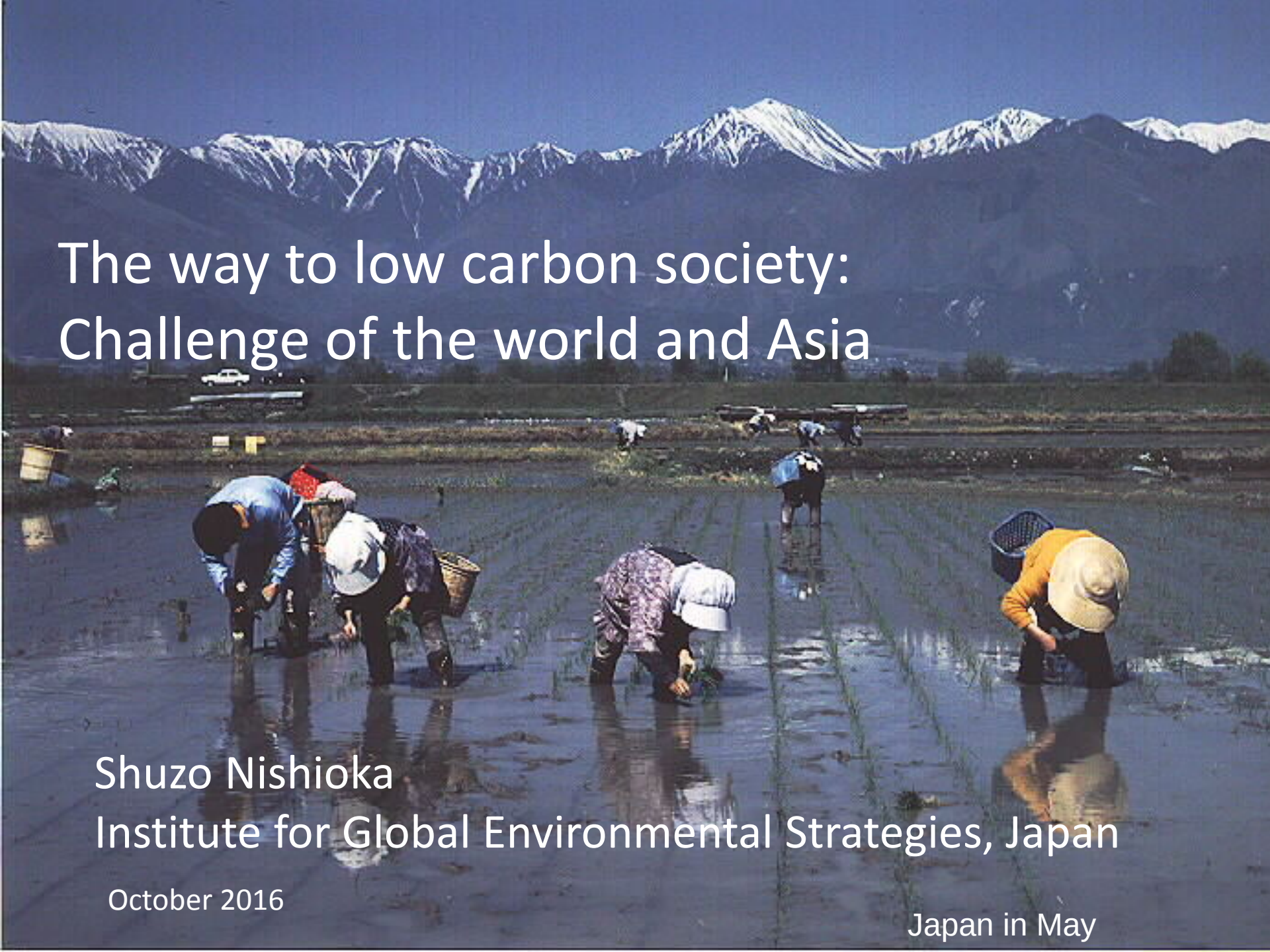


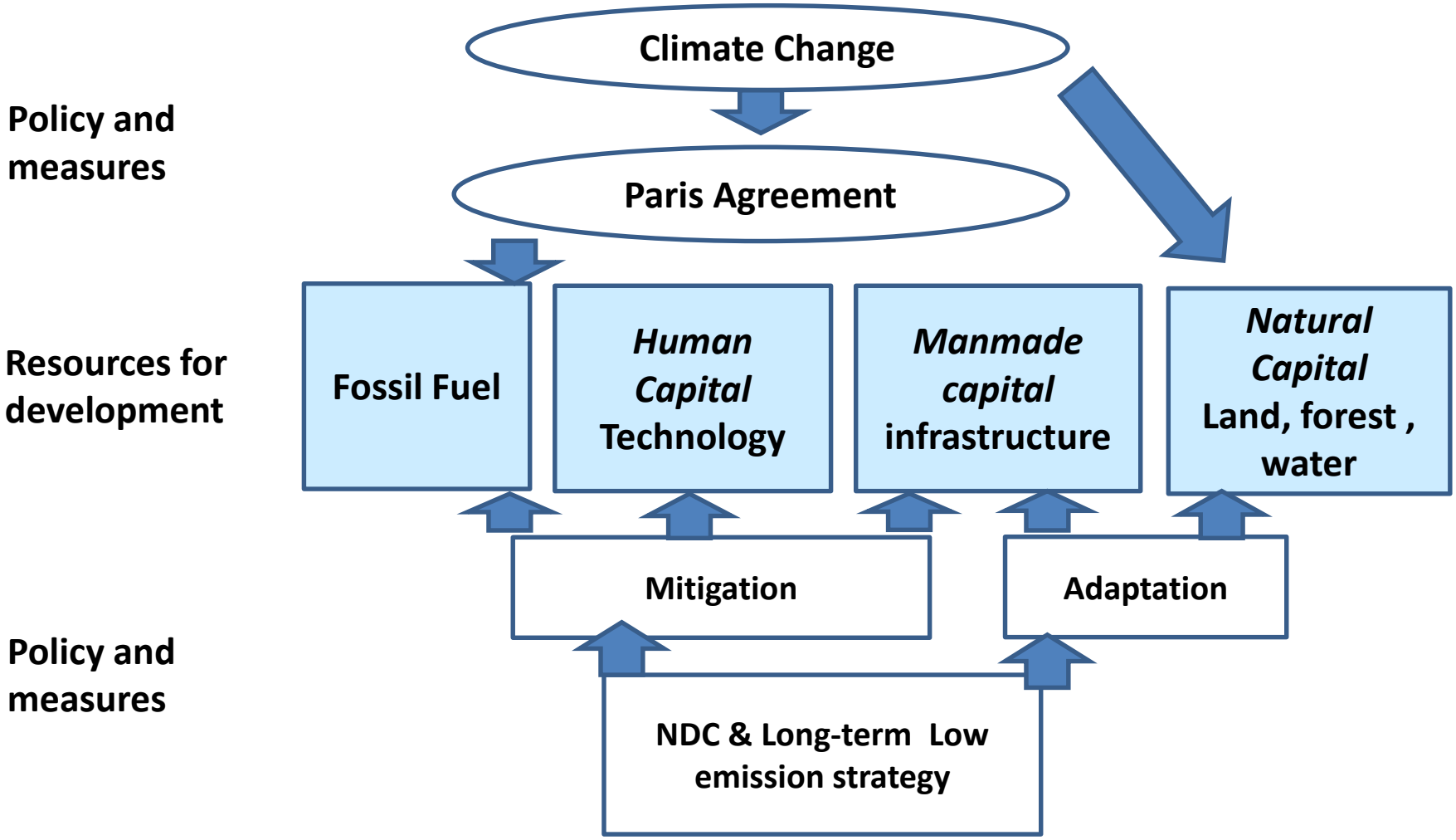
The way to low carbon society: Challenge of the world and Asia

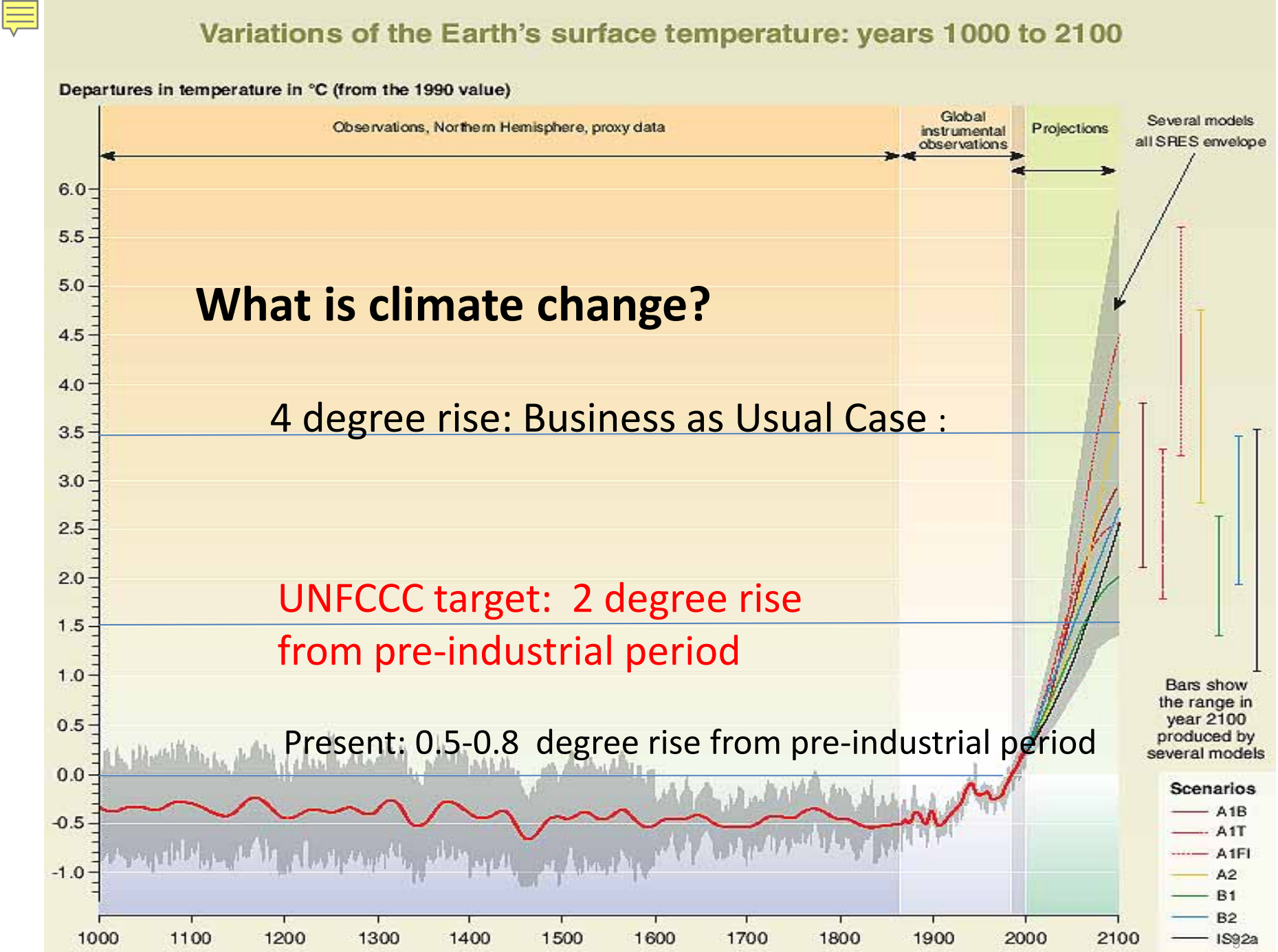
Shuzo Nishioka
Institute for Global Environmental Strategies, Japan

October 2016

Japan in May

Climate Change:
Impact to Resources for Development





IPCC Synthesis report 2001

Major Decision of Paris Agreement at COP21 (2015)

- Set target of less than 1.5/ 2.0 degree temperature rise from pre-industrial period

