COP 17 and Beyond: Japan-UK and the Global Action to Addressing Climate Change, November 11, 2011

In search of effective and feasible International Framework

A Balanced Approach (vertically and horizontally)

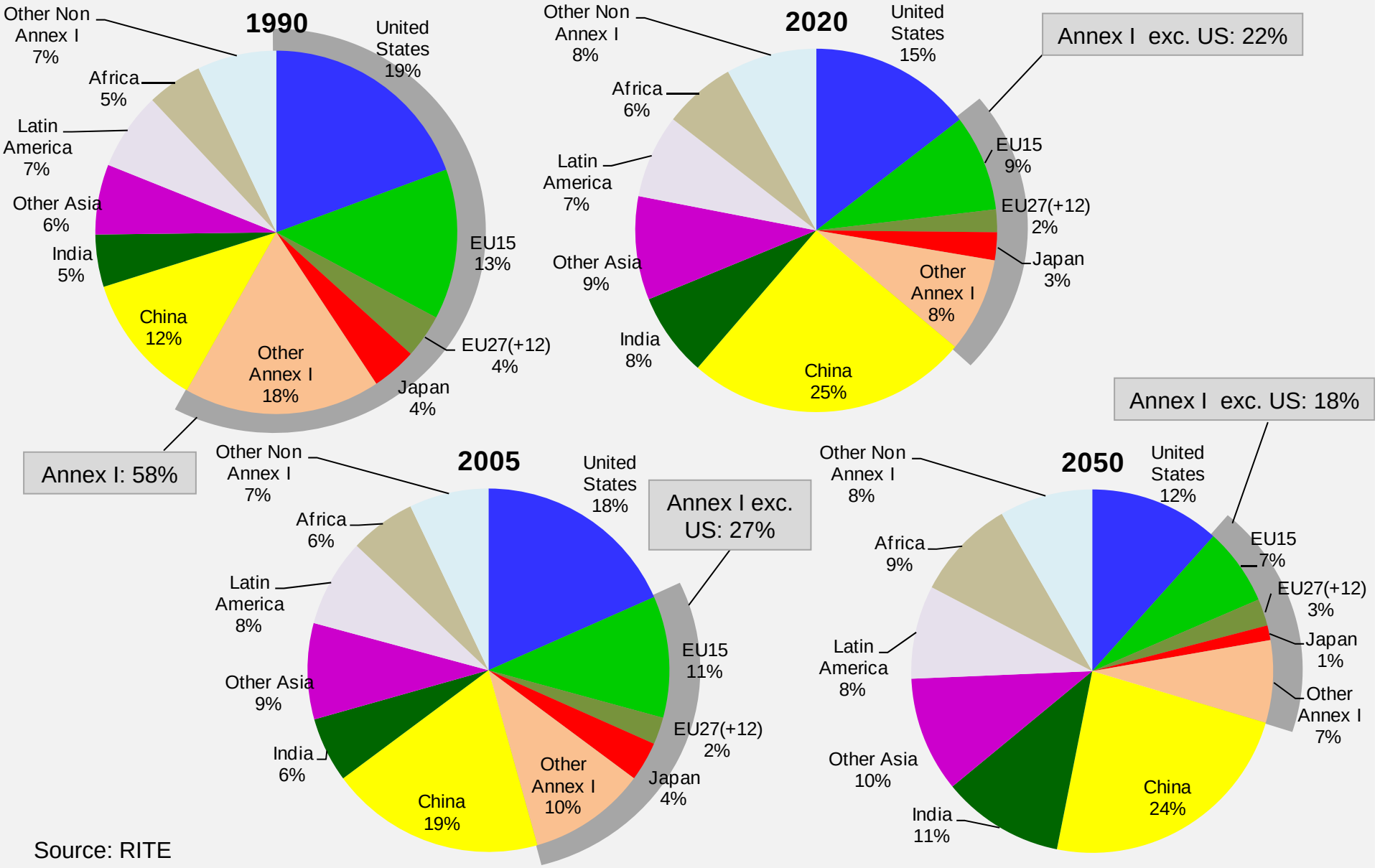
Mitsutsune Yamaguchi

University of Tokyo

Today’s presentation

1) Are we on track?
2) Scale of challenges
3) Discussions of 2 degree targets from various aspects (vertical balance)
4) Efficient allocation of scarce resources (horizontal balance)
5) In search of effective and feasible international framework
6）ALPS Project

Drastic Change of portion of GHG Emissions (by country/region)



Source: RITE

Are we on track?

