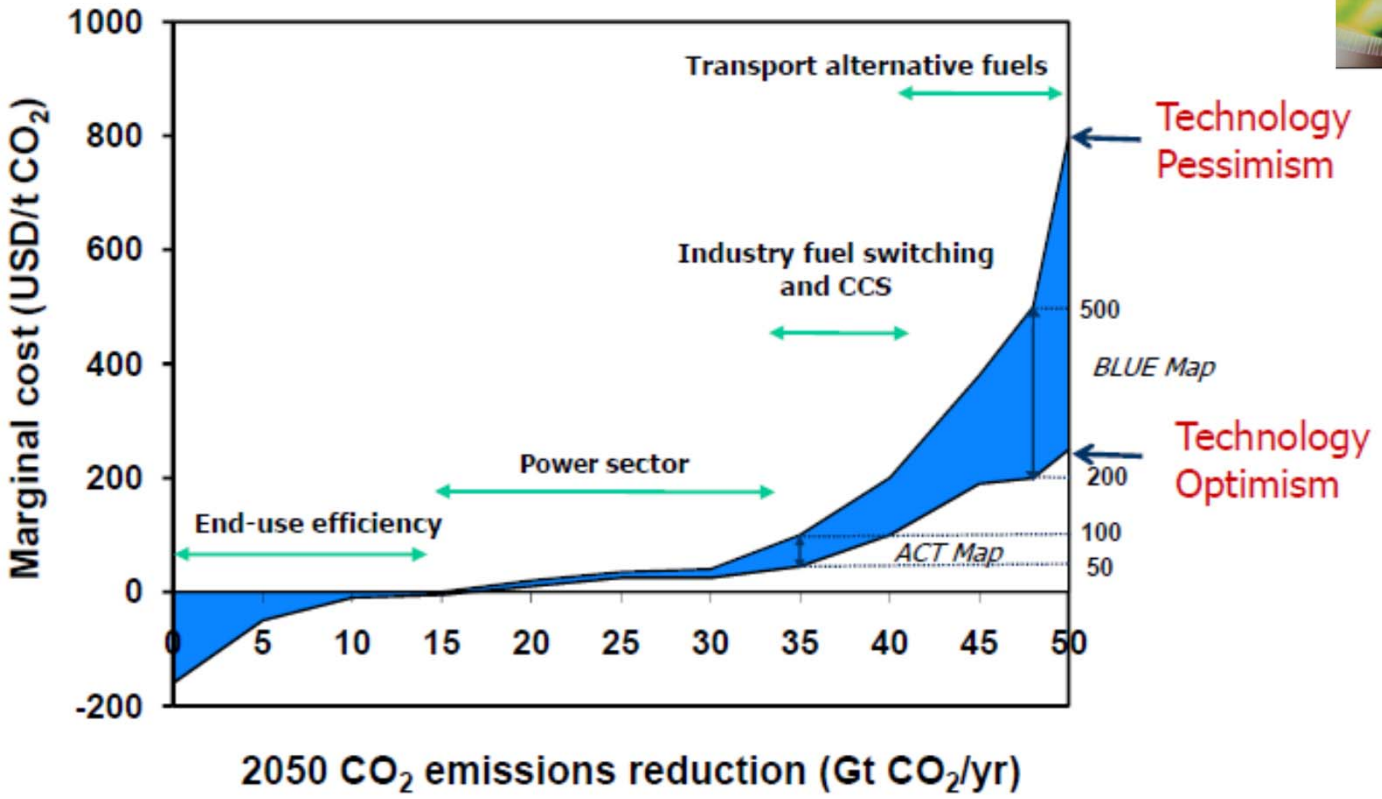
ETP2008
CO_2 Emission Reduction Scenario





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**

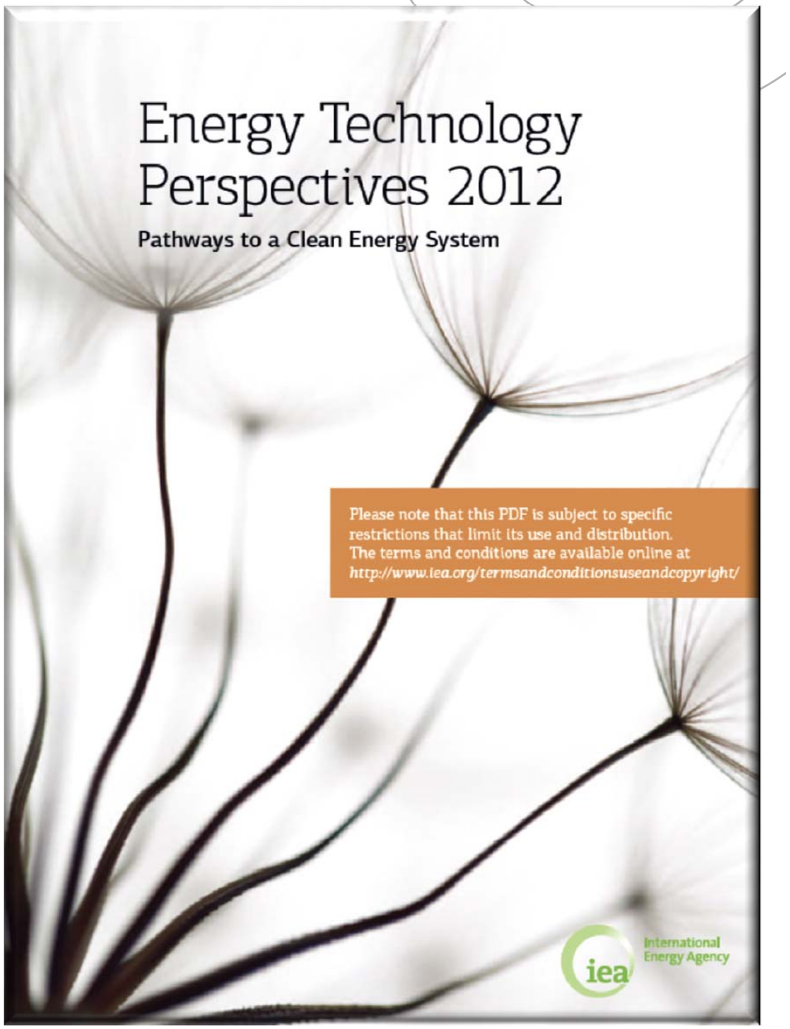
Energy Technology Perspectives 2012

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

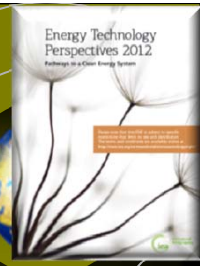
Part 2: Energy Systems
5. Heating and Cooling
6. Flexible Electricity Systems
7. Hydrogen

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

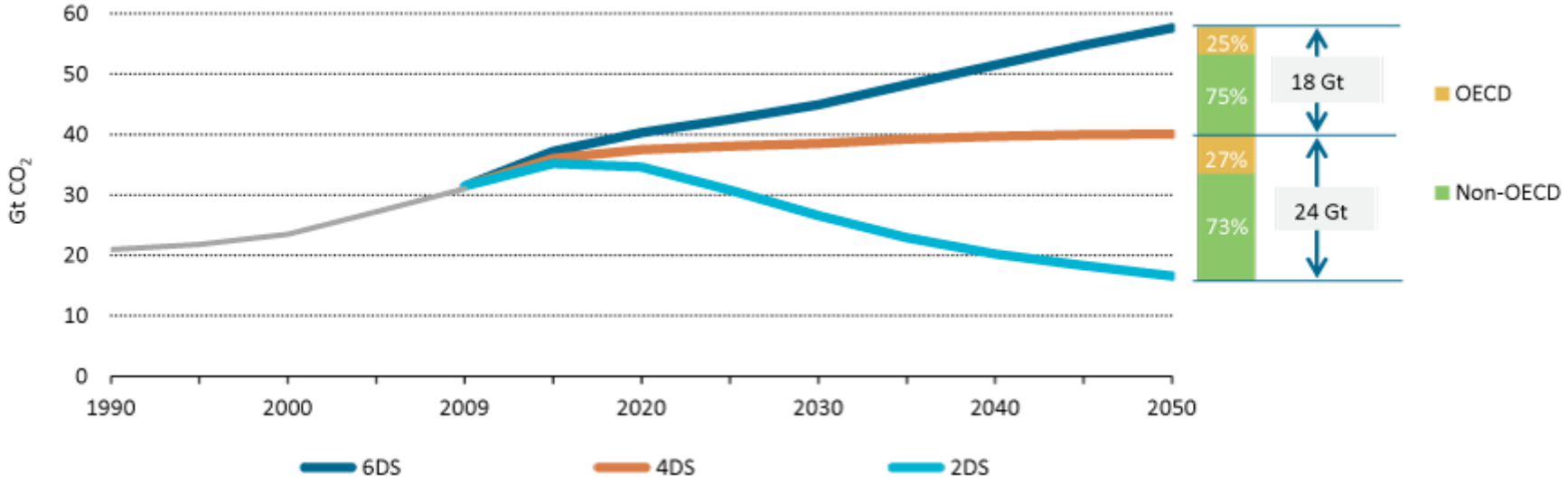
reflecting pledges by countries to cut emissions and boost energy efficiency

The 4°C Scenario

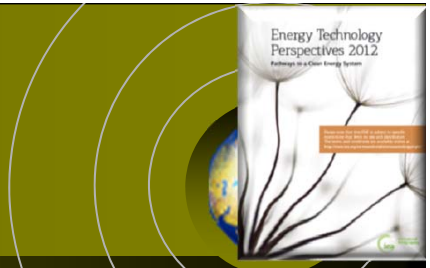
6DS

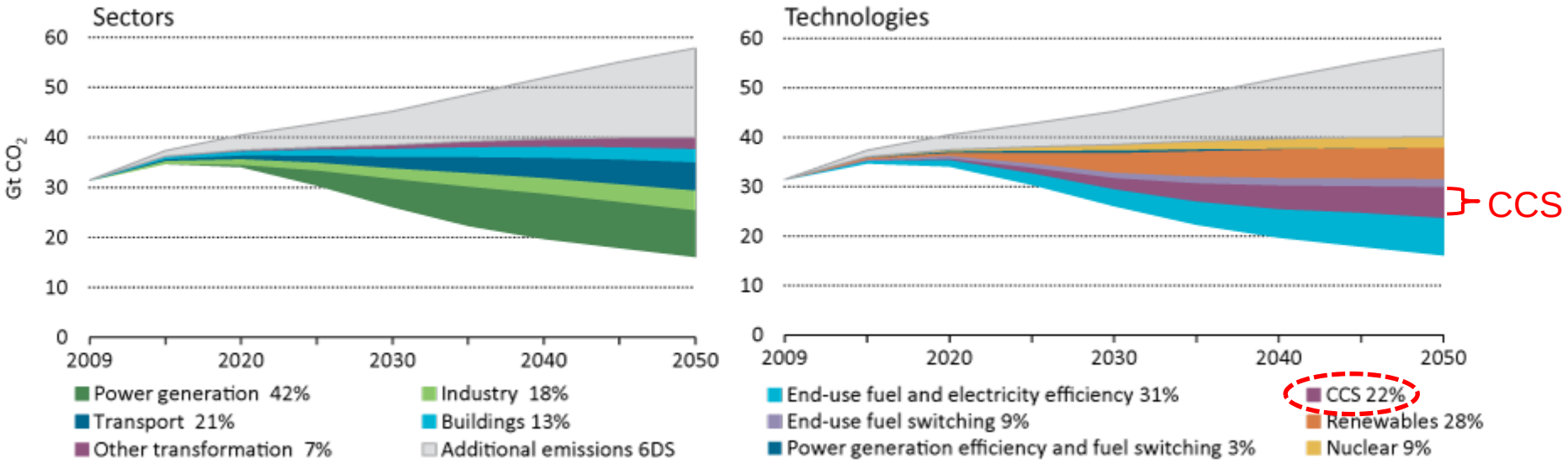
where the world is now heading with potentially **devastating** results