- All parties participate to take action under NDC

  ⇒**Transform to Zero-emission society**

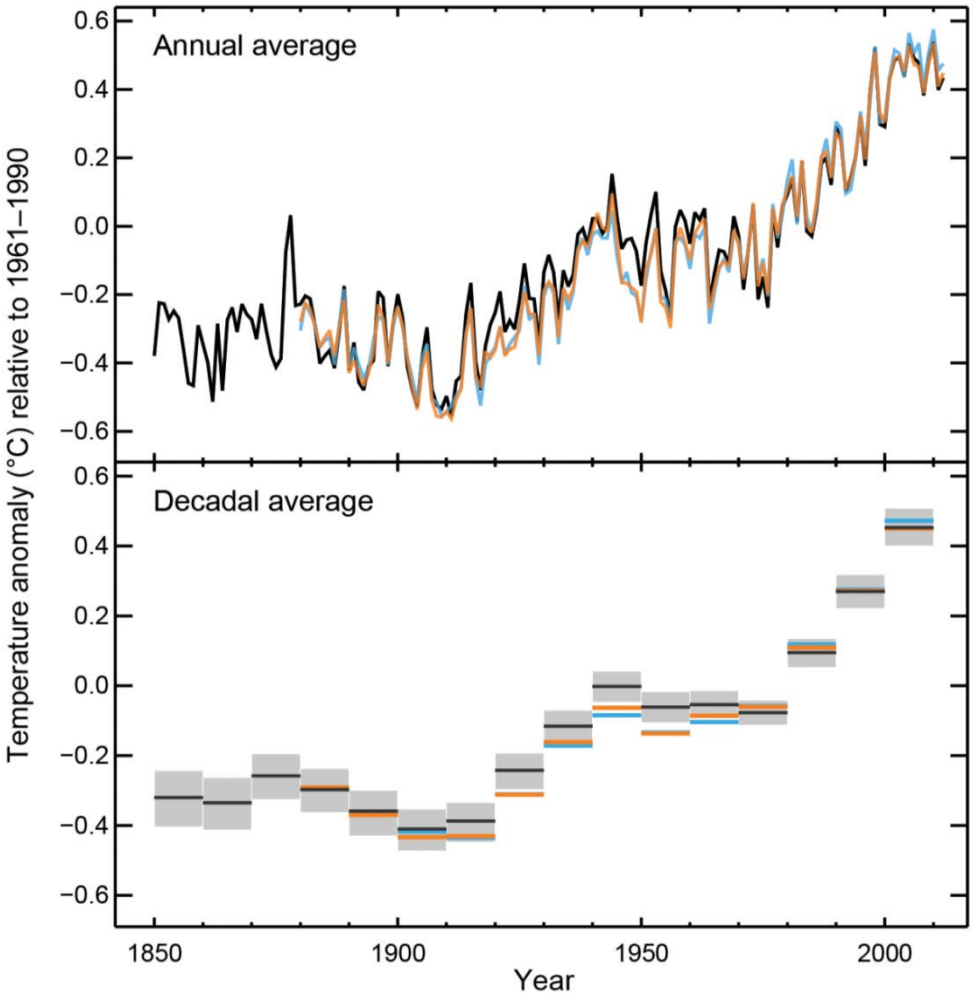
  by the end of this century

  ⇒long-term low GHG emission strategies

- Strengthen cooperation for capacity building in mitigation and adaptation

- Mobilize stakeholders in all levels to act immediately

Present state of climate : Observed globally averaged combined land and ocean surface temperature anomaly 1850-2012