- We are not on track to attain 2 degree target (steps in the right direction but the door to 2 ℃ is closing (IEA WEO 2011)

- Situation is becoming worse. This illustrates the scale of challenges we are faced with.

- What should and can we do?

What does 2 degree target mean? 450ppmCO2e and 50% reductions

Category	CO_2 concentration at stabilisation (2005 = 379 ppm)[b]	CO_2-equivalent concentration at stabilisation including GHGs and aerosols (2005=375 ppm)[b]	Peaking year for CO_2 emissions[a,c]	Change in global CO_2 emissions in 2050 (percent of 2000 emissions)[a,c]	Global average temperature increase above pre-industrial at equilibrium, using 'best estimate' climate sensitivity[d,e]	Global average sea level rise above pre-industrial at equilibrium from thermal expansion only[f]	Number of assessed scenarios
	ppm	ppm	year	percent	°C	metres	
I	350 – 400	445 – 490	2000 – 2015	-85 to -50	2.0 – 2.4	0.4 – 1.4	6
II	400 – 440	490 – 535	2000 – 2020	-60 to -30	2.4 – 2.8	0.5 – 1.7	18
III	440 – 485	535 – 590	2010 – 2030	-30 to +5	2.8 – 3.2	0.6 – 1.9	21
IV	485 – 570	590 – 710	2020 – 2060	+10 to +60	3.2 – 4.0	0.6 – 2.4	118
V	570 – 660	710 – 855	2050 – 2080	+25 to +85	4.0 – 4.9	0.8 – 2.9	9
VI	660 – 790	855 – 1130	2060 – 2090	+90 to +140	4.9 – 6.1	1.0 – 3.7	5

Source: IPCC/AR4 Synthesis Report

Maximum emissions in 2050 to achieve 2 degree target is 50% of that in 2000.
Global emissions must peak at the latest by 2015

Scale of challenges

Fossil & Industrial CO_2 Emissions by various models (Reference Case) Units $GtCO_2/yr$

Model	2000	2050	2100
ETSAP-TIAM	23.2	51.8	77.1
FUND	26.0	58.2	116.3
GTEM	24.4	84.1	131.5
GTEM	26.6	45.3	60.1
MERGE Optimistic	24.8	66.5	117.9
MERGE Pessimistic	24.8	48.2	87.1
MESSAGE	26.8	43.5	42.7
MiniCAM - BASE	26.5	57.8	80.5
POLES	24.2	52.9	67.8
SGM	23.4	55.8	77.0
WITCH	24.5	62.3	86.5

Source: ENERGY MODELING FORUM (2011)

http://emf.stanford.edu/events/emf_briefing_on_climate_policy_scenarios_us_domestic_and_international_policy_architectures

RCP3PD: 2050 emissions are 11.7 Gt/CO2

Paradigm Shift (international negotiation)

Why top down approach has failed at Copenhagen

- Lack of cool-headed discussion (religion)
- International community was not really convinced at 2 degree target

  (Vertical balance --- focusing on climate change)
- Different priorities by countries

  (Horizontal balance --- in relation to other urgent issues)

  Recent economic/budgetary/financial crisis and CC

Ultimate objective of response measures

Vertical Balance

- Article 2

  Stabilization at the level not dangerous

  Such a level should be achieved within a time-frame sufficient to ---**enable economic development to proceed in a sustainable manner**

- IPCC AR4 WG3 Ch.1

  -- the balancing of the risks of climate change --- against the risk of response measures that may threaten economic sustainability.