The 6°C Scenario

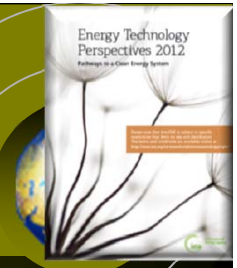


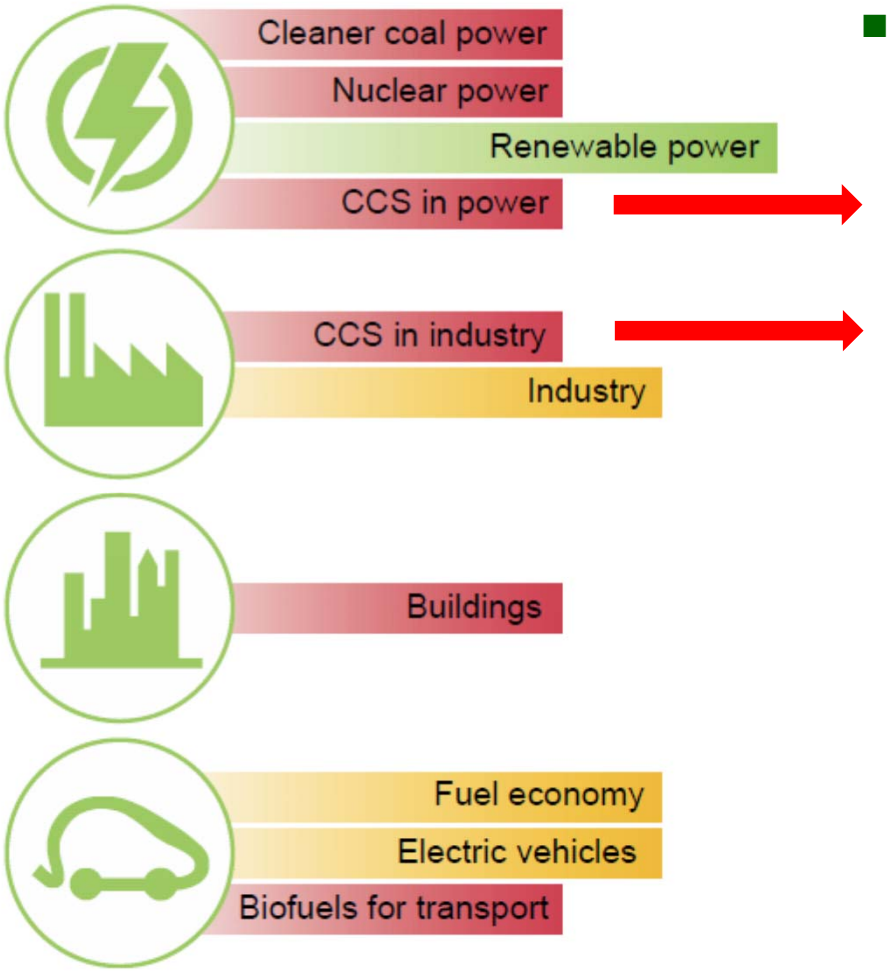
ETP 2012
Challenges for 2DS Scenario





ETP 2012
Progress in Clean Energy is too Slow

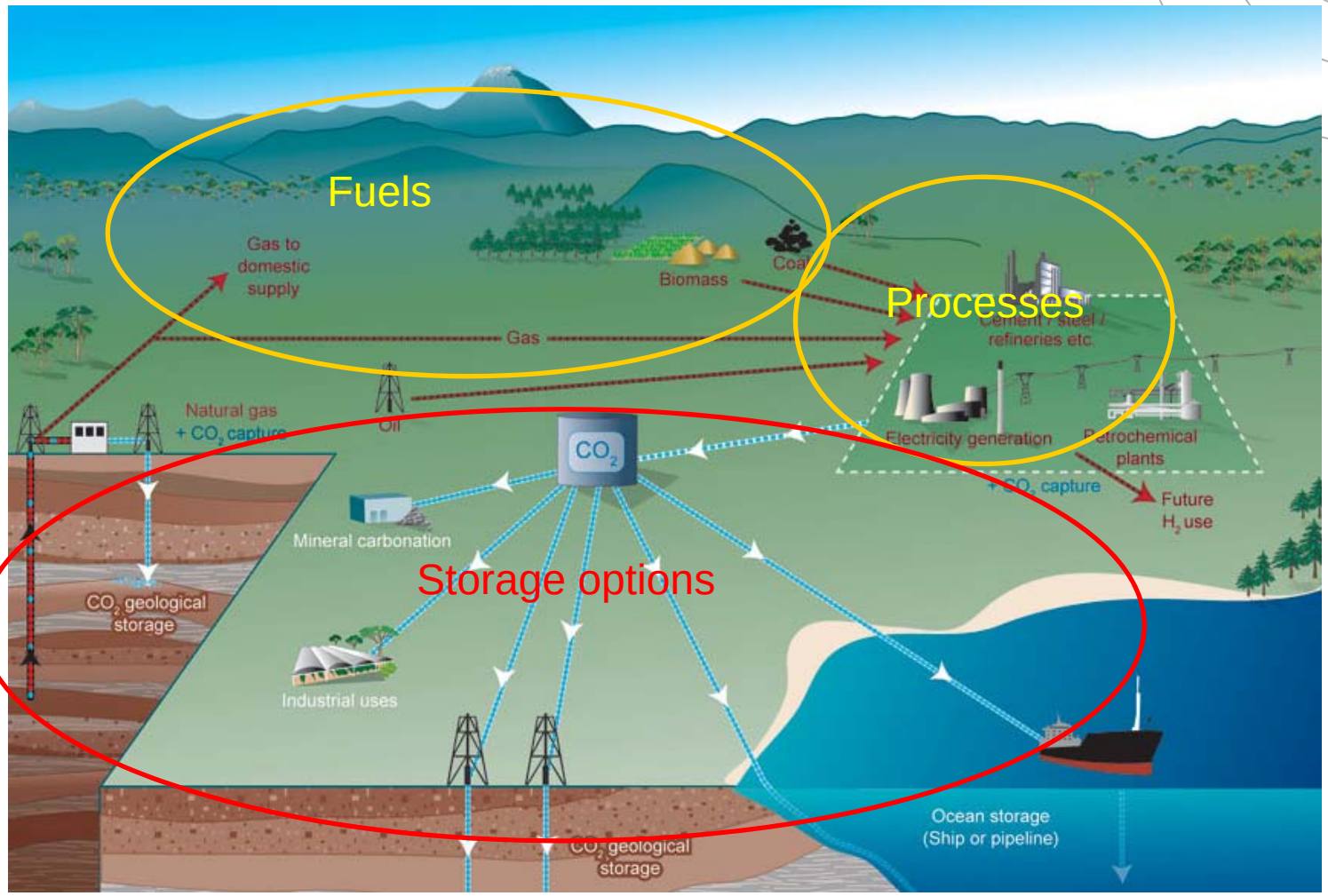




- **Some of the technologies with the largest potential are showing the least progress**
  - **Development and deployment of CCS is seriously off pace to reach 269 Mt/CO2 captured across power and industrial applications in 2020 in the 2DS. This is equivalent to about 120 CCS facilities.**

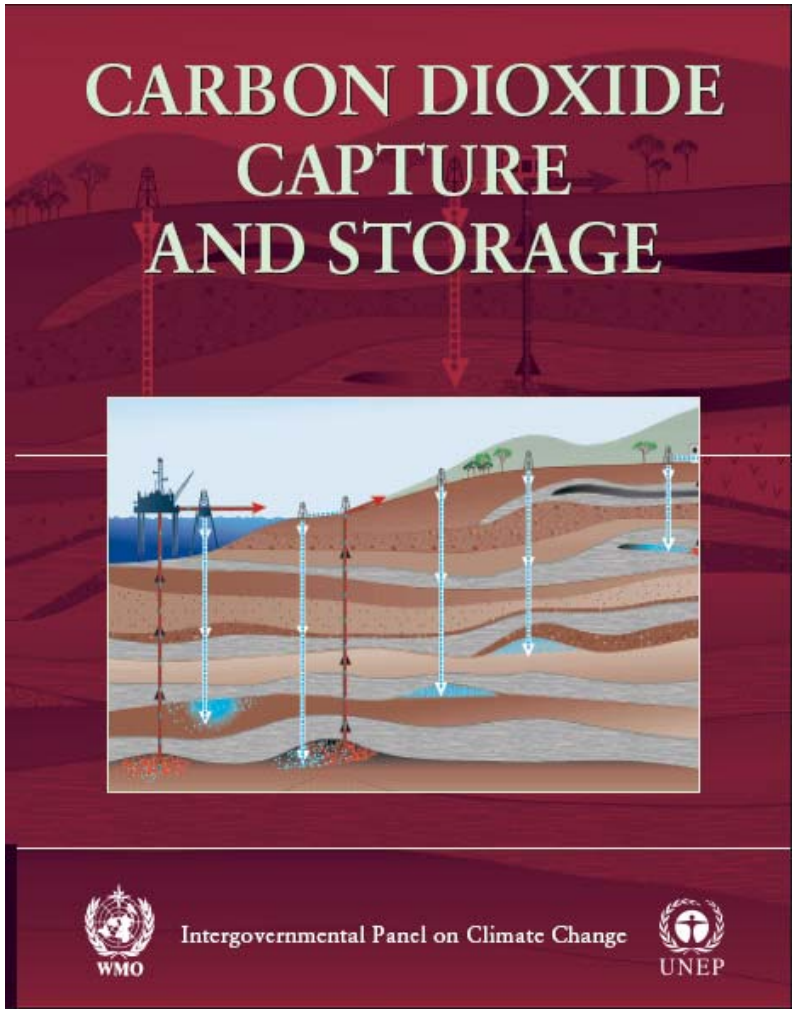
CO_2 Capture and Storage
or
CO_2 Capture and Sequestration
(CCS)

CO_2 Capture and Storage System

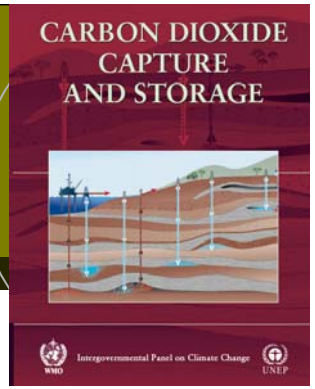


Source: IPCC SRCCS

The IPCC Special Report on Carbon Dioxide Capture and Storage

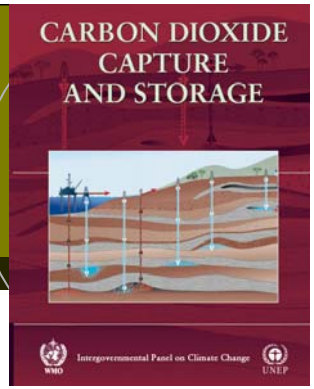


How Could CCS Play a Role in Mitigating Climate Change?