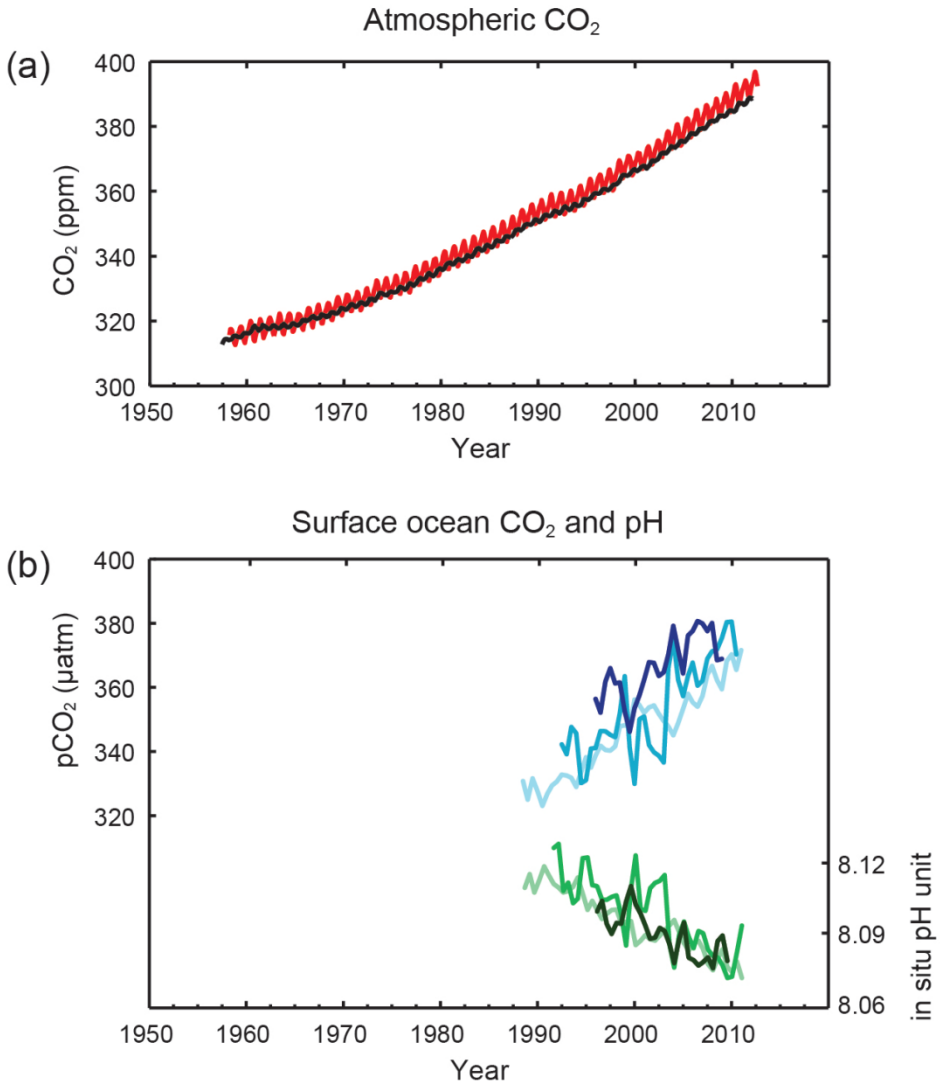
IPCC AR5 WG1 2013

Multiple observed indicators of a changing global carbon cycle

Concentration of CO_2

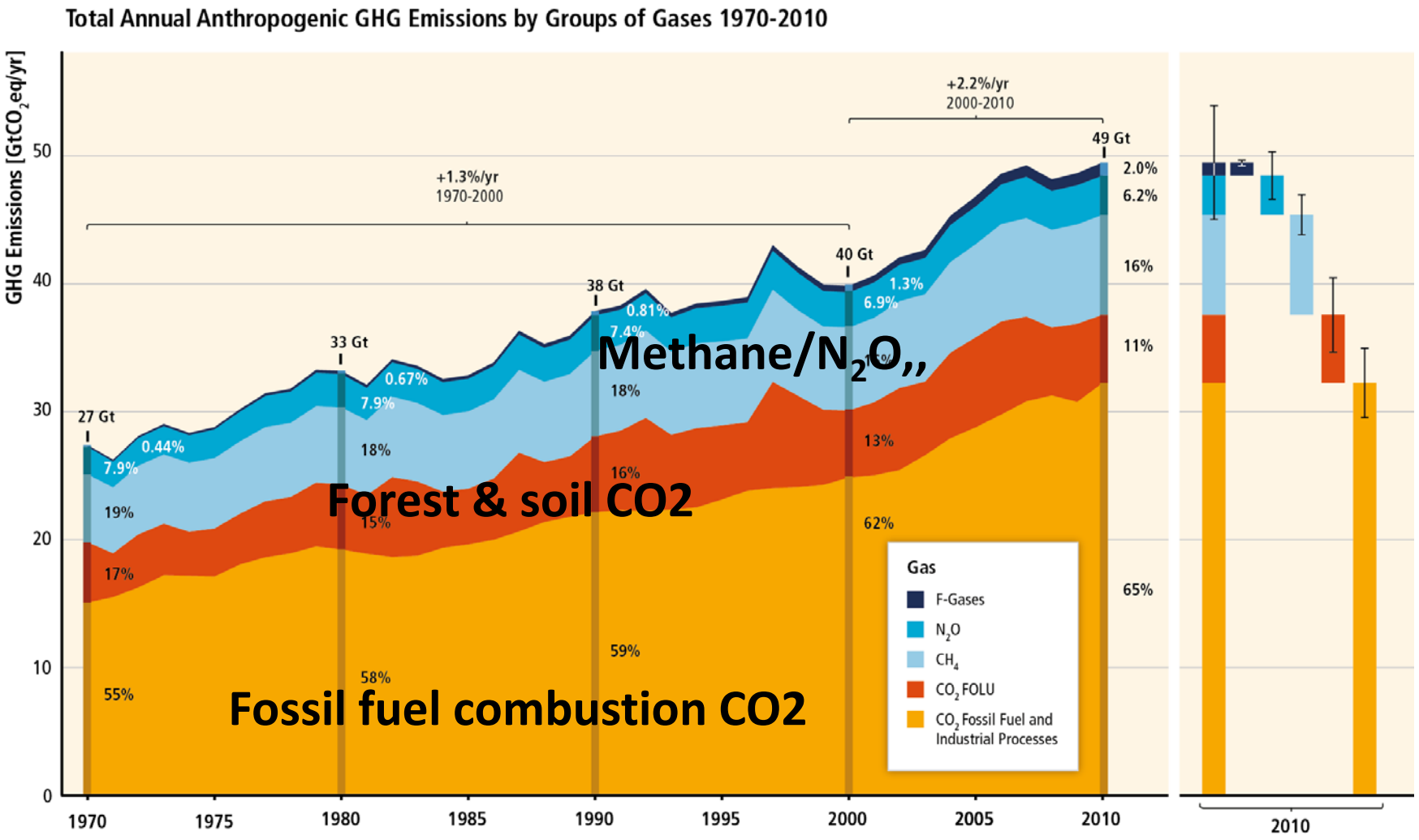
Atmosphere

Ocean

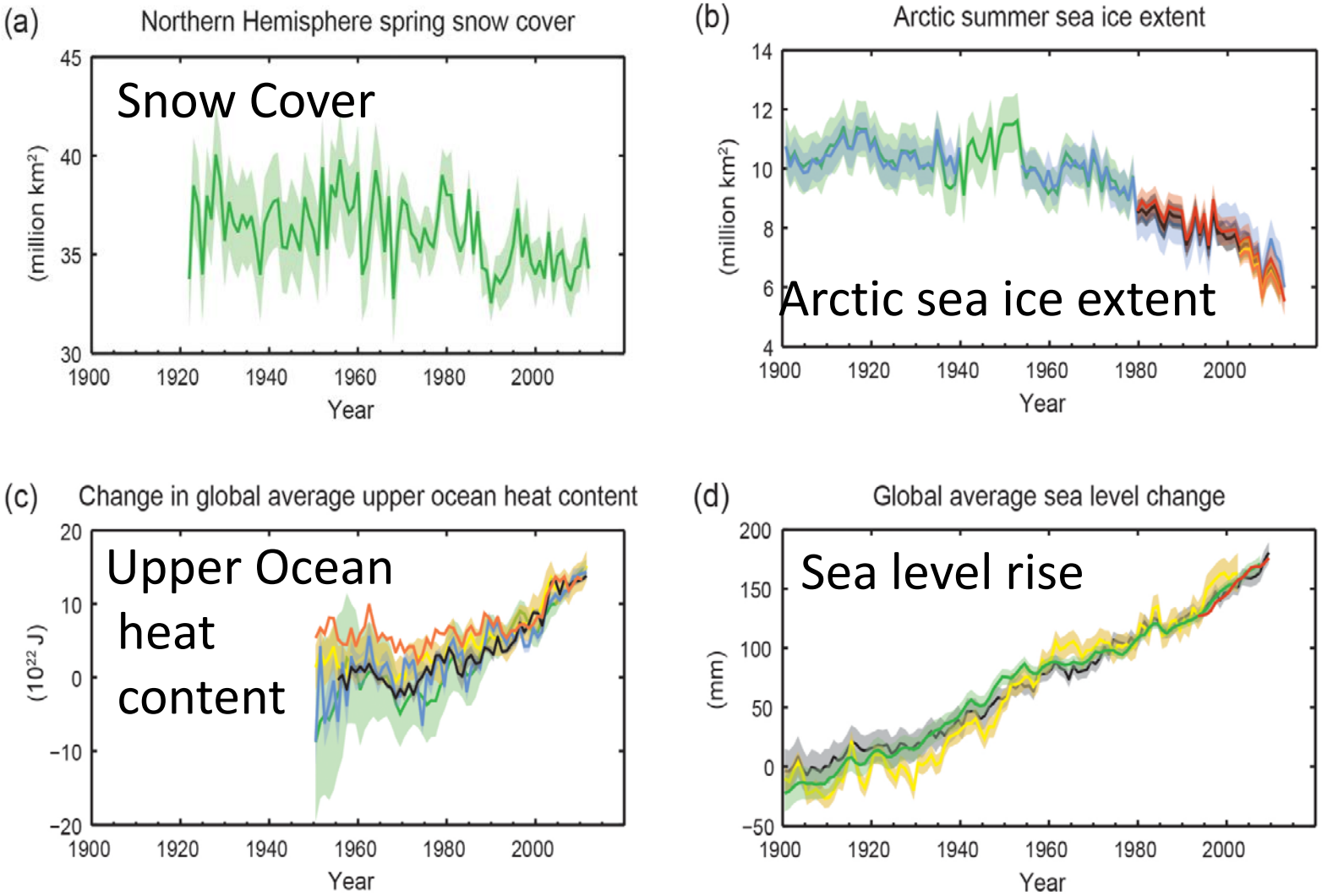


IPCC AR5 WG1 2013

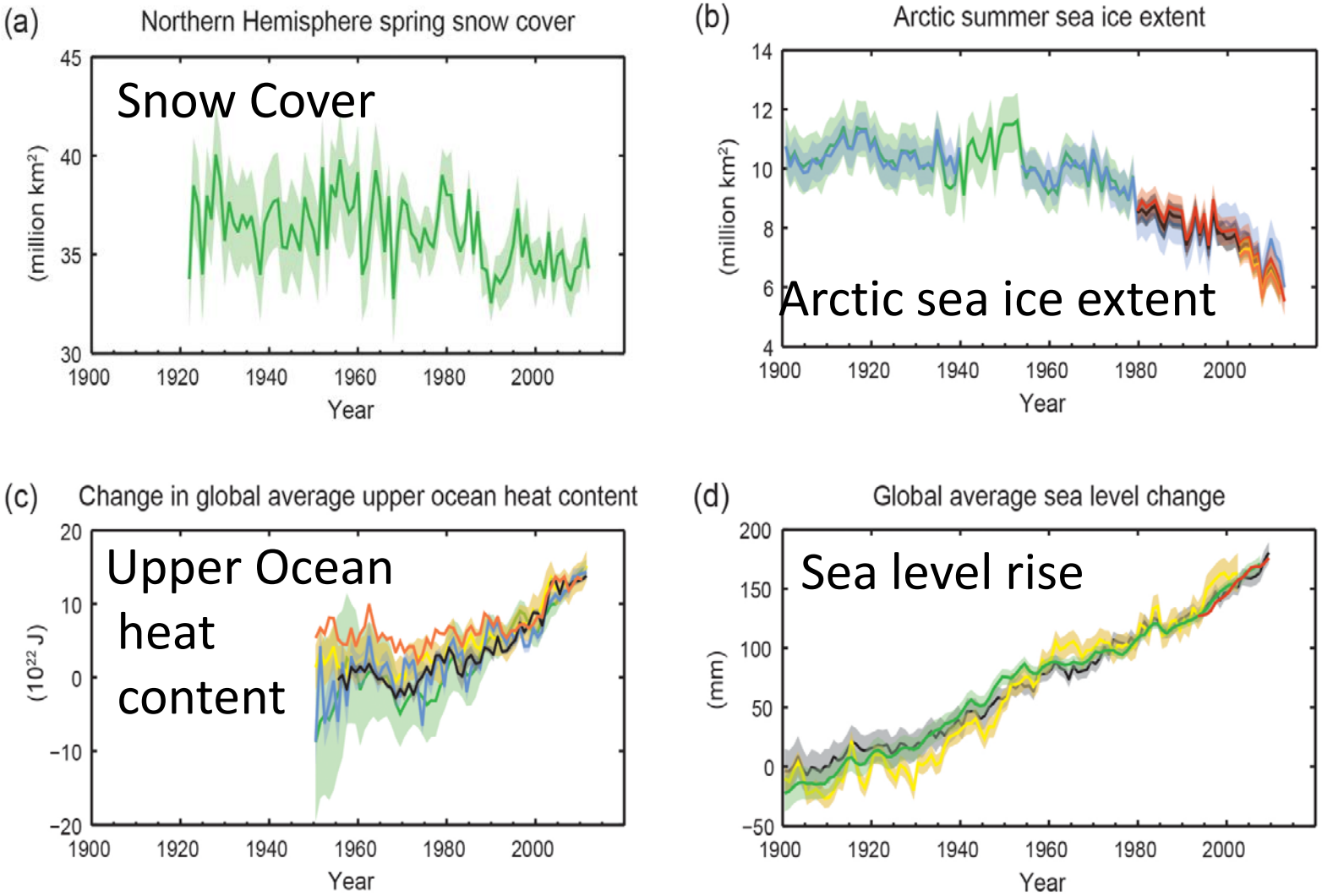
GHG emissions accelerate despite reduction efforts. Most emission growth is CO_2 from fossil fuel combustion and industrial processes.