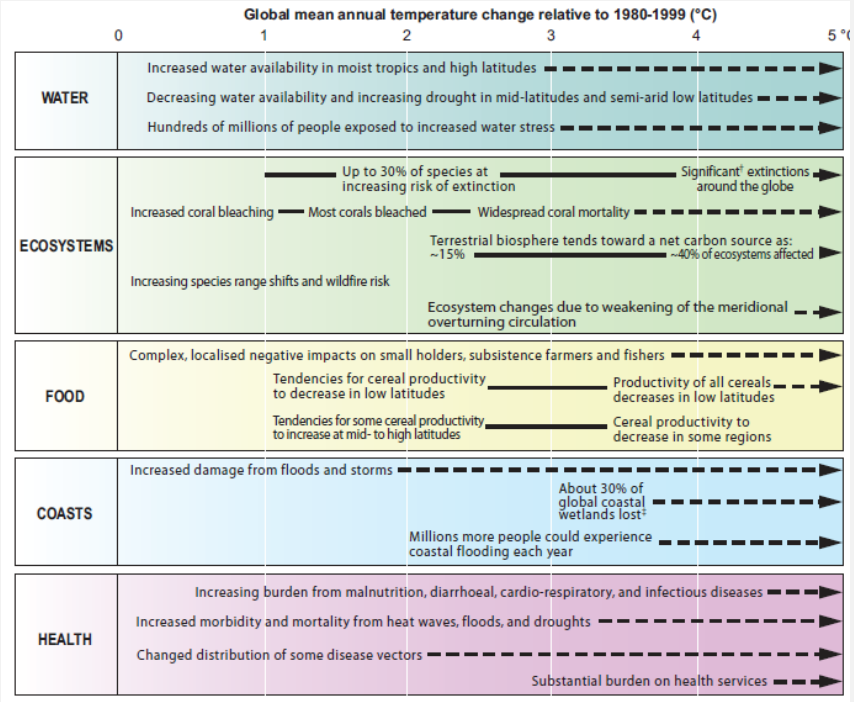
→ Sustainable Economic Growth

Is 2 degree increase dangerous?

- temperature increase 2-3 ℃→ declines in net benefits or increases in net costs (above 1990 levels)

  （IPCC AR4 ）
- Corresponds to 2.6 to 3.6 ℃ since pre-industrialization
- No adaptation considered

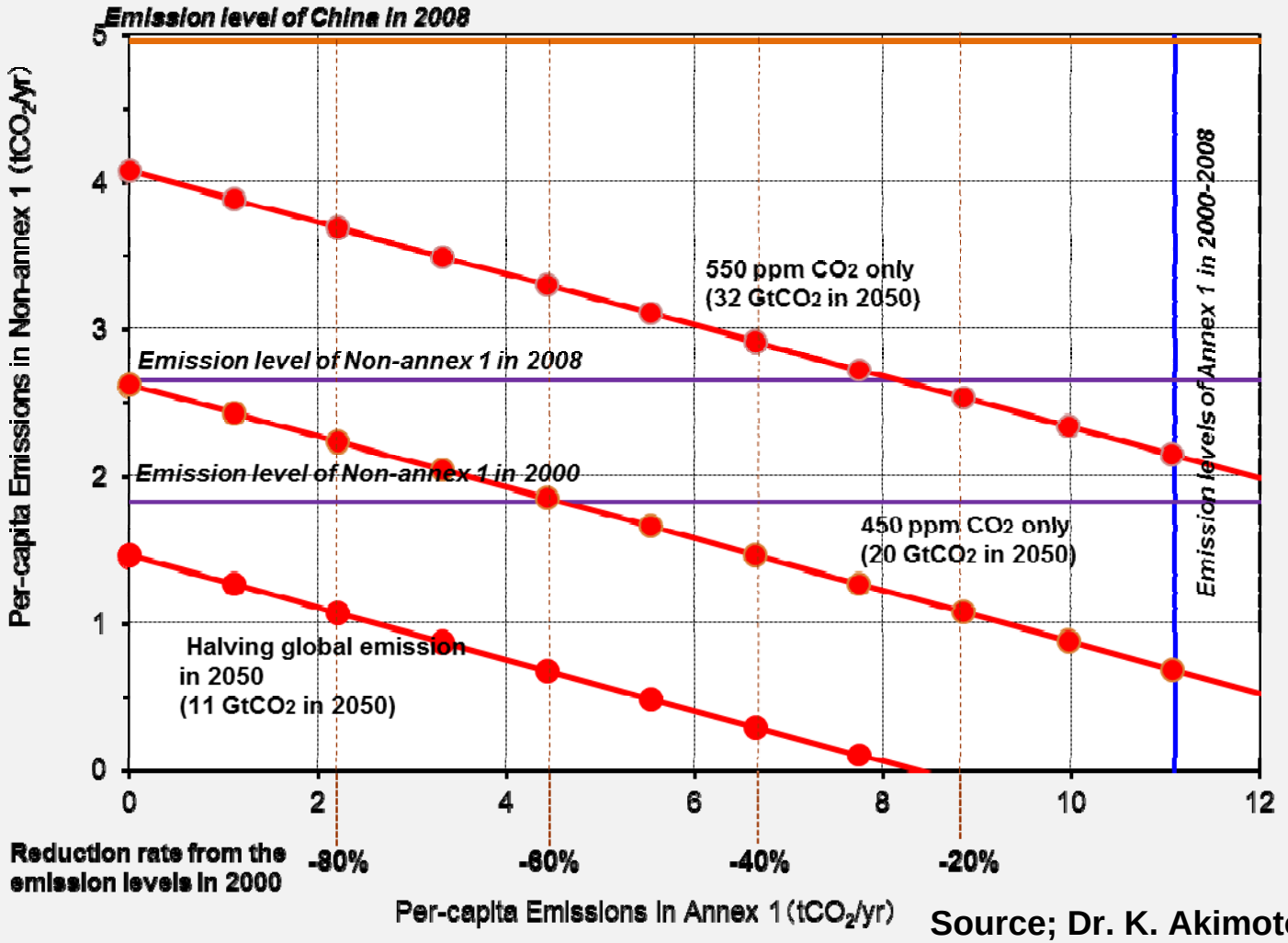
  Unrealistic
- Why 2 degree? (1.4 ℃)