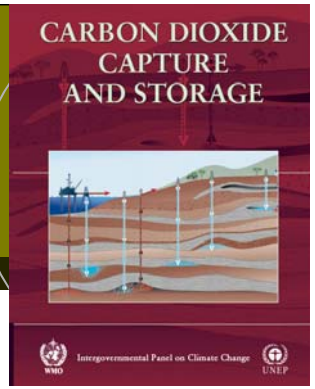
- **Part of a portfolio of mitigation options**
- **Reduce overall mitigation costs**
- **Increase flexibility in achieving greenhouse gas emission reductions**
- **Application in developing countries important**
- **Energy requirements point of attention**

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$/t$CO_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**

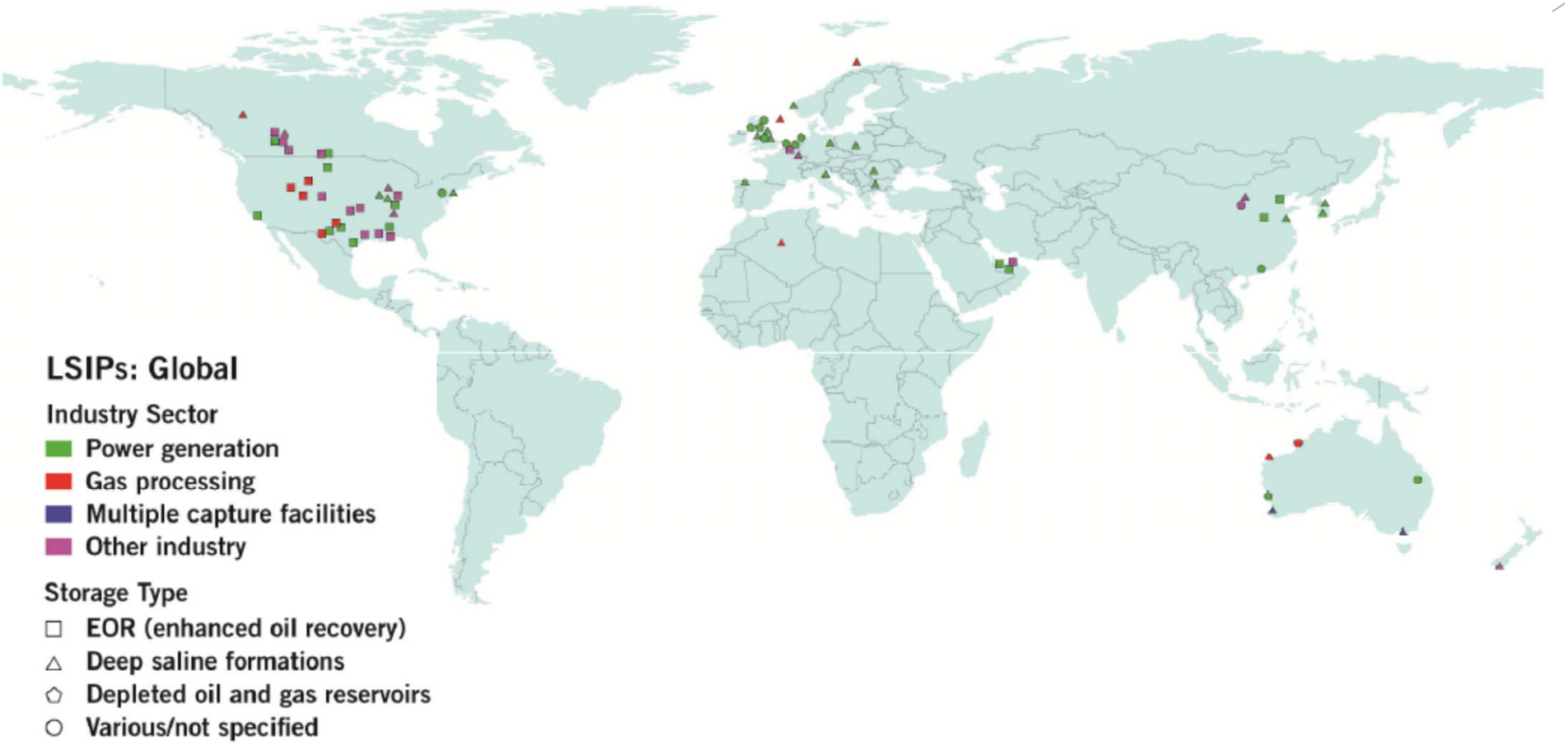
Storage Potential



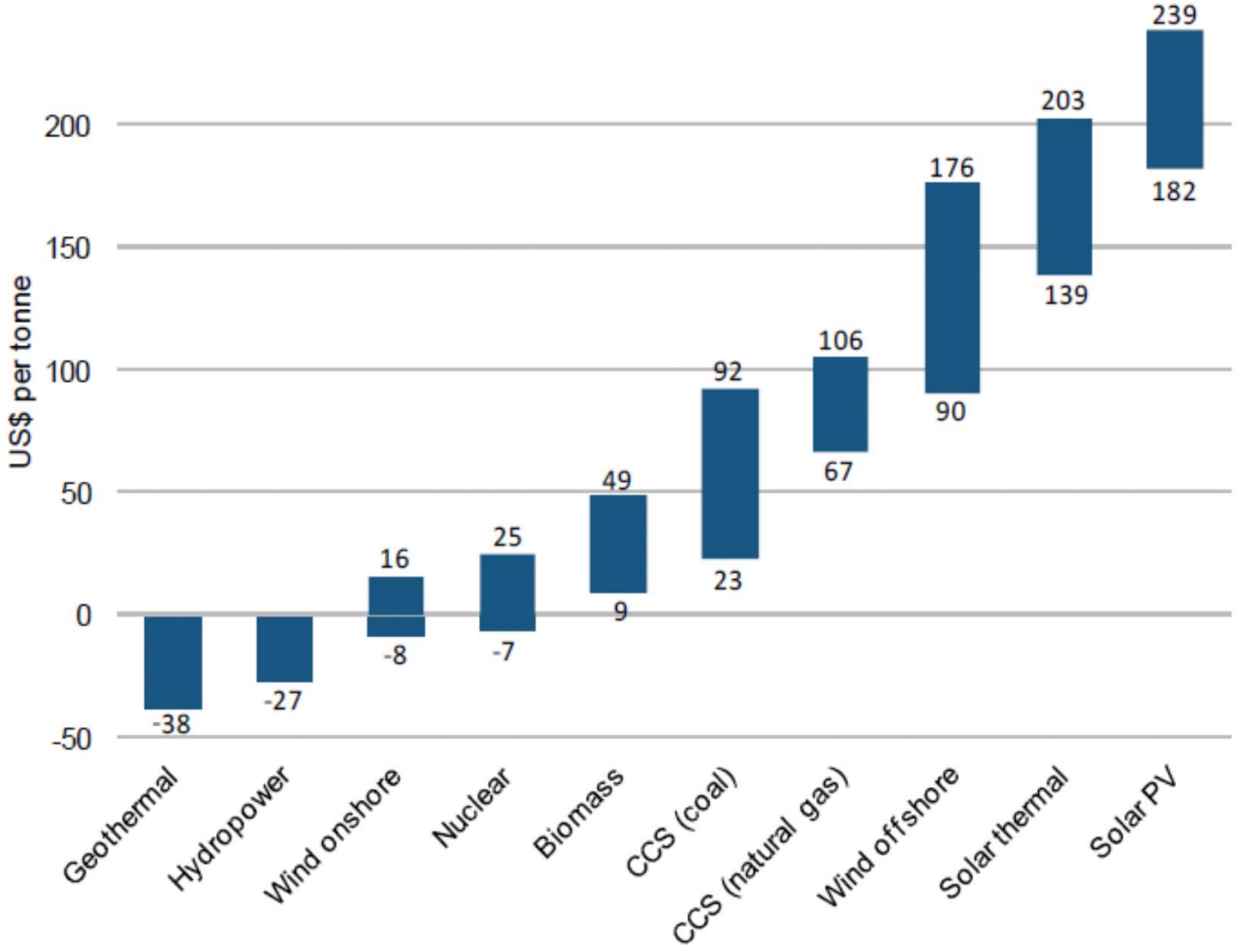
- **Geological storage: likely at least about 2,000 $GtCO_2$ in geological formations**
  - *"Likely" is a probability between 66 and 90%.*
  - **Oil / gas fields: 675 - 900 $GtCO_2$**
  - **Saline formations: 1000 - ~ 104 $GtCO_2$**
  - **Coal beds: 3 - 200 $GtCO_2$**
- **Ocean storage: on the order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

Large Scale Integrated Project

(Global CCS Institute, 2011)



Levelised Cost of Electricity of Low-carbon Technologies and Conventional Power Generation
（Global CCS Institute, 2011）



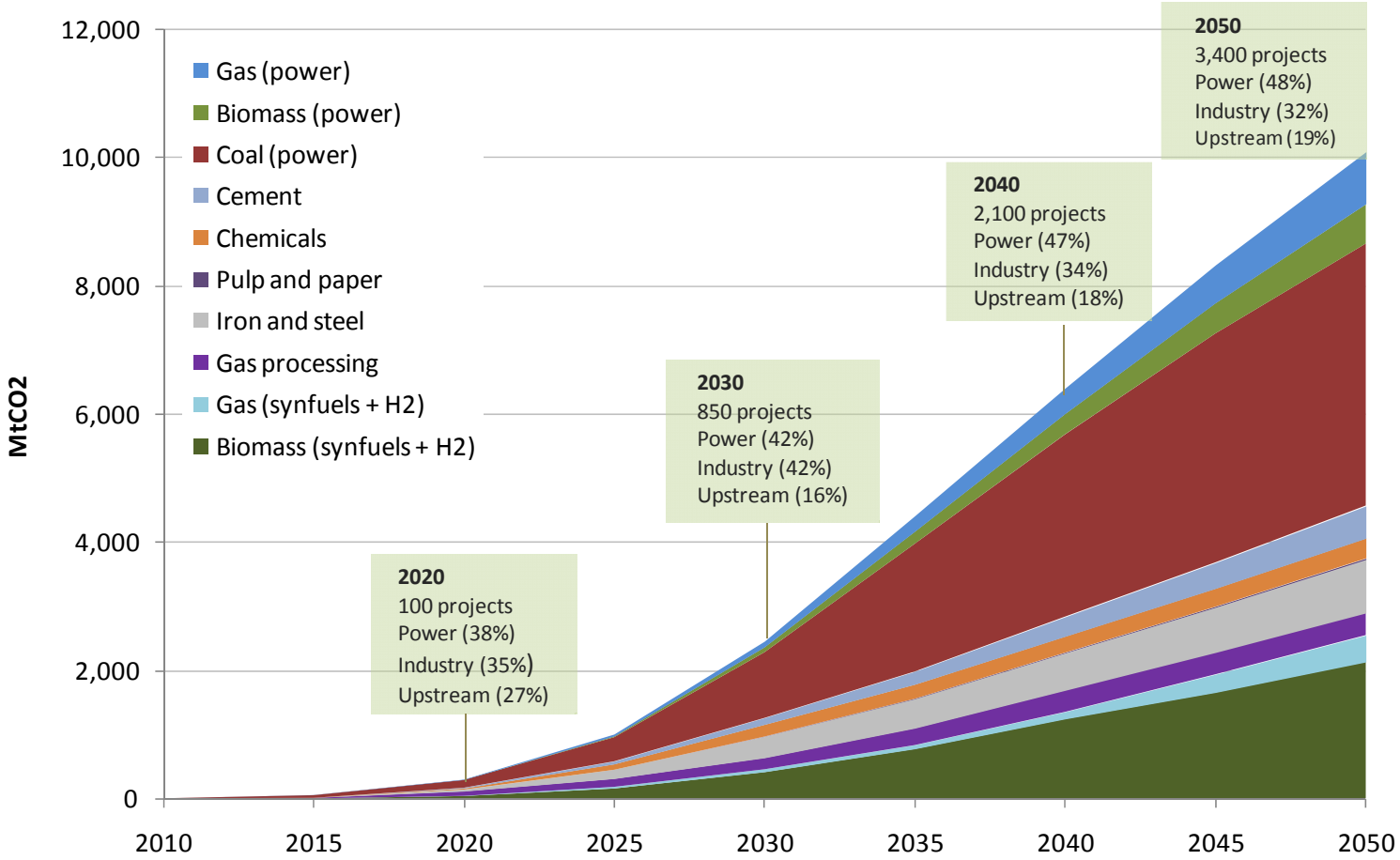
CCS in G8 Summit
G8 Hokkaido Toyako Summit Leaders Declaration (8 July 200)