Multiple observed indicators of a changing global climate

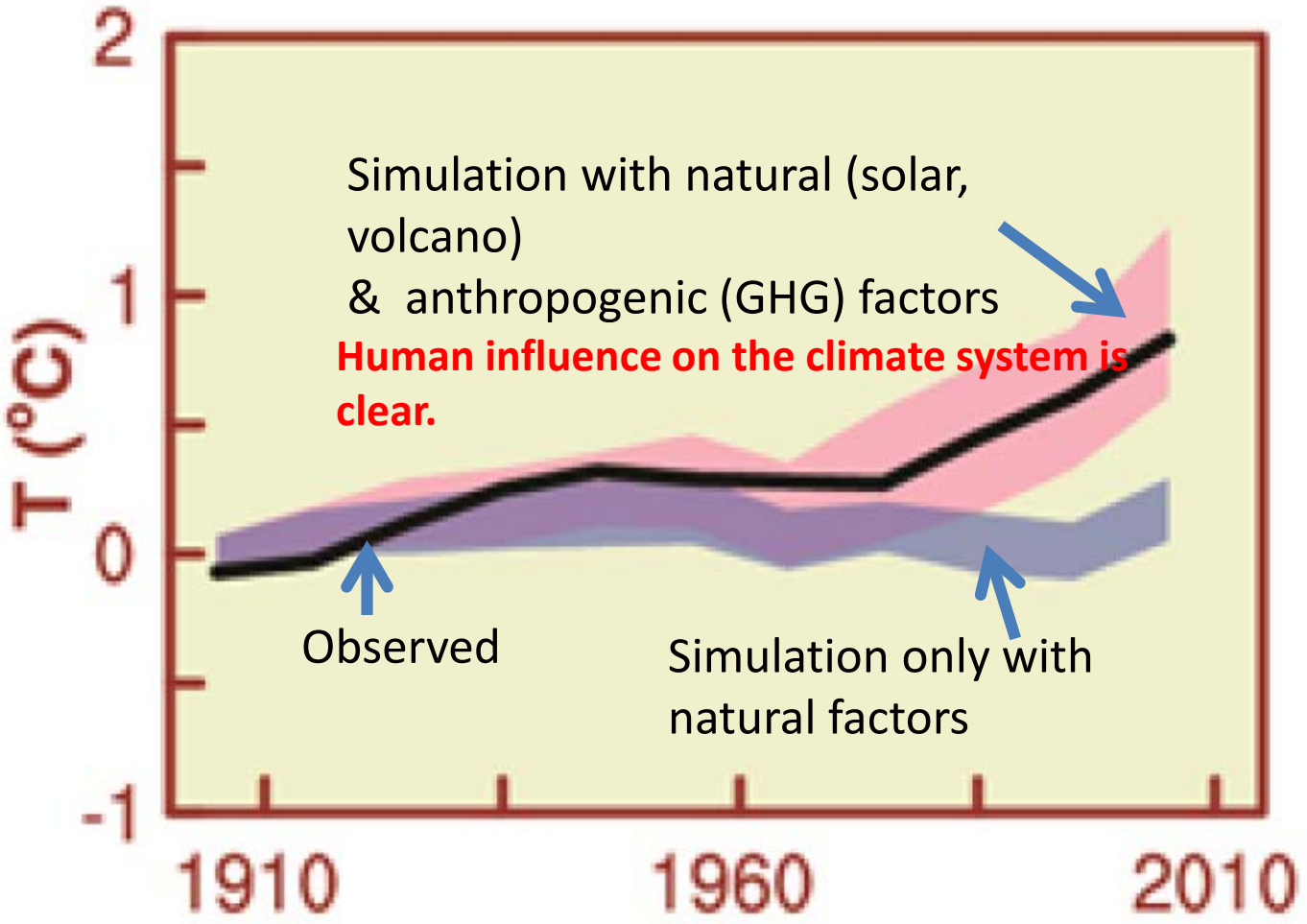


Multiple observed indicators of a changing global climate



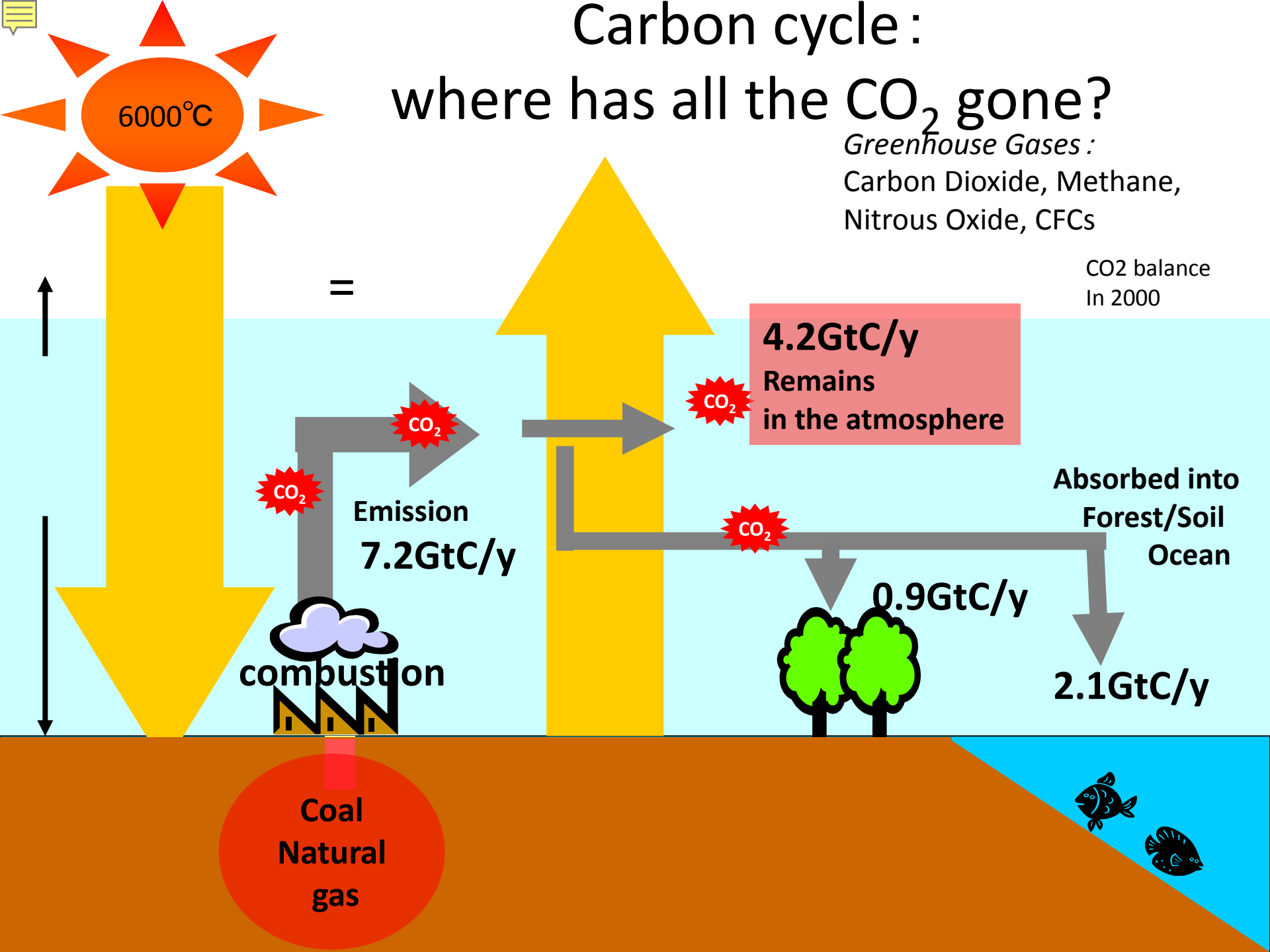
Human influence on the climate system is clear

This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system.

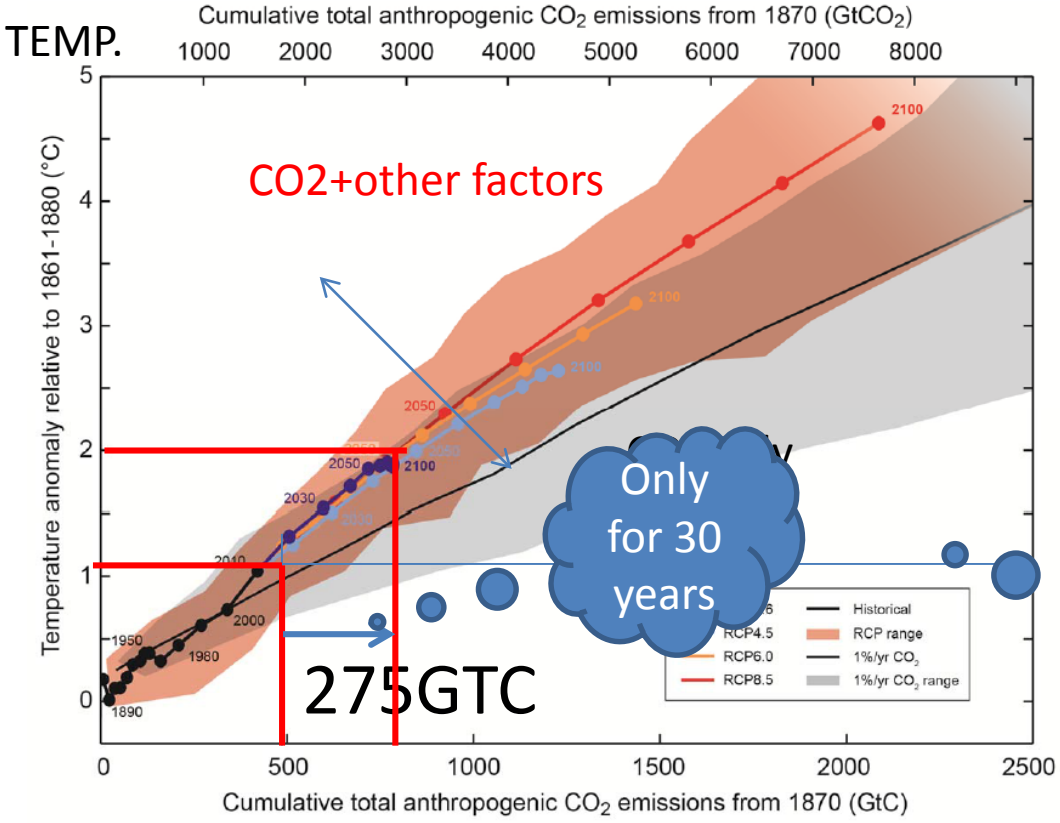


Comparison of observed and simulated climate change

Carbon cycle : where has all the CO_2 gone?



Temp. rises in relation with cumulative GHG emission
⇒Temp. rises as long as emission continues
⇒ Zero emission is only one ultimate solution to stabilize climate



Allowable budget

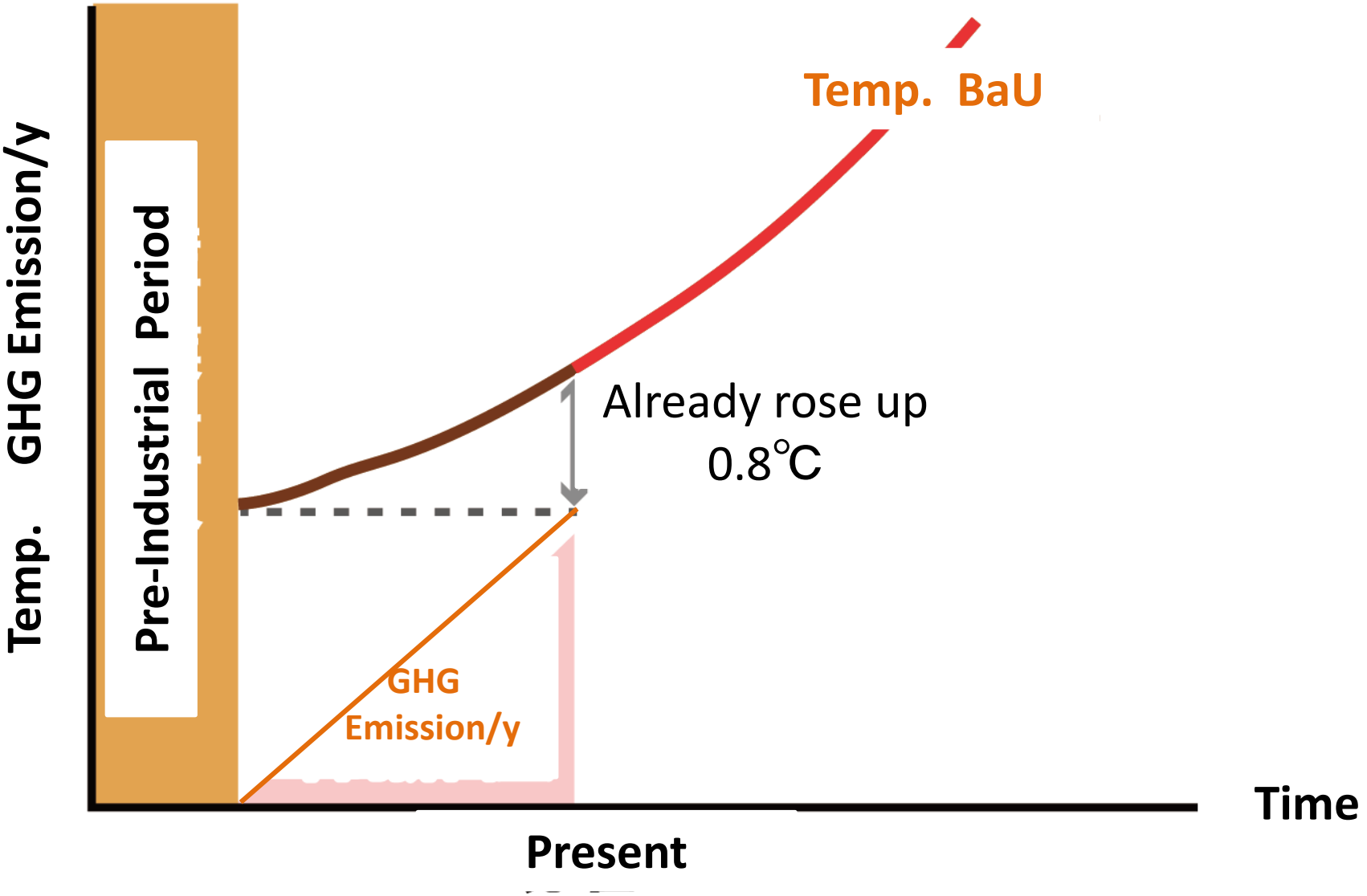
- 2℃ ⇒ 790 GtC
- 515GtC emitted already
- only 275GtC remained
- 2013 emission= 9.9GtC

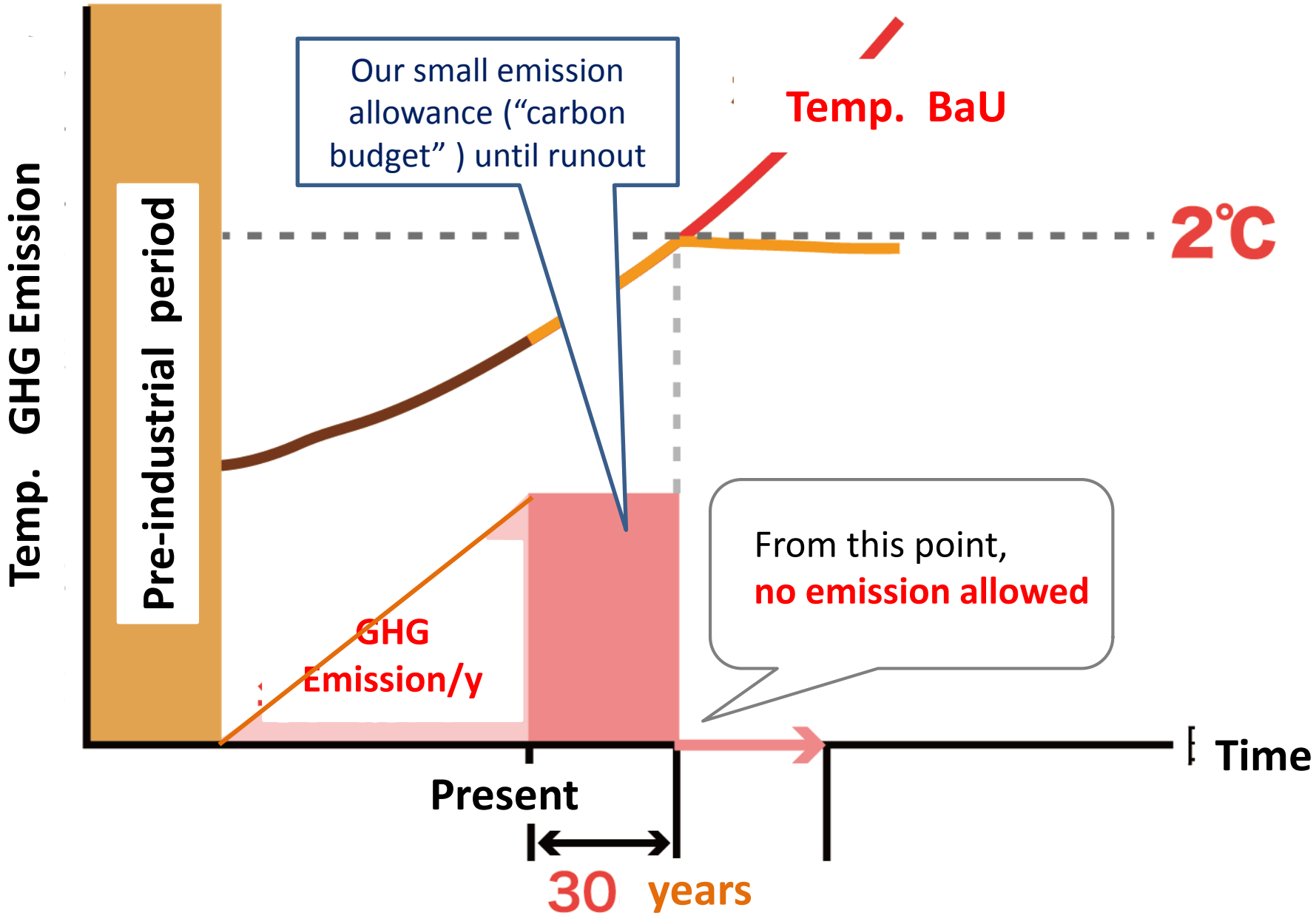
Transition to low carbon society within 50-100 yr.