Temperature increase since 1990,
Source: IPCC /AR4/Synthesis

Feasibility of 2 degree target

Halving global emissions 2050/2000



Source; Dr. K. Akimoto, RITE

Can developing countries reduce per capita emissions **58%** from **2.6t (2008)** to **1.1t** (**2050)** in case that developed countries reduce 80% reduction?

Can we reduce 50% by 2050?

- 80% reduction of per capita emissions for developed countries from 11.0 t to 2.2 t CO2 by 2050.

  Still

- 58% reduction of per capita emissions for developing countries from 2.6 t to 1.1 t CO2 by 2050

- China's per capita emissions in 2008 is 5 t CO2.

Technology is the key (kaya identity)
Feasibility of 50% reductions (2050/2000)

- $\text{CO2 emissions} = \frac{\text{CO2 emissions}}{\text{GDP}} \times \text{GDP}$
- $\Delta \text{CO2/CO2}$

$$= \frac{\Delta(\text{CO2 emissions/GDP})}{\text{CO2 emissions/GDP}} + \frac{\Delta \text{GDP}}{\text{GDP}}$$

$$= \text{Technology improvement ratio} + \text{GDP growth ratio}$$

Global BAU GDP in 2050 will be $113 Trillion. 75.5% reduction corresponds to $27.7 trillion, that is 30% less that that in 2009.

To achieve 50% reduction in 2050 (base year 2000)	
GDP loss (%) against BAU	Technology improvement ratio (%)
0	3.91
10	3.70
20	3.46
30	3.20
40	3.89
50	2.52
80	0.69

In case annual technology improvement ratio is 1.1%	
CO2 reduction (%)	GDP loss (%)
0	50.9
10	55.8
20	60.8
30	65.7
40	70.6
50	75.5

The highest technology improvement ratio in the past 38 years was 2.9% in 1981 (Average 1.1%, 2000-2008 0.1%)

BAU GDP growth ratio up to 2050 is 2.56%/yr. (RITE estimate based on UN World Development Indicator and UN World Population Prospects 2008).

Cost Benefit Perspective

- W. Nordhaus: A question of Balance 2008

  BAU: 3.1 degree in 2100 (relative o 1990)

  Optimal: 2.6 degree increase in 2100 (PRTP 1.5%)

  Carbon Price $25/tCO2 in 2050 and $55 in 2100

  1.5 degree case: benefit 2.4 times, cost 12.5 times

  Need to consider Weitzman's fat tail issue

- Stern Review 2006

  550ppmCO2e stabilization: Benefit(20% of GDP>Cost (1% of GDP)