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

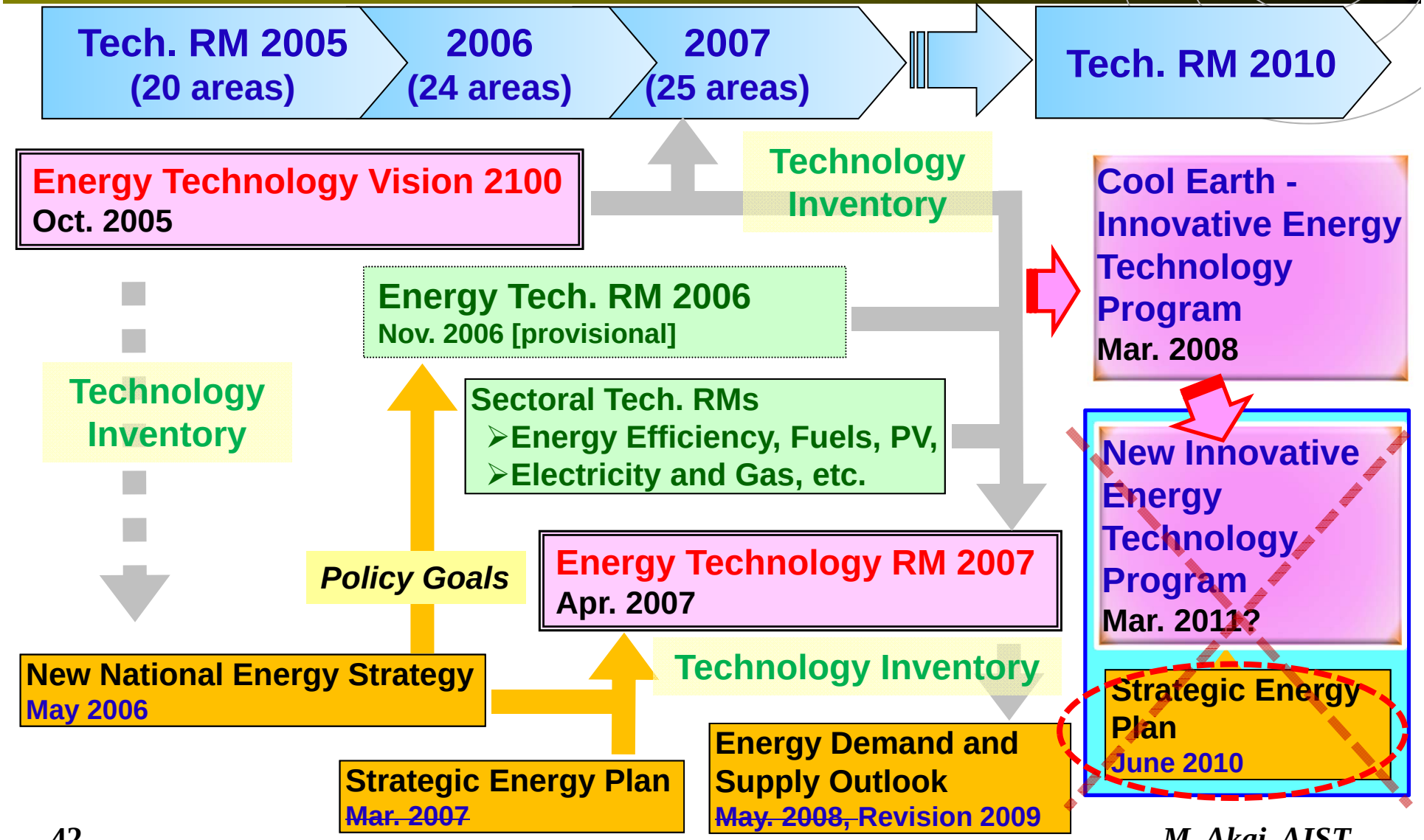
Global Deployment of CCS 2010–50 by Sector

BLUE Map Scenario (~450 ppm)



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

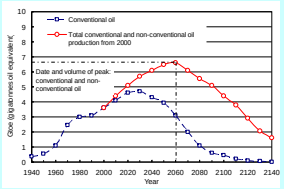
- **An approach to Low Carbon Society from Energy Policy**
- **Purpose**
  - **To establish strategic energy R&D plan by**
    - **identifying technologies and developing technology portfolio to prepare for resource and environmental constraints**
    - **considering optimum R&D resource allocation in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

⇒http://www.iae.or.jp/2100.html

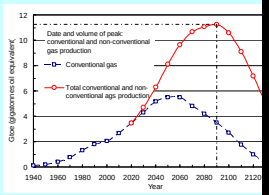
Assumptions towards 2100

Resource Constraints

- Although assumption of the future
  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

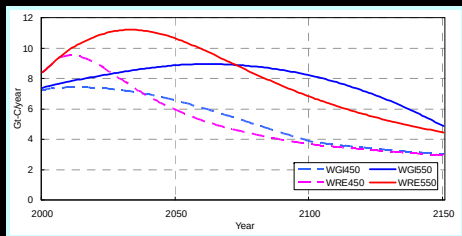


The Complementarity of Conventior Conventional Gas Production: giving a H Peak to Global Gas Supplies

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**

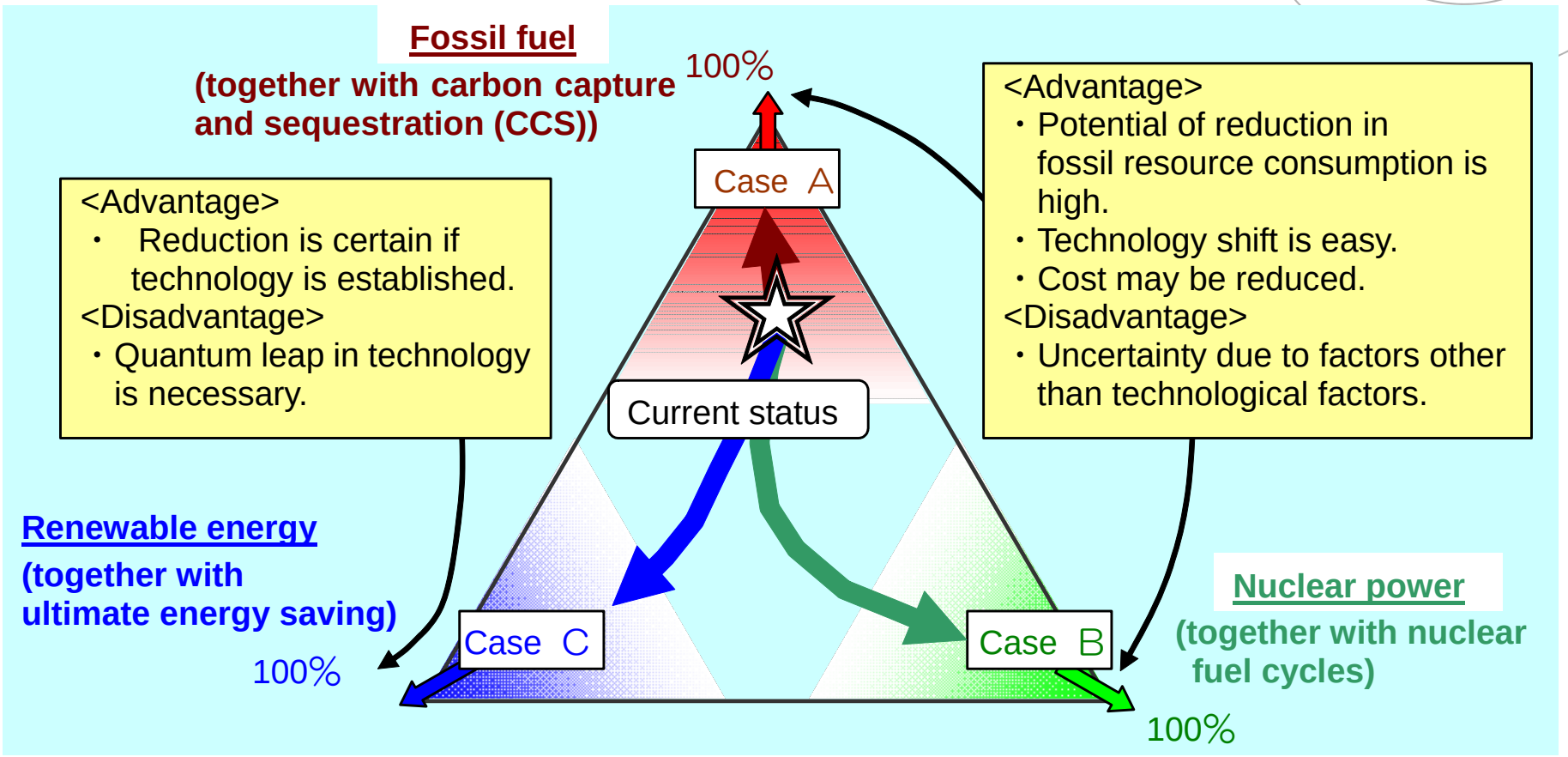
To Overcome Constraints ---

- **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)

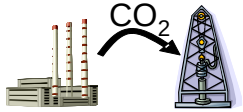
- *Case A assumes a situation where we cannot heavily rely on energy saving.*
- *The increase of the share of electricity and hydrogen is considered.*

** 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)

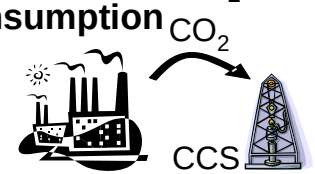
Supplying with coal fired power plants with CCS

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

Electric Power

Efficient coal-fired power plant

CCS

Innovative solar power

Advanced nuclear power

Efficient LNG-fired power plants

Superconducting power transmission

Demand side

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

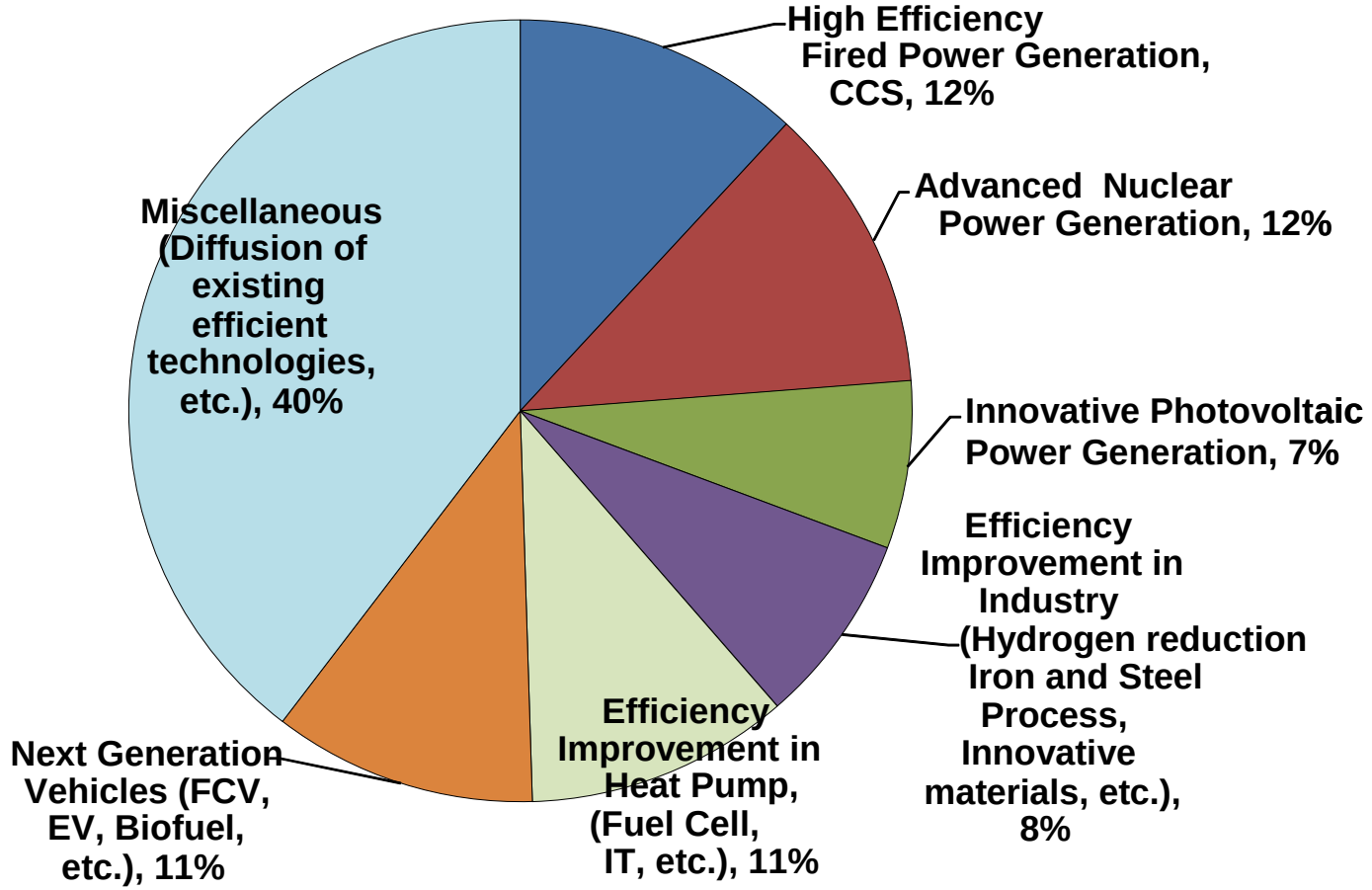
Efficient IT devices / networks

HEMS / BEMS / Regional EMS

Cross sectoral

Power storage | **Power electronics** | **Hydrogen production / storage / transport** | **CCS (restated)**