Cumulative total anthropogenic CO2 emission from 1870 (GtCO2)

(IPCC AR4 and Emori, NIES)

Why to zero-emission?

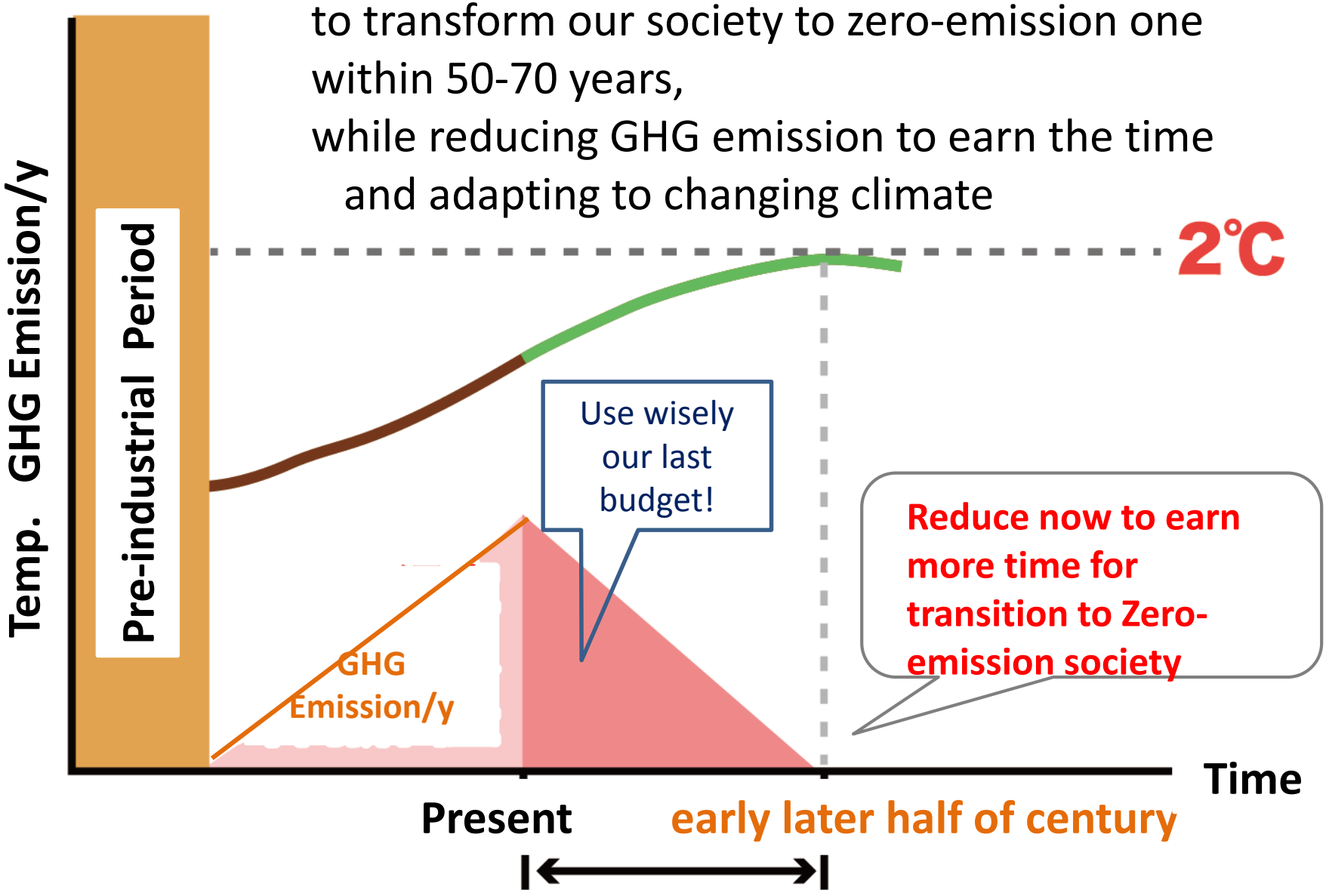



Temp. GHG Emission
Pre-industrial period
Our small emission allowance ("carbon budget") until runout
Temp. BaU
2℃
GHG Emission/y
From this point, no emission allowed
Time
Present
30 years

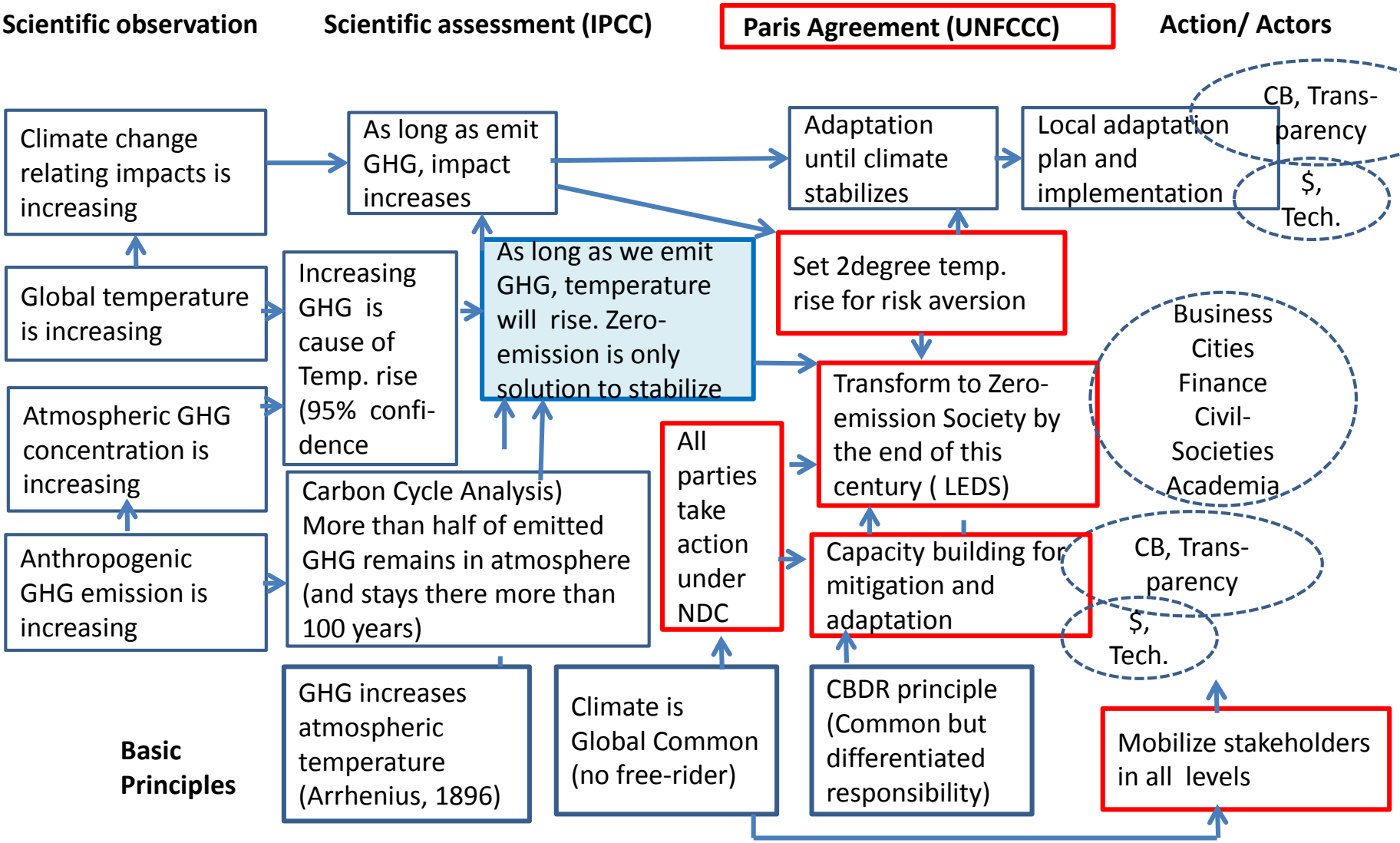
Our challenge is:

to transform our society to zero-emission one within 50-70 years,

while reducing GHG emission to earn the time and adapting to changing climate



Scientific Logic of Paris Agreement

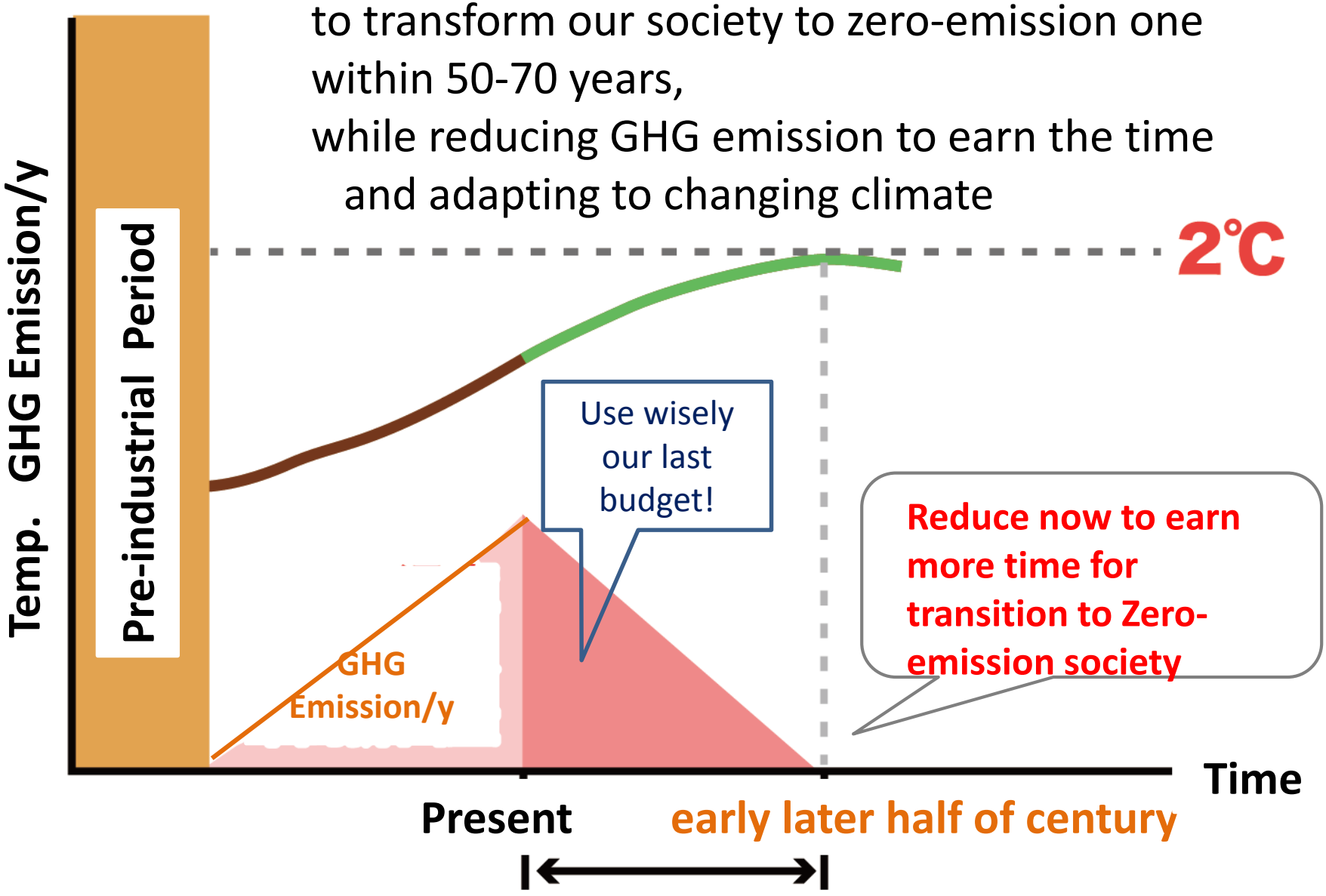


Implication to each country
Most country needs reduction towards 2050

Our challenge is:

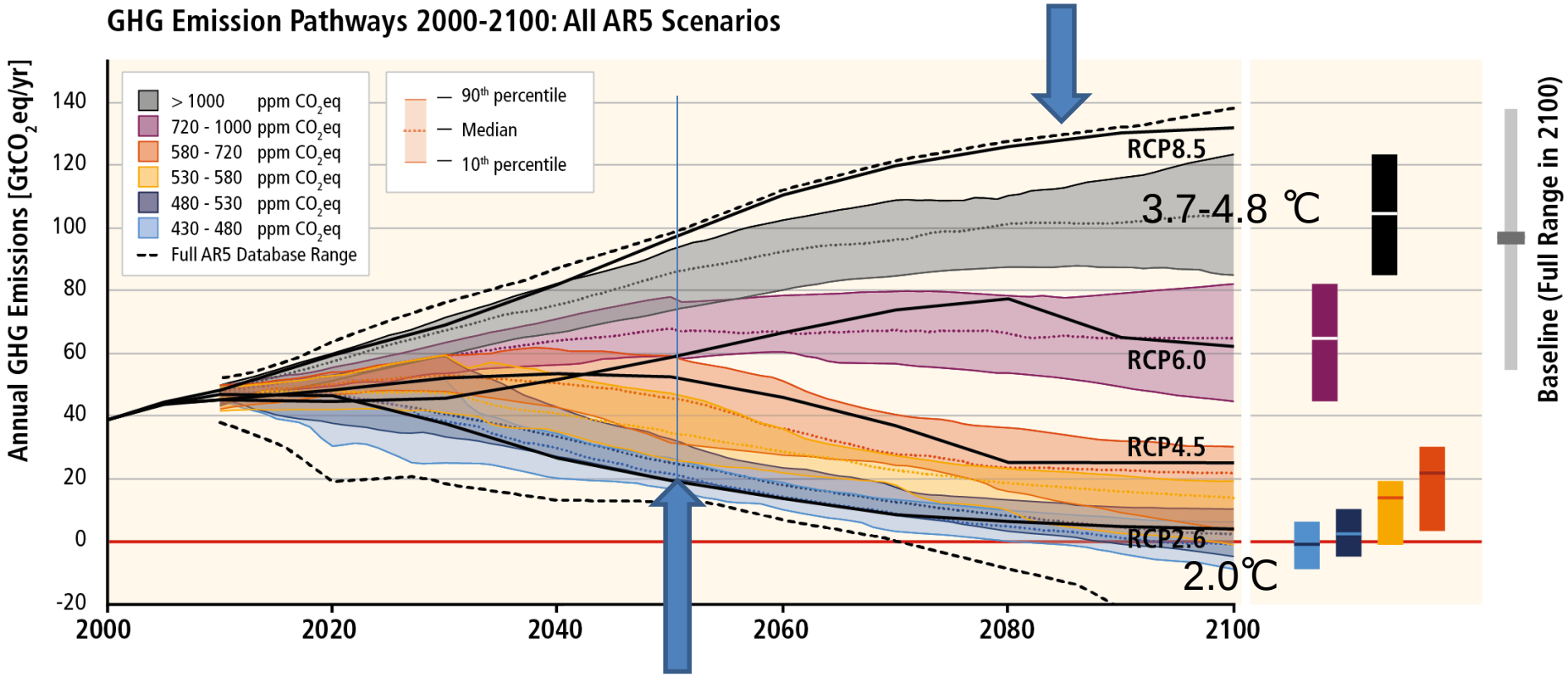
to transform our society to zero-emission one within 50-70 years,

while reducing GHG emission to earn the time and adapting to changing climate



Global target: Halving current emission by 2050

Without more mitigation, global mean surface temperature might increase by 3.7° to 4.8°C over the 21st century



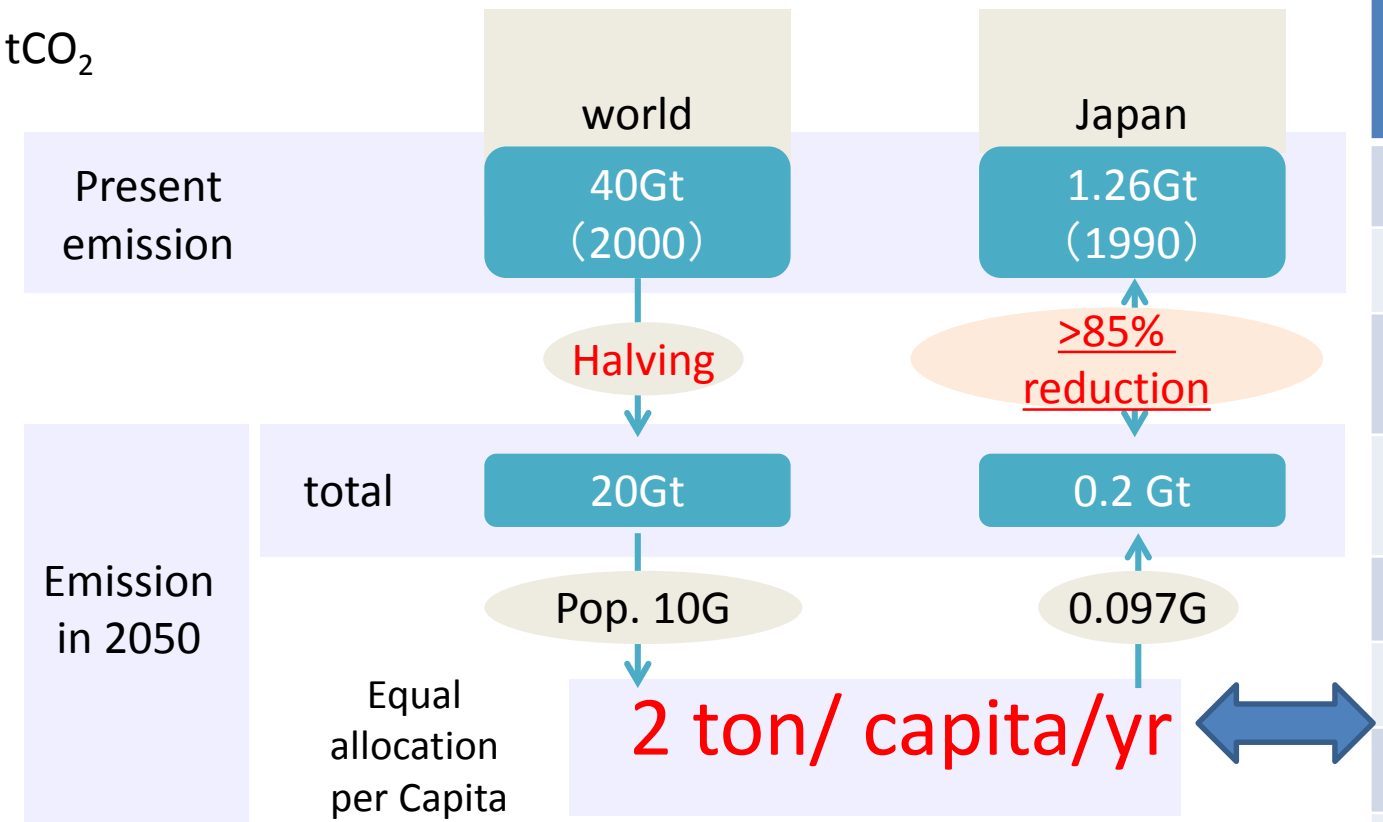
To avoid 2 degree rise, path of passing 50％ reduction from now in 2050 is feasible and reasonable .

IIPCC AR5 2013

Towards 2ton/Capita world

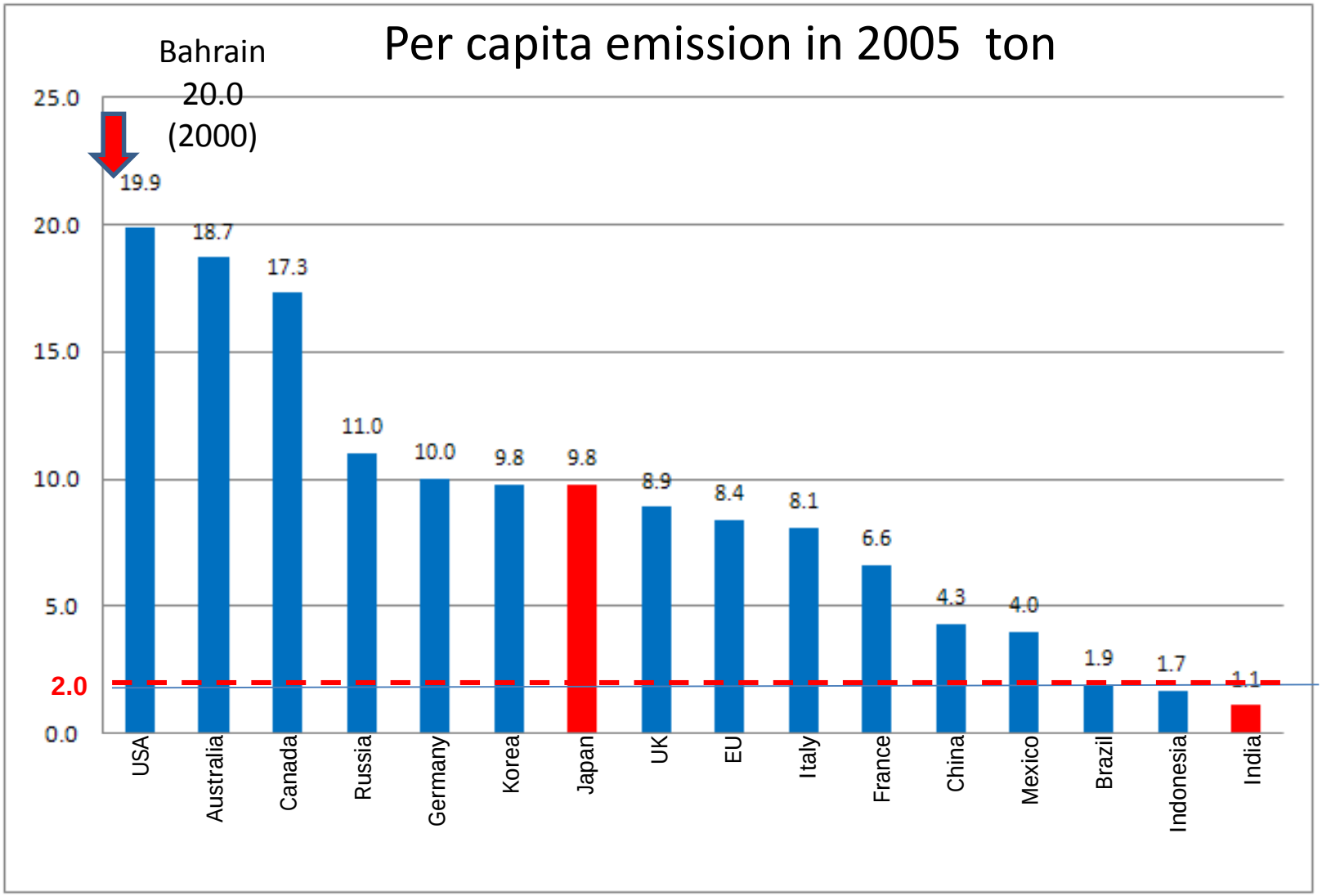
2℃ Target⇒Halving in 2050 worldwide⇒ 2 tCO_2 /Capita

Japan: more than 80% reduction(base:1990)



2010/ 2012	Per Capita tCO_2
USA	17.4/16.1
China	5.88/6.71
Iran (2000: 2nd NC)	5.4
Bahrain (2000 2nd NC)	20
Thailand	3.38/3.65
France	5.28/4.94
Germany	9.12/9.04
UK	7.77/7.36
Japan	9.08/9.57

※世界の人口は国連「World Population Prospects, the 2012 Revision」より、日本の人口は社人研「日本の将来推計人口（平成24年1月推計）」より.一人当たり排出量エネ起源のみ、EDMC エネルギー・経済統計要覧2015



World Resources Institute, Climate Analysis Indicators Tool

Implication of 2 ℃ target & 2ton /cap. to countries

- UNFCCC agreed to limit temperature less than **2℃** increase, avoiding dangerous climate change(Article 2).
- IPCC report : a path to halve the current GHG emissions by 2050 is reasonable in order to attain this goal.
- When halved GHG emissions in 2050 is allocated equally, per capita CO2 emissions is about 2 tonCO_2/ capita
- Currently: about 5ton world average (Japan 10t, US 19t, China 5.5t, Iran 5.4t)

- **Challenges**

  Fossil fuel rich countries : ⇒Stranded Asset :
  What are alternative resources?