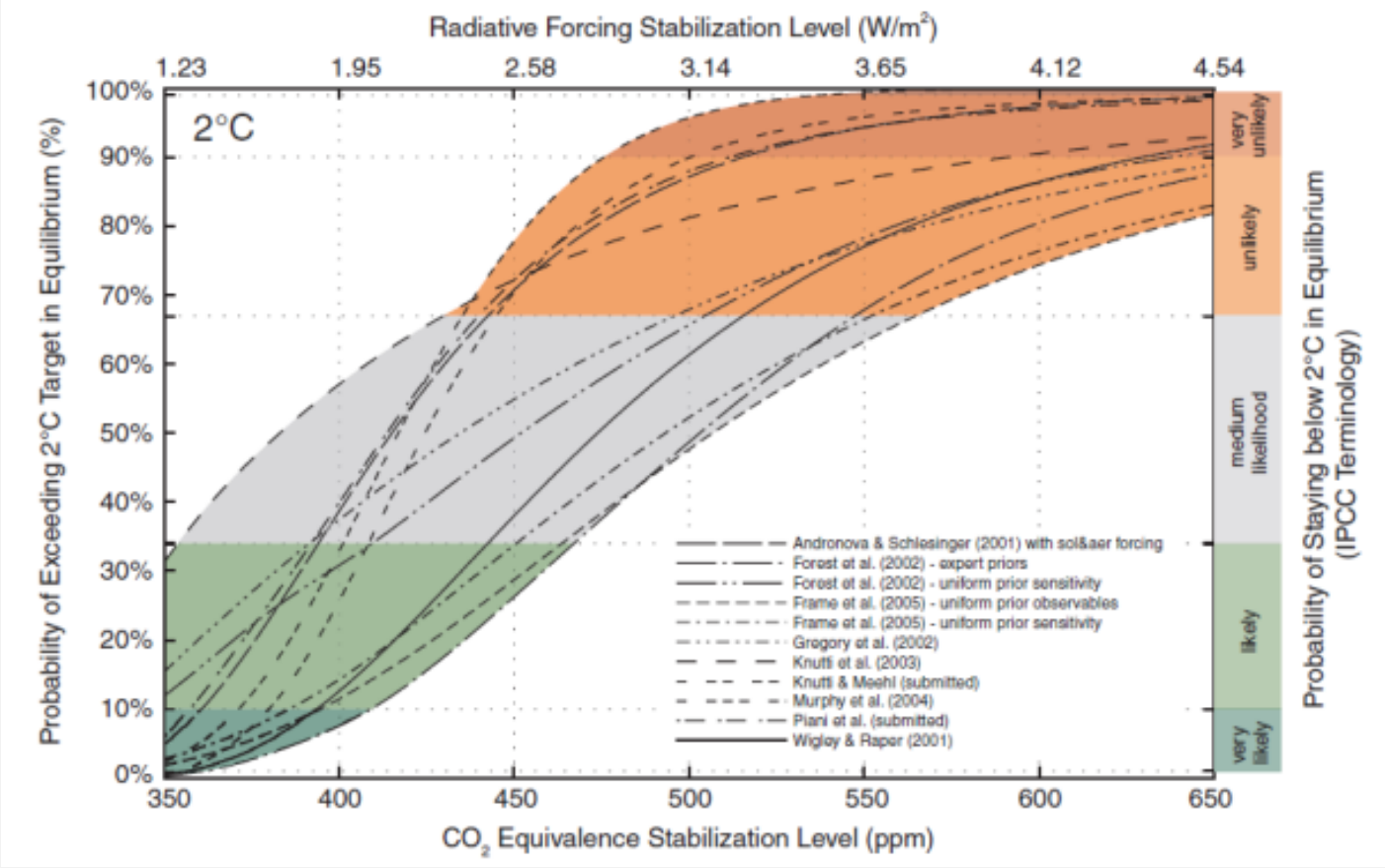
  450ppmCO2e: very difficult and costly

  550ppmCO2e stabilization may lead to 3 degree increase

  Even Stern Review did not justify 2 degree target

  What if PRTP is 1.5% rather than 0.1%

2 degree and uncertainty



M. Meinshausen, “What Does 2˚ C Target Mean for Greenhouse Gas Concentrations? A Brief Analysis Based on Multi-Gas Emission Pathways and Several Climate Sensitivity Estimates,” H-J. Schellnhuber ed., *Avoiding Dangerous Climate Change*, Chapter 28

2 degree target and science

- Defining what is dangerous anthropogenic interference with the climate system and, consequently, the limits to be set for policy purposes are complex tasks that can only be partially based on science, as such definitions inherently involve normative judegments. (IPCC AR4/WG3 Chapter 1)

- It (2 degree target) bears no relationship to emission controls that most governments will actually adopt. And it isn't based on much science either. (Victor, D. G. 2011, *Global Warming Gridlock)*

2010 Blue Planet Prize Commemorative Lecture by Robert Watson (former IPCC chair)

October 27, 2010, Tokyo

-- it (2 degree target) must be recognized to be a stretch target and, unless political will changes drastically in the near future, it will not be met. Therefore, we should be prepared to adapt to global temperature changes of 4-5° C.