Contribution of Technologies for 50 % Emission Reduction in 2050

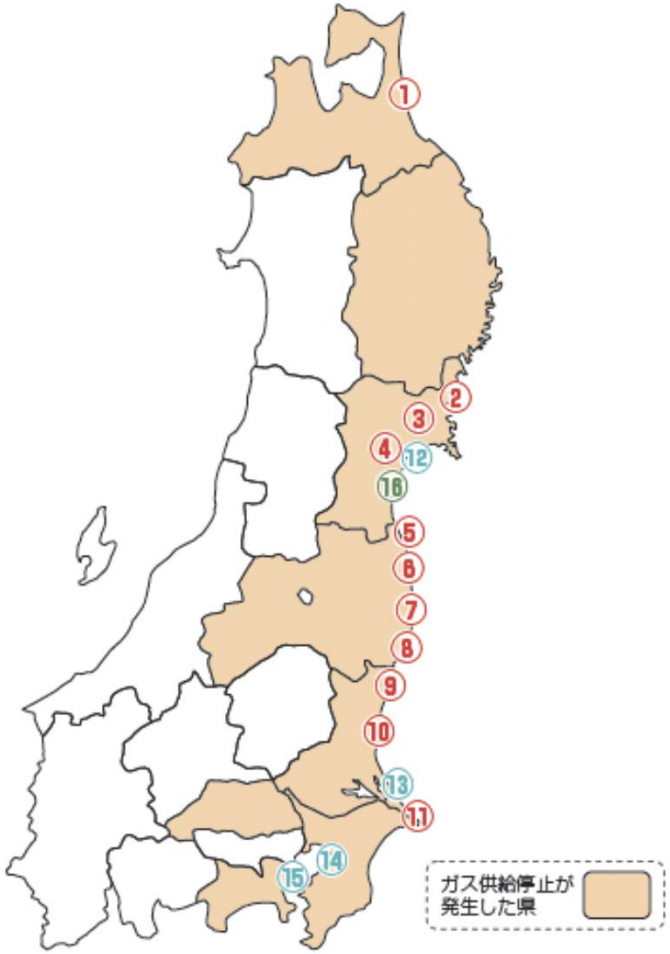


Source: Institute of Applied Energy

- 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.

Process

Future Schedule

19

July

National disucussions

- Development of the information database (early July)
- Public hearing sessions (at 11 places nationwide, on every weekend from July 14 to mid-August)
- Solicitation of public comments (from July 2 to the end of July)
- Deliberative Polling (early August)

August

Decide on Innovative Strategy for Energy and the Environment

Promptly

Formulate a New Strategic Energy Plan of Japan

By the end of 2012

Formulate Framework for Nuclear Energy Policy, Global Warming Countermeasures, and Framework for Green Development Policy

Thereafter

- **Continuous review**
  : Provide the relevant information to the public, while grasping international energy situations and other international circumstances relating to the global environment, trends in technological innovation, and public confidence in the government's energy policy.

- **Verification to be made by 2030**
  : Verify the general direction of the policy by 2030, whichever scenario is chosen.

Three Scenarios for 2030

•The shares mean those in the electric energy generated. Figures in parentheses indicate changes from 2010 before the Great East Japan Earthquake.

	2010	2030				
		0% scenario		15% scenario	20-25% scenario	(Reference) Current Strategic Energy Plan of Japan
		Before additional measures	After additional measures			
Share of nuclear energy	26% Note 1	0% (-25%)	0% (-25%)	15% (-10%)	20 to 25% (-5 to -1%)	45%
Share of renewable energy	10%	30% (+20%)	35% (+25%)	30% (+20%)	30 to 25% (+20 to +15%)	20%
Share of fossil fuels	63%	70% (+5%)	65% (Current level)	55% (-10%)	50% (-15%)	35%
Share of non-fossil energy resources	37%	30% (-5%)	35% (Current level)	45% (+10%)	50% (+15%)	65%
Electric energy generated	1.1 trillion kWh	Approx. 1 trillion kWh (-10%)	Approx. 1 trillion kWh (-10%)	Approx. 1 trillion kWh (-10%)	Approx. 1 trillion kWh (-10%)	Approx. 1.2 trillion kWh
Final energy consumption	390 million kl	310 million kl (-72 million kl)	300 million kl (-85 million kl)	310 million kl (-72 million kl)	310 million kl (-72 million kl)	340 million kl
Greenhouse gas emissions Note 2 (compared to 1990)	-0.3%	-16%	-23% (-21%)	-23% (-22%)	-25% (-25%)	(Around -30%)

Note 1: The share of nuclear energy under the current Strategic Energy Plan of Japan (53%) is the share of large-scale power sources (excluding cogeneration and private power generation)
Note 2: Figures in parentheses indicate only energy-related CO2 emissions.

July 2012

Innovative Strategy for Energy and the Environment

Overview

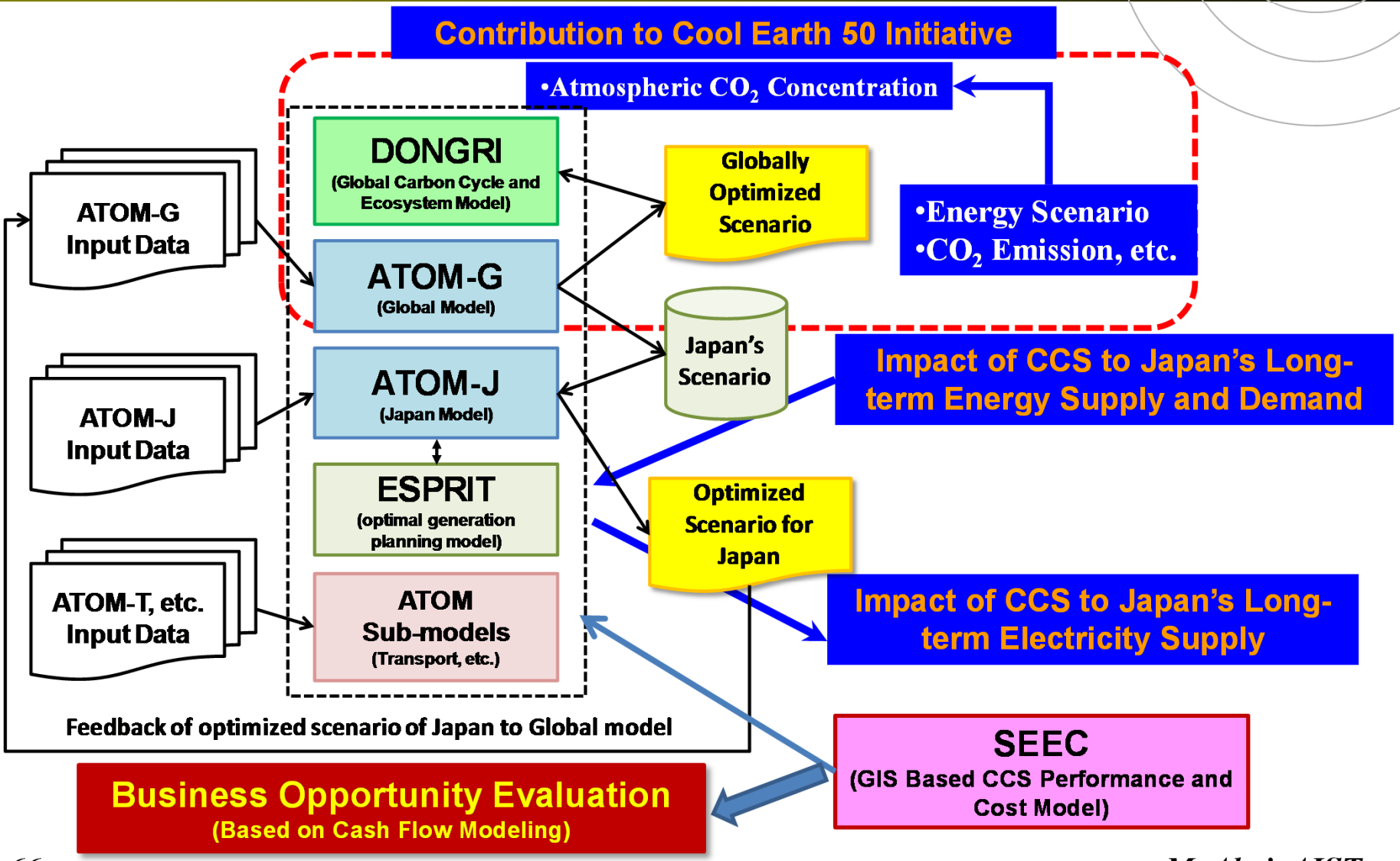
1. Realization of a society not dependent on nuclear power
2. Realization of Green Energy Revolution
3. For ensuring stable supply of energy
4. Bold implementation of reform of electric power system (Compose the Strategy for the "Reform of Electricity Power Systems (tentative)" by the end of this year)
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