  Developed countries: ⇒Significant reduction under locked –in capitals
  Difficult to continue high energy-dependent technologies

  Developing countries: ⇒Alternative develop pathway, quite innovative one fit for this huge transition..

Fossil fuel rich countries: Iran/ Bahrain

Value of fossil fuel decrease:

- Possible reserves of natural gas would greatly exceed 1000 $GtCO_2$=300GtC

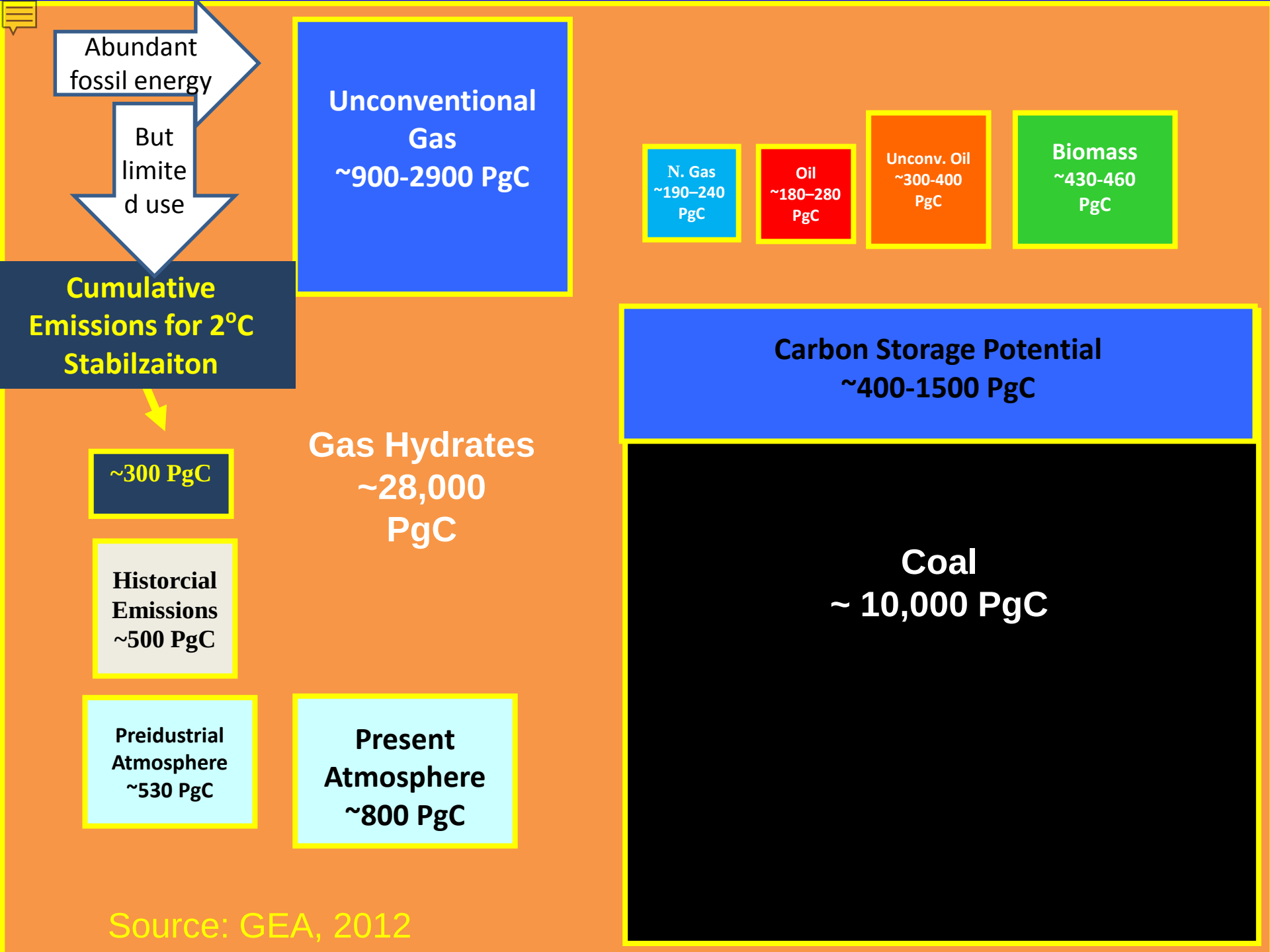
  ⇒Coal and oil with higher carbon intensity will become less priority

- "Amount of permissible emissions of GHG" = world's scarce resources=remaining money in our wallet **("budget")**

  Inevitably, its value will rise gradually. Instead, value of fossil fuels goes down

Transition to low carbon society

- Countries have begun a competition to create societies robust to zero carbon use
  - Financial guidance: the World Bank policy not to lend to coal
- Petroleum resource nations should use present accumulated capital to quick transition to low carbon society based on renewable energies and energy saving system
  - Governments should move investments and consumption in the direction of carbon-saving societies, carrying out carbon pricing such as carbon taxes or emissions quotas
  - In business, add carbon price to investment decisions: preparations for low-carbon transitions.
- Same situation: Oil price up from $1 to 10 in early 1970s ⇒ Japan turned to an energy-saving society⇒ caught up developed countries by energy-saving technologies /high fuel efficient cars


Abundant fossil energy
But limited use
Cumulative Emissions for 2°C Stabilzaiton
~300 PgC
Historcial Emissions ~500 PgC
Preidustrial Atmosphere ~530 PgC
Present Atmosphere ~800 PgC
Unconventional Gas ~900-2900 PgC
N. Gas ~190–240 PgC
Oil ~180–280 PgC
Unconv. Oil ~300-400 PgC
Biomass ~430-460 PgC
Gas Hydrates ~28,000 PgC
Carbon Storage Potential ~400-1500 PgC
Coal ~ 10,000 PgC
Source: GEA, 2012

relative CO2 intensity / calorie

Energy	Intensity
COAL	4
Petroleum	3
Natural gas	2
Nuclear	≒0
Renewable Energy	≒ 0
Biomass	≒ 0

Developed Country: Japan

Japan's energy and GHG emission situation (2014)

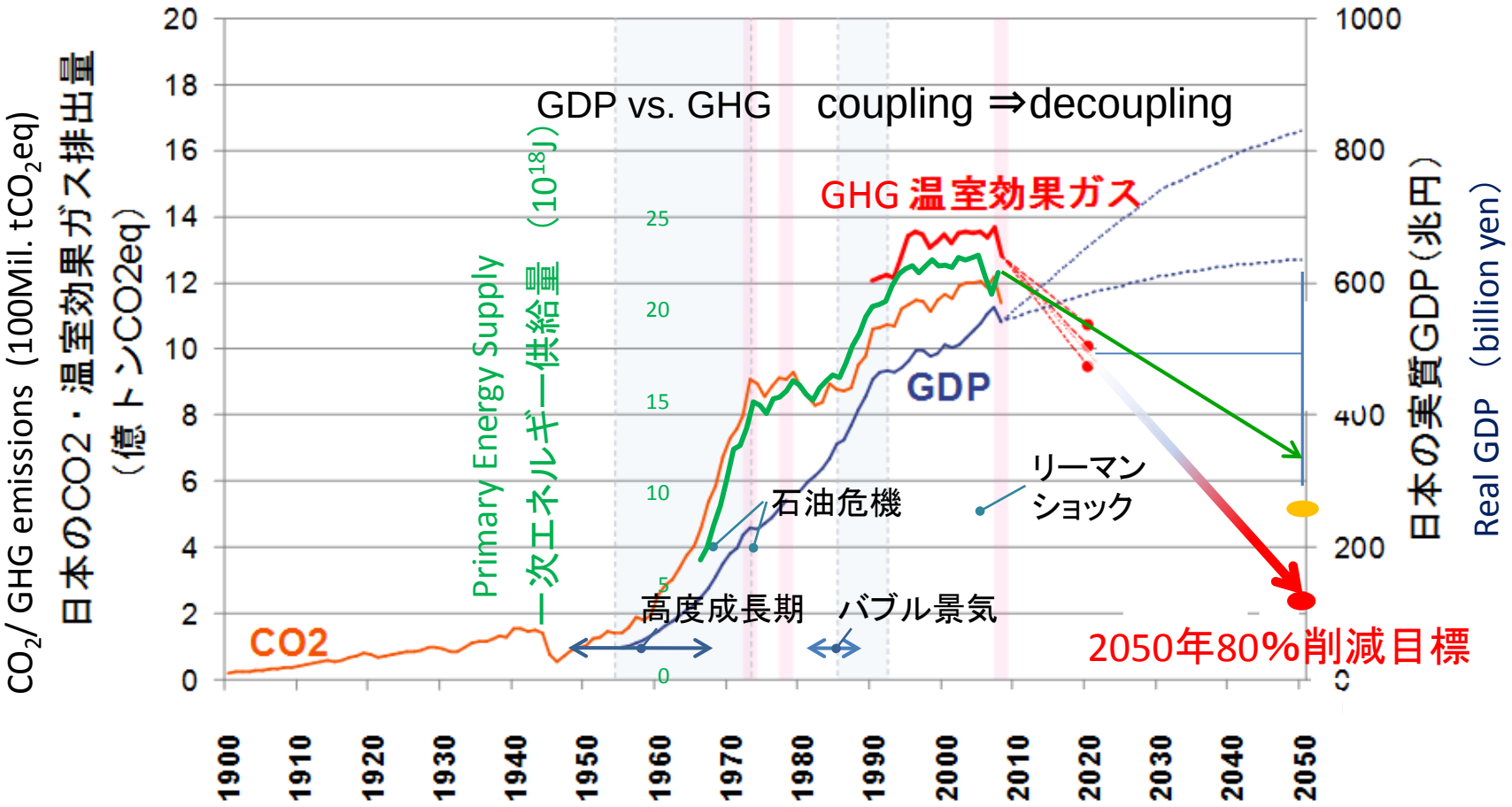
- Total primary energy supply: 550 Million kl Oeq

- Share in primary energy supply: Coal 25%, Oil 45%, NG24%, Nuclear 0%, hydro-Power 3%, Renewable energy 3%
- Energy self-sufficiency rate: low at 6% (20% prior to earthquake disaster 25% target for 2030)
- Dependency to Middle East: Oil 80%, NG: 28%

- Electricity price: high internationally
- Nuclear power: 54 reactors (30% of electric power generation)
  Following earthquake disaster: zero, at present 3 reactors in operation