- Robert Watson's another Lecture at the National Institute for Environmental Studies, October 28, 2010, Tsukuba, Japan

--- But I will argue that we are going to be lucky to stabilize at 4. And the reason is that to stabilize at 2, you only have a 50-50 chance of stabilizing at 2 or 400 ppm of carbon dioxide equivalent. --- But I honestly don't believe we are going to stabilize at 400 ppm, I think we are going to stabilize at 550-650. --- The USA is not going to stabilize its emissions before 2020, China probably won't until 2030 ---

Need to reconsider 2 degree target

- One idea is to put is on the shelf or make it as aspirational goal and not calculate insufficiency of efforts against the goal.
- Forcing 2 degree target with legally binding treaty may bear the risk of the reaching no agreement or collapse of the treaty.
- Geo-engineering as an insurance

Balance between global urgent matters Horizontal Balance

Efficient allocation of scarce resources among urgent issues

- Economic growth, employment
- International Competitiveness
- Energy/food security
- Health care, pension
- Millennium Development Goals, in particular for least developing countries

Efficient allocation of resources

- Copenhagen Consensus (2004 and 2008)
- Sachs criticized that the outcome --was based on wrong question, wrong participants, and wrong conclusions. But he admitted "the core concept of the Copenhagen Consensus is a good one" but needed improvement in several points
- Summers commented that "the greatest acts of statesmanship --- have been motivated by a concern for posterity not by benefit-cost analyses". But he still pays serious attention on the efficient allocation of scarce resources.
- Azar pointed out four inherent shortcomings with respect to CBA but said "this does not mean that cost-benefit optimization models cannot and should not play any role in climate change policies".
- Democracy and policy makers

In search of effective and feasible international framework – A Balanced Approach