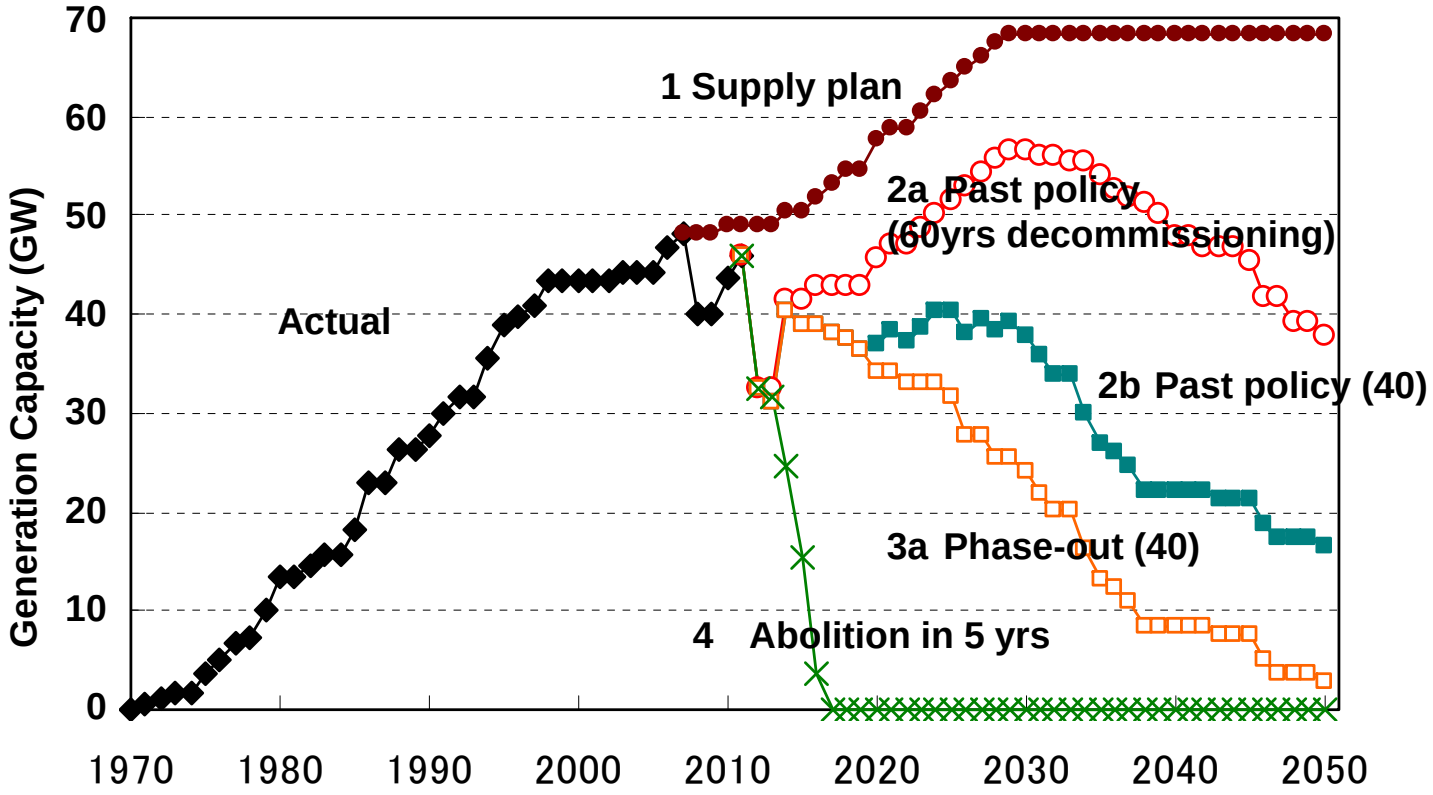
Energy Scenario Study

Energy Scenario Analysis

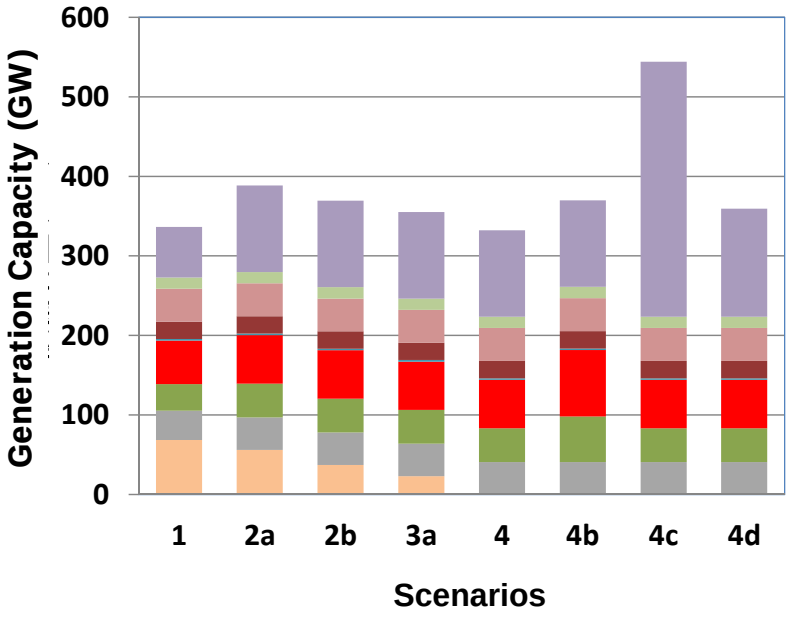
Economic and Scenario Studies to Appraise Potential Contribution of CCS to Long-term Stabilization Goal

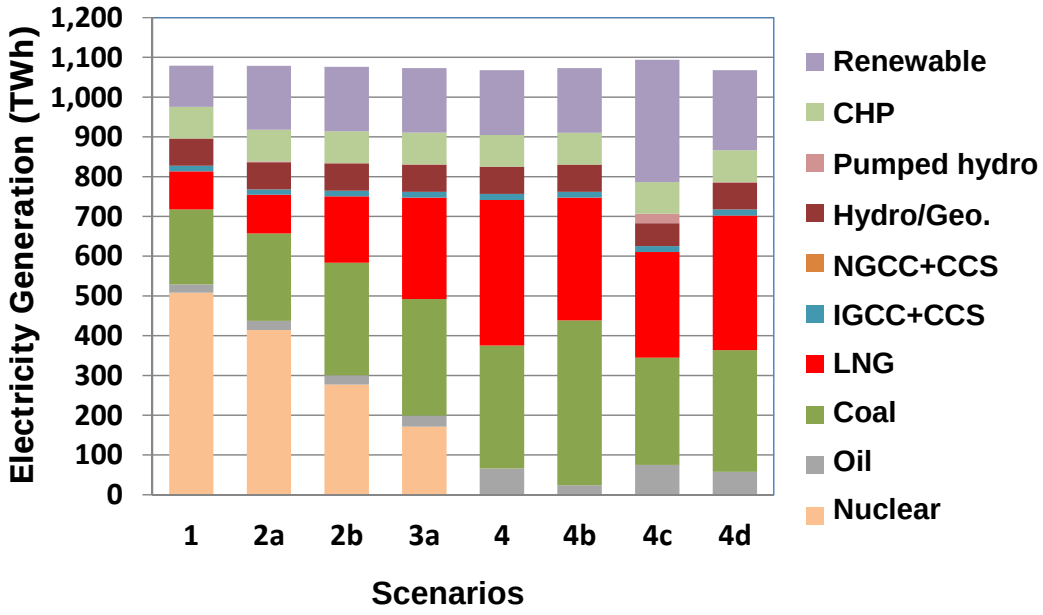


Nuclear Scenarios

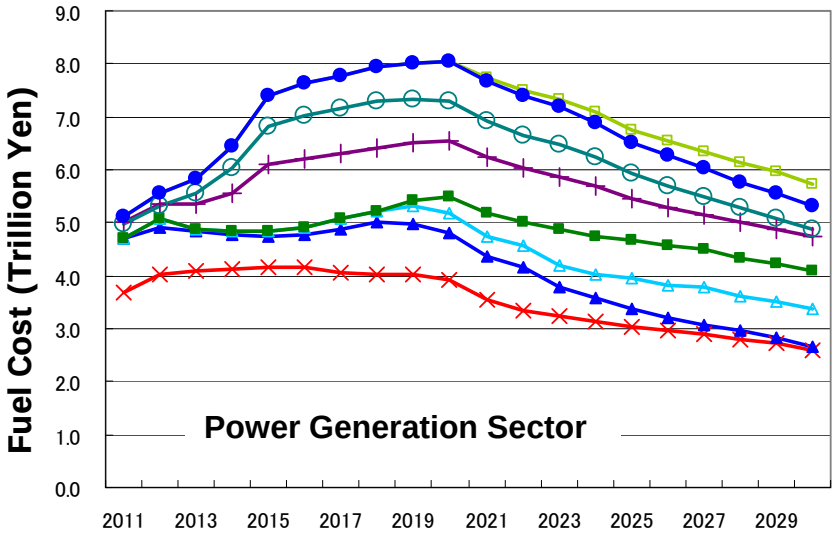


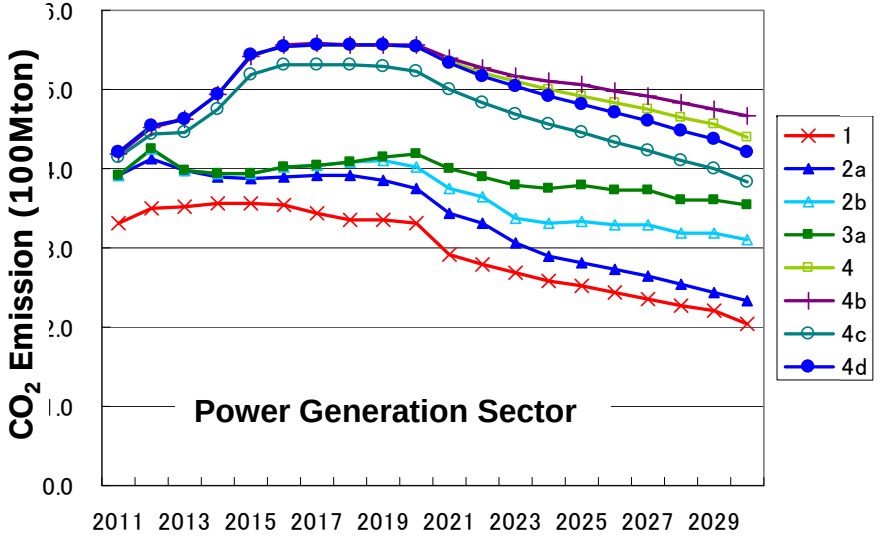
Electricity Generation in 2030



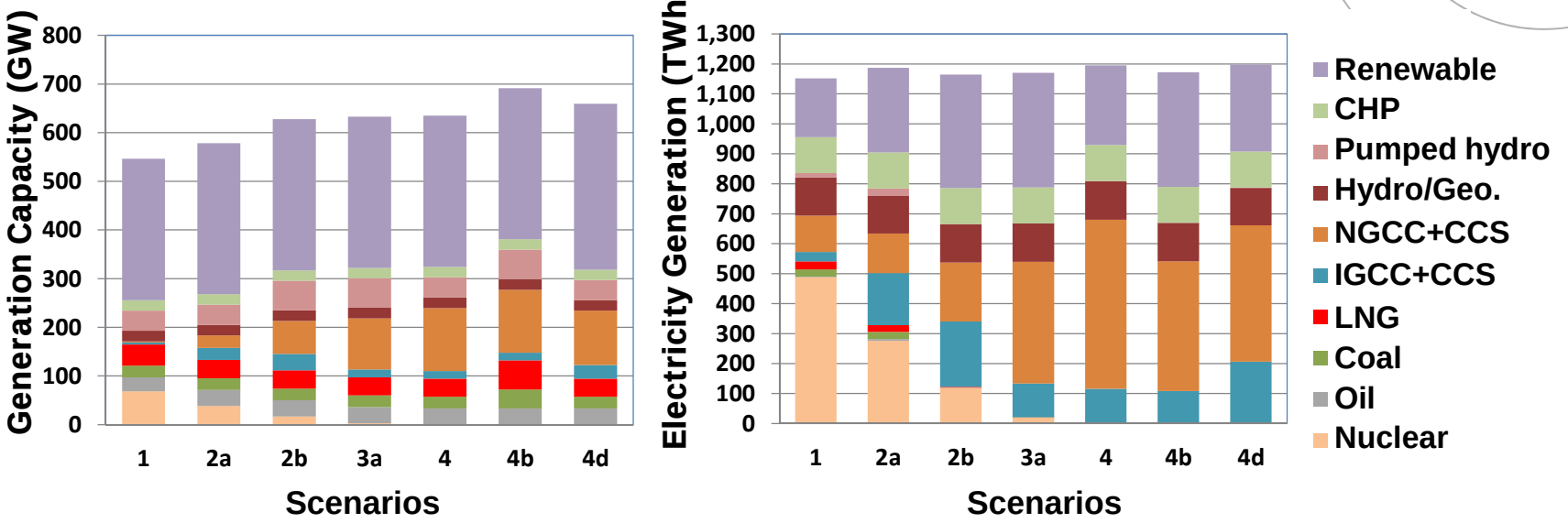


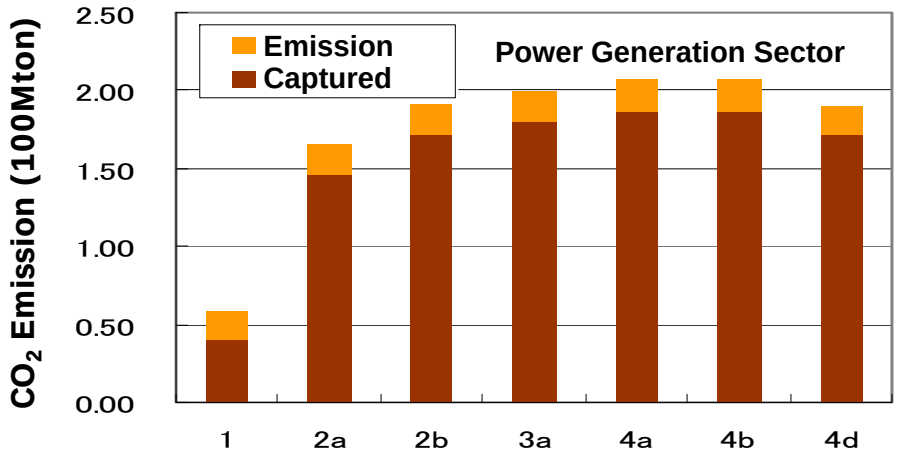
Fuel Cost and CO_2 Emission towards 2030