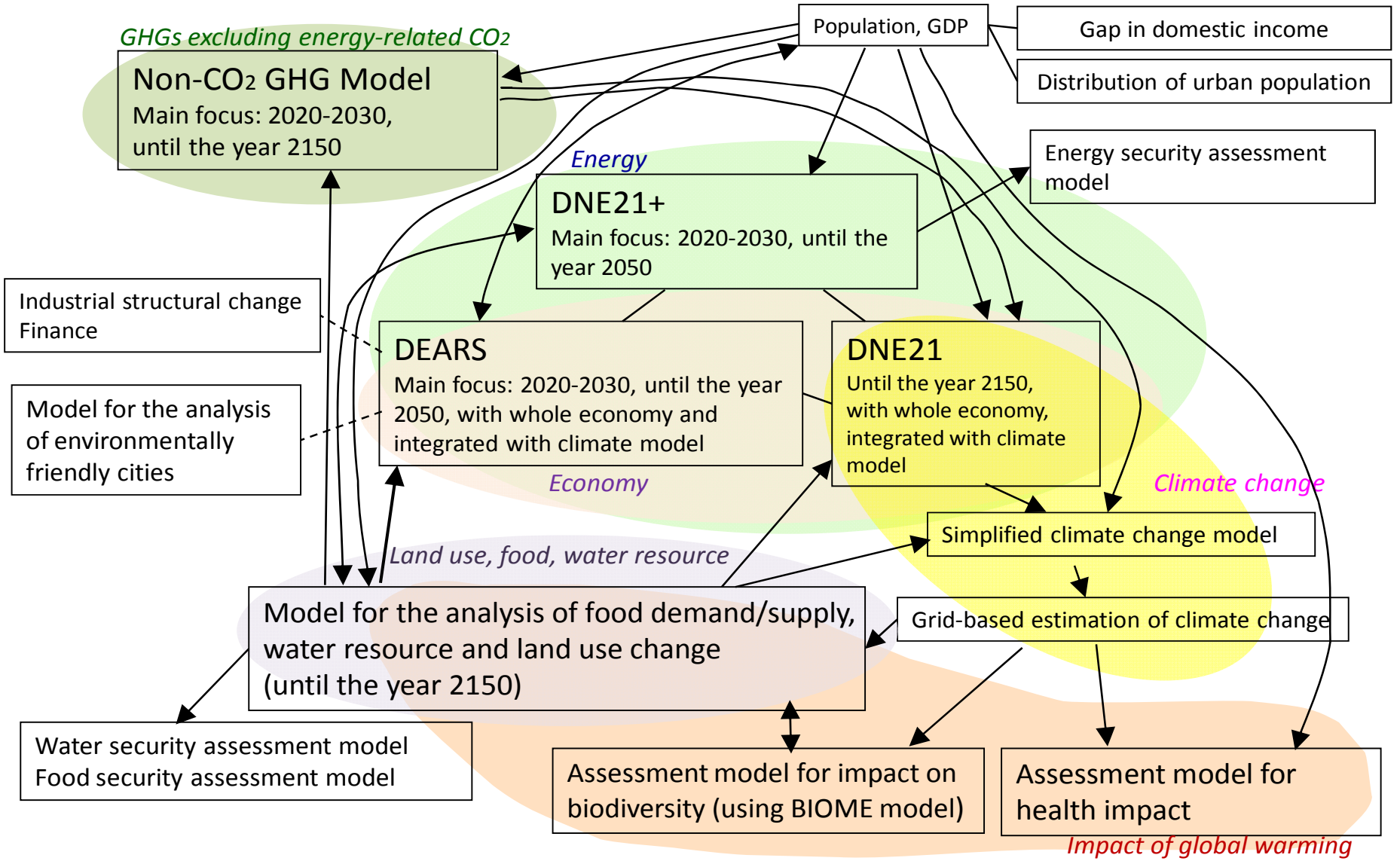
- Review of 2 degree target taking into consideration of adaptation
- Pledge and review of each country' target
- Difference of circumstances taken into account (especially developing countries)
- Ensure comparability of efforts among developed countries
- Review of classification of Annex 1 and non-Annex 1
- Integrated approach (not only mitigation but also adaptation, technology transfer and funding)
- Mobilization of all policies (sectoral approach, removal of subsidies, promotion of trade/investment, green growth)

Need economic development to cope with climate change

“Better a strong weak agreement that has
a good chance of being honored
than a weak strong agreement
that is likely to collapse”

The Economist, November 29, 1997

Models for the Development of ALPS Quantitative Scenarios



Assessed Indicator (Preliminary)

Category	Indicator
Economic and poverty	Income (GDP per capita)
	People living in poverty
	Deaths in children younger than five years
	Food access or hunger (amounts of food consumption per GDP)
Health	Deaths by factors regarding temperature
Agriculture, land-use, and biodiversity	Agriculture land area
	Food security (amount of food import per GDP)
	Potential change in vegetation
Water	People under water stress
Energy and climate change	Access to modern energy
	Energy security (share of oil and gas import with country risks in total primary energy consumption)
	Sustainable energy use (cumulative fossil fuel consumption)
	Energy use efficiency (primary energy supply per GDP)
	Economic impact by mitigation measures (mitigation cost per GDP)
	Aggregated economic impacts by climate change (the cost per GDP)
	Global mean temperature change

Correlations among ALPS Core Scenarios

3PD: 450ppmCO2e, 3.5PD: 550ppmCO2e, 4.5: 600-700ppmCO2e, 6: 700-850ppmCO2e

Economic and social conditions / Scenarios for climate policy background	[A] Medium technological progress scenarios				[B] High technological progress scenarios			
	CP6	CP4.5	CP 3.5PD	CP3PD	CP6	CP4.5	CP 3.5PD	CP3PD
I. Pluralistic society scenario	○	◎	○	△	◎	○	△	×
II. Climate policy prioritized scenario	△	○	○	○	○	○	△	△
III. Energy security prioritized scenario	◎	○	○	×	◎	△	△	×

Note) ◎: strong correlation, ○: correlation, △: weak correlation, ×: little correlation
These correlations are evaluated subjectively on the basis of difficulties to achieve each stabilization level in macro-level and socio-economic scenarios (Scenario A and B) and Social scenarios for climate policy background (Scenario I, II and III), and therefore, these correlations are not projections.

ALPS: ALternative Pathways toward Sustainable development and climate stabilization; FY2007-2011(on going)