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

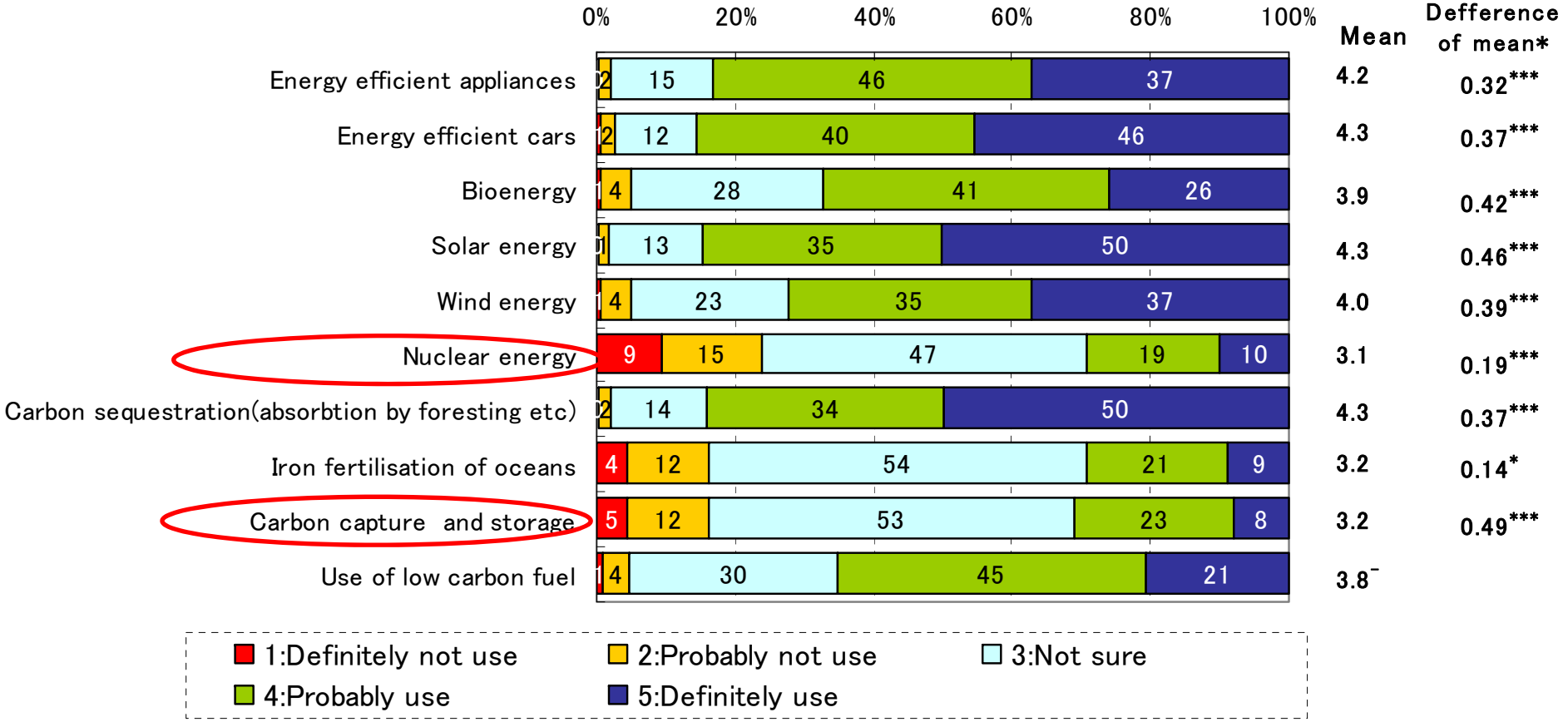




Public Perception

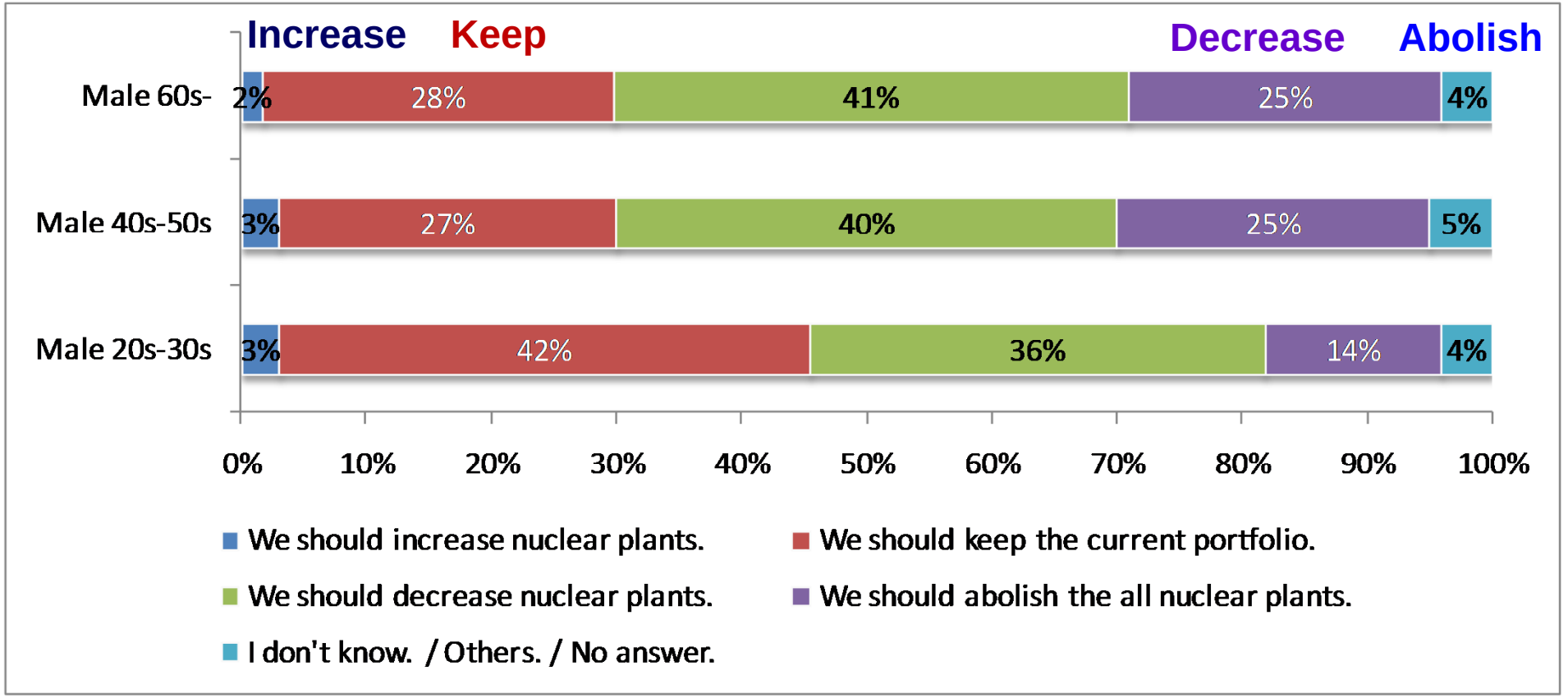
Nuclear and CCS:
Similarity in Perception (AIST Study)

- **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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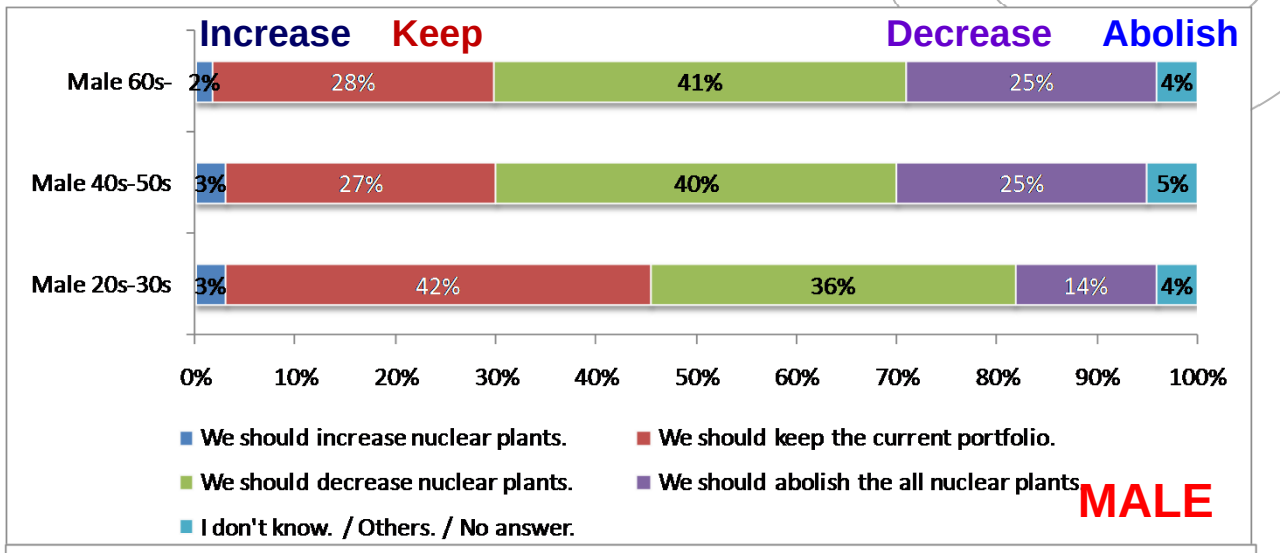
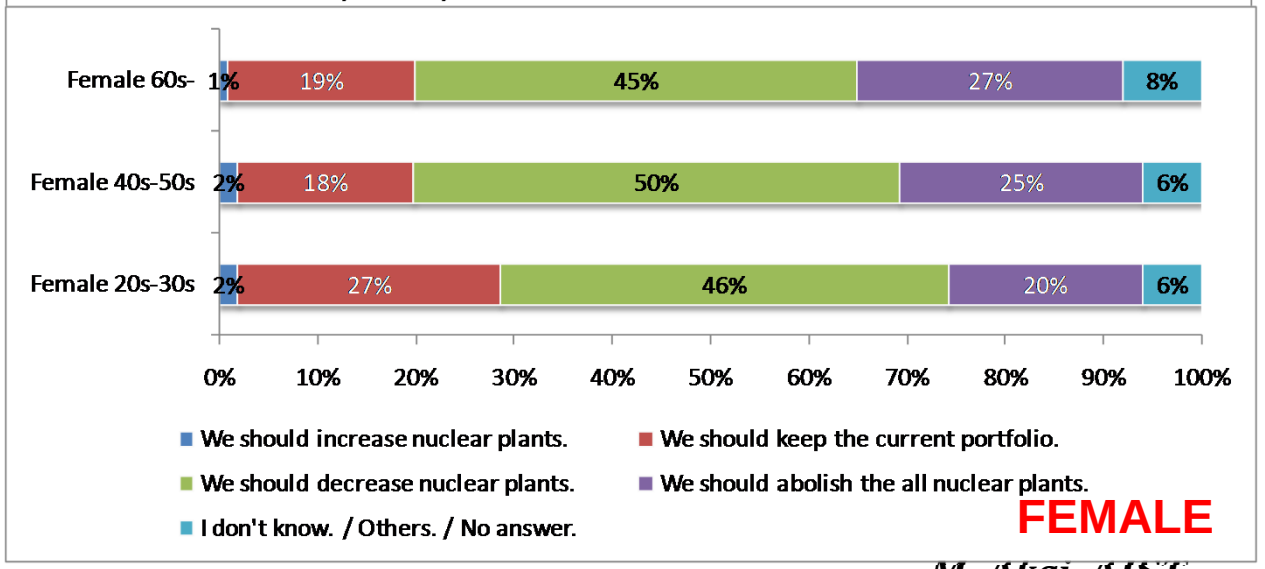
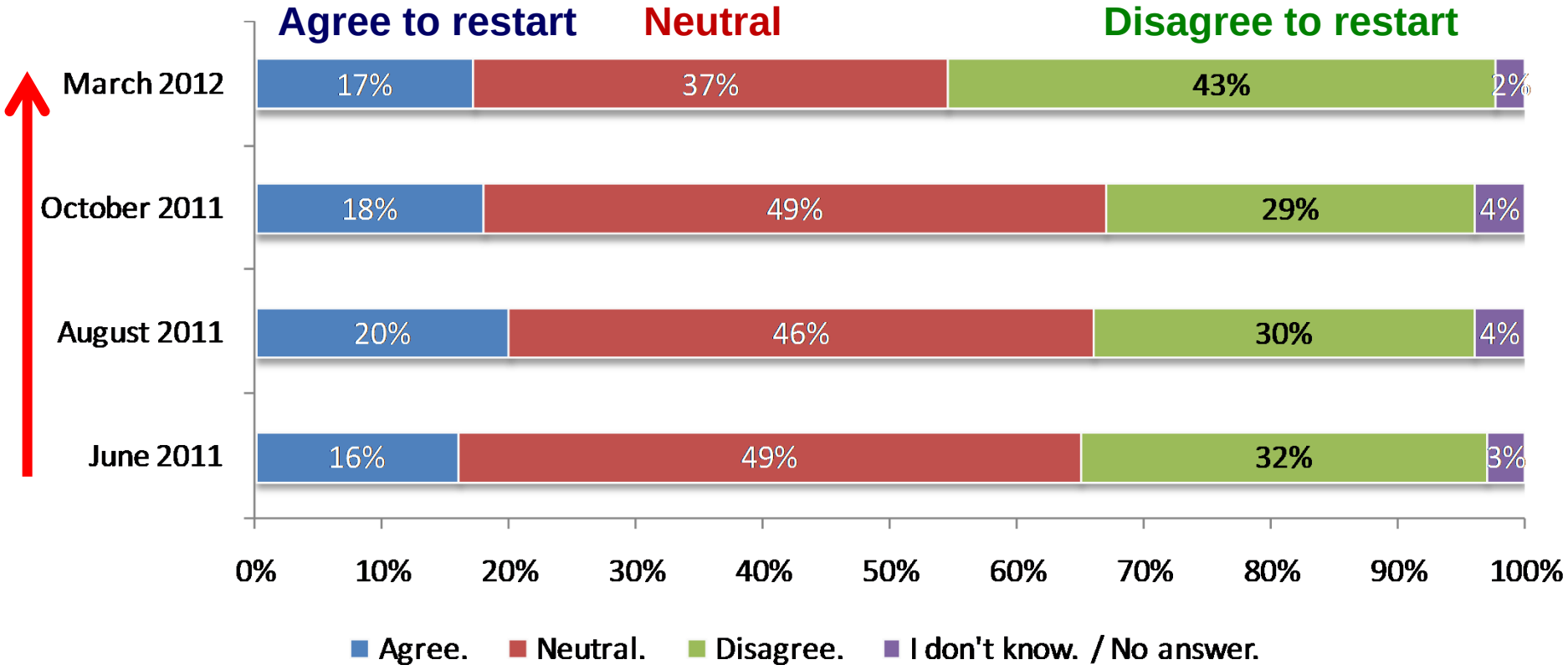




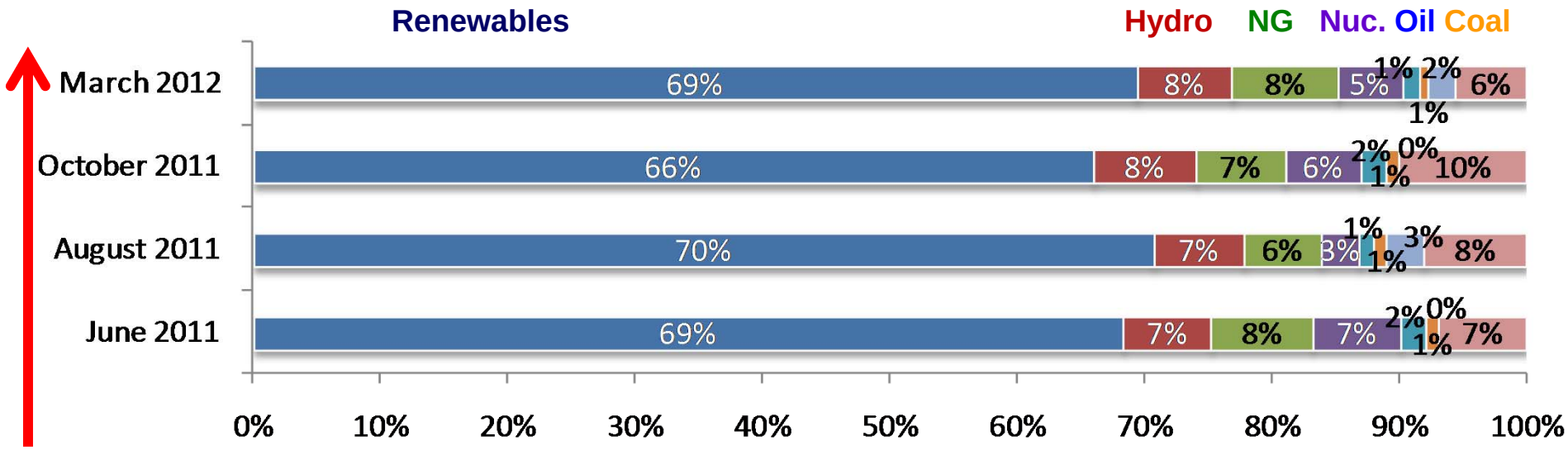
Public Opinion on Restarting Nuclear

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



Public Opinion
Future Energy Portfolio

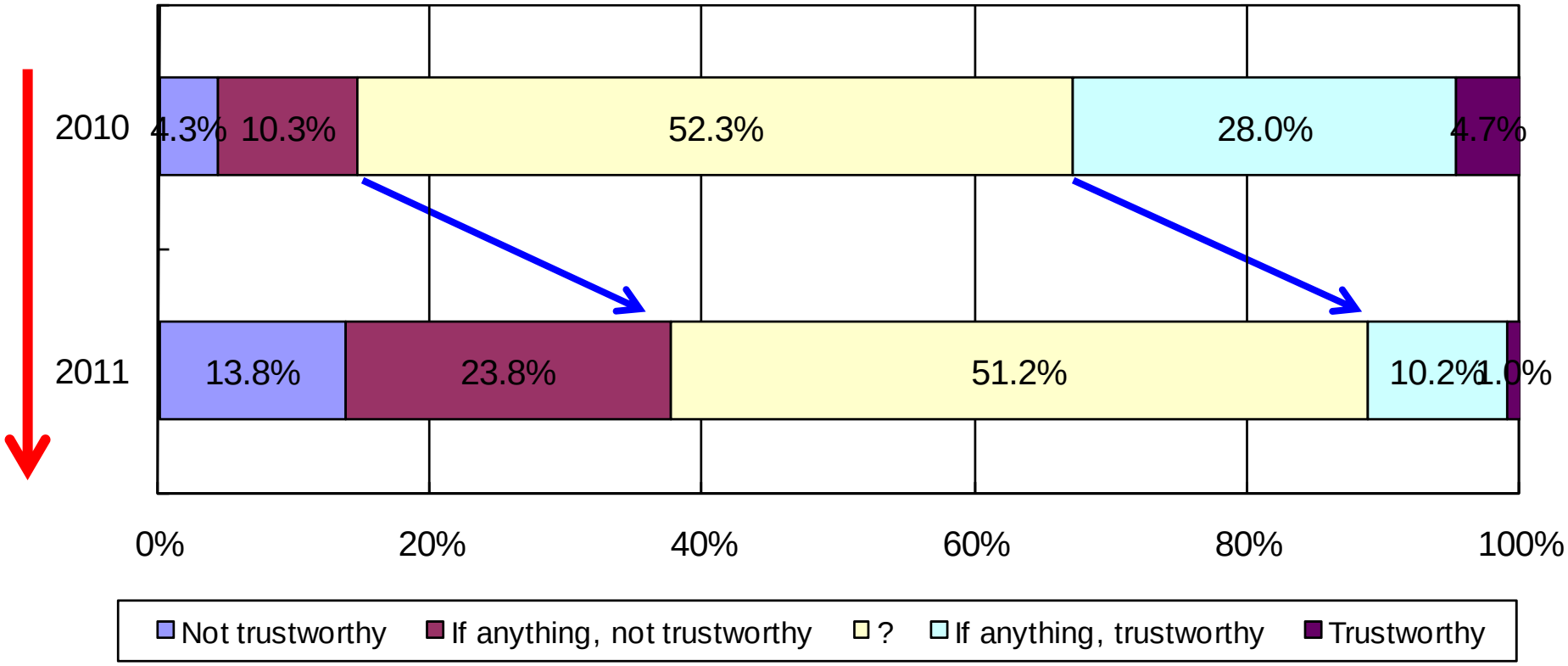
- **What kinds of energy sources should we expand more in the future?**



- Renewable natural energy such as solar or wind.
- Hydro.
- Natural gas.
- Nuclear.
- Oil.
- Coal.
- Other.
- I don't know. / No answer.

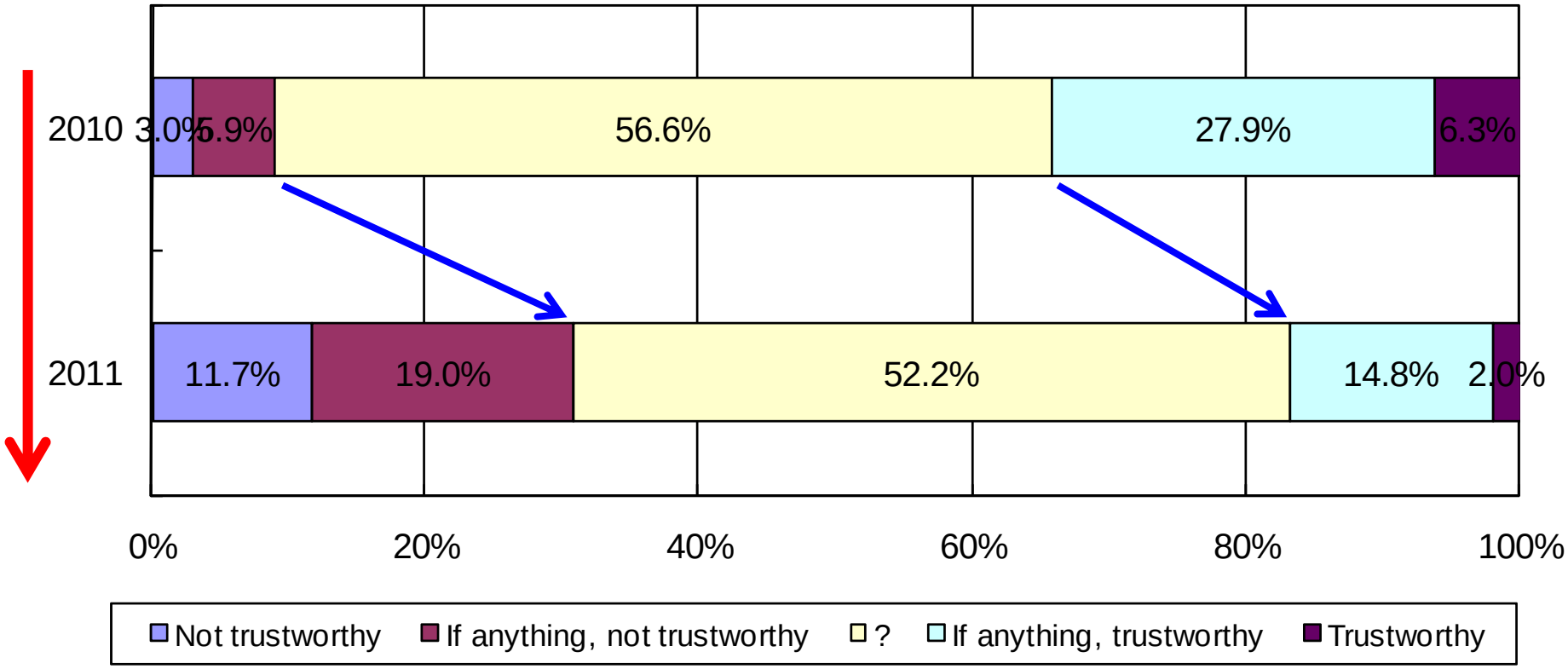
Public opinion - Losing Trusts
Governments

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



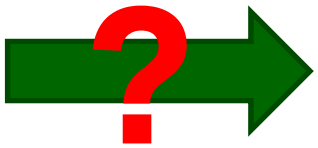
Public opinion - Losing Trusts
Experts

- **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.**

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**

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**