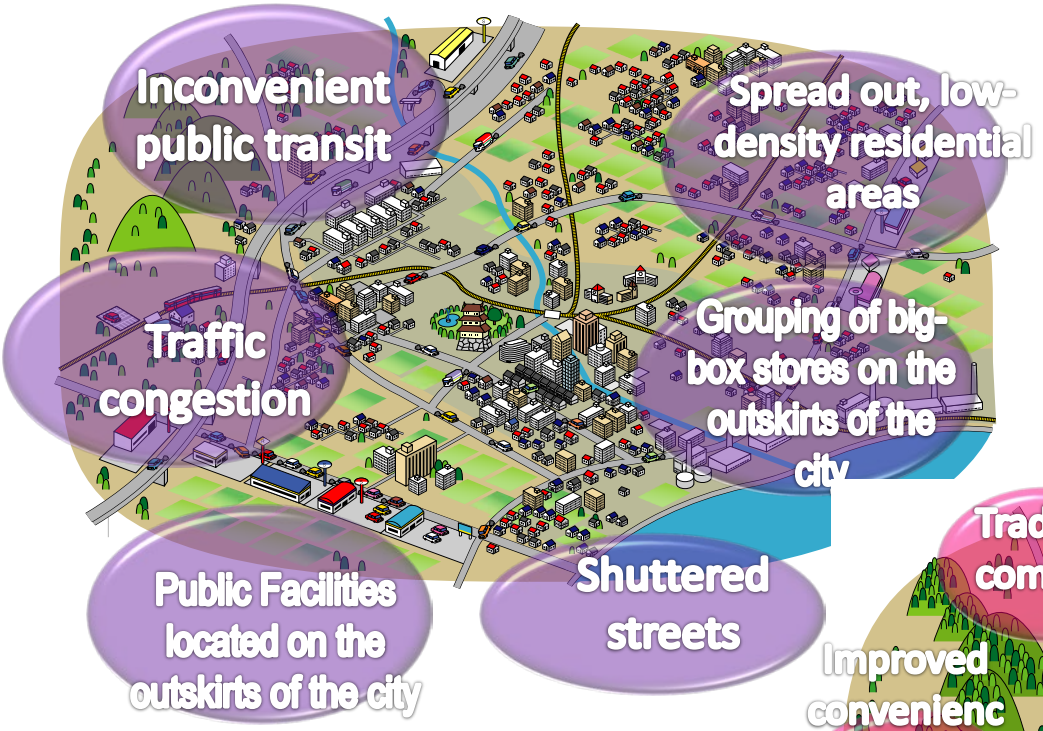
- Greenhouse gas emissions: 1.4Gt CO2eq ≒11ton/capita
  - 8% increase after nuclear shut down by Tsunami in 2011
  - 3% reduction compared to 2013: energy-saving investments, advances in energy-saving behavior, improved carbon-intensity of electric power

Japan: Drastic transformation towards 2050
Break away from high energy and carbon dependent society



）GDPの将来値は国立環境研究所 脱温暖化2050プロジェクト A･Bシナリオの想定値

2050 vision of compact city and rural life for aged society



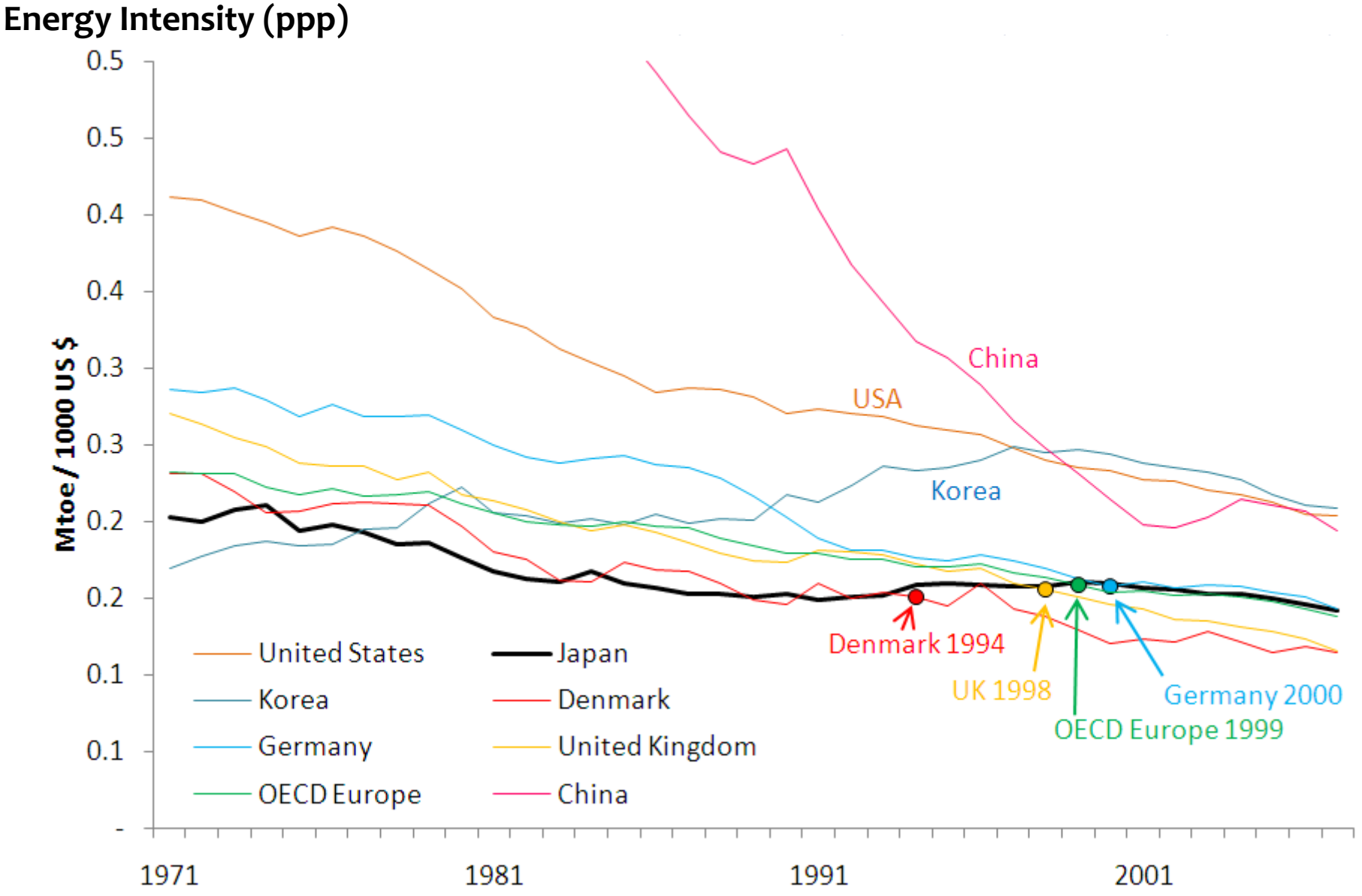
Before

and

After

Source: Local Development WG team

Glory of the past
"Japan as saving-energy frontrunner"



Original Data: IEA (2009) CO_2 Emissions from Fuel Combustion - Highlights

Characteristics of Old and New "Mission-Oriented" Projects

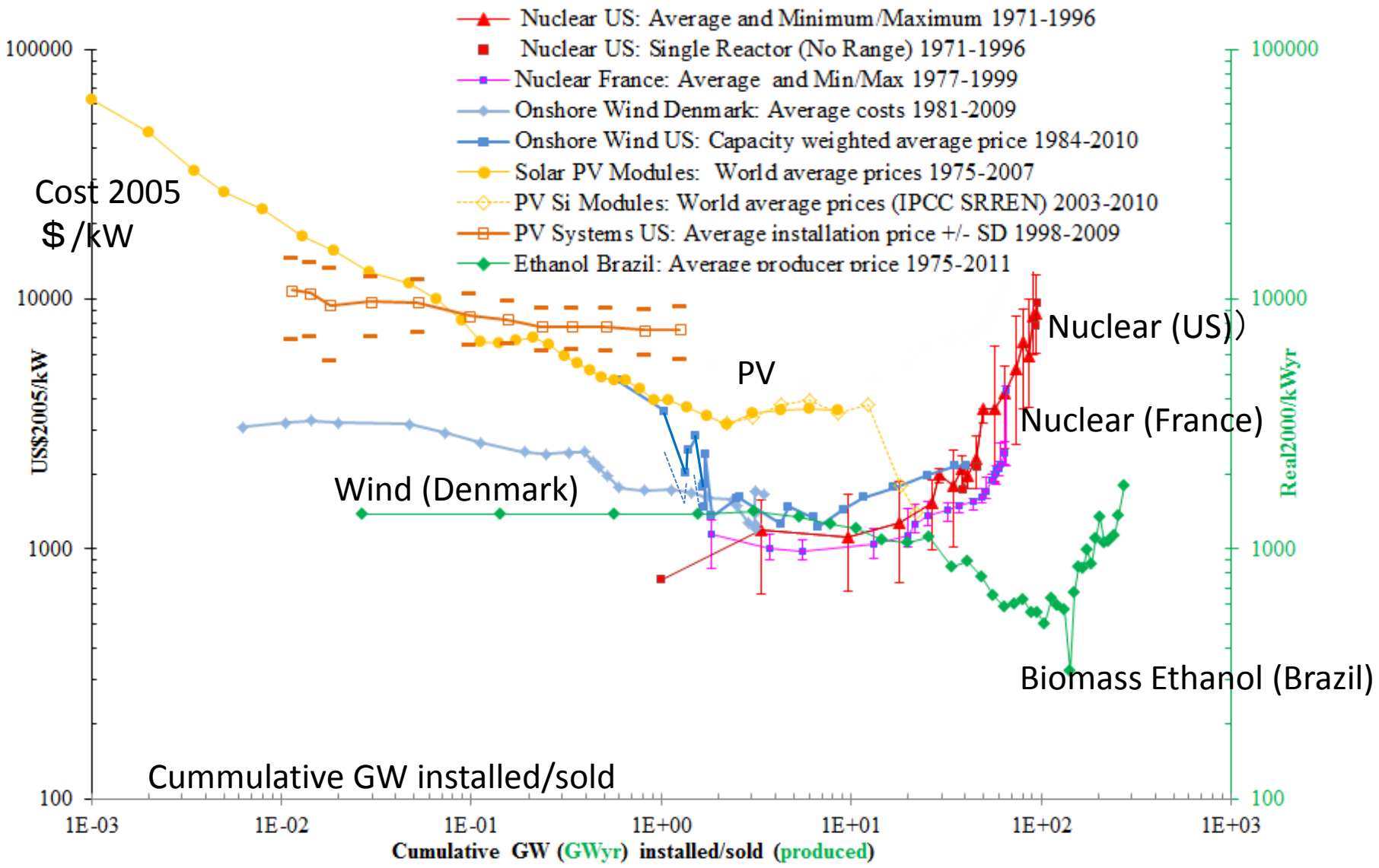
Source: Soete and Arundel (1993, p. 51)

Old: Defence, Nuclear and Aerospace	***New: Low Carbon Technologies***
The mission is defined in terms of the number of technical achievements with little regard to their economic feasibility	The mission is defined in terms of **economically feasible technical solutions** to particular environmental problems.
The goals and the direction of technological development are defined in advance by a small group of experts	The direction of technical change is **influenced by a wide range of actors** including the government, private firms and consumer groups
Centralised control within a government administration	**Decentralised control** with a large number of involved agents
Diffusion of results outside the core of participants is of minor importance or actively discouraged	**Diffusion of the results** is a central goals and is actively encouraged
Limited to a small group of firms that can participate owing to the emphasis on a small number of radical technologies	An emphasis on the **incrementalist** development of both radical and incremental innovations in order to permit a large number of firms to participate
Self-contained projects with little need for complementary policies and scant attention paid to coherence	**Complementary policies vital** for success and close attention paid to coherence with other goals

Japan's Primary Energy Supply (Million kl Oeq) (%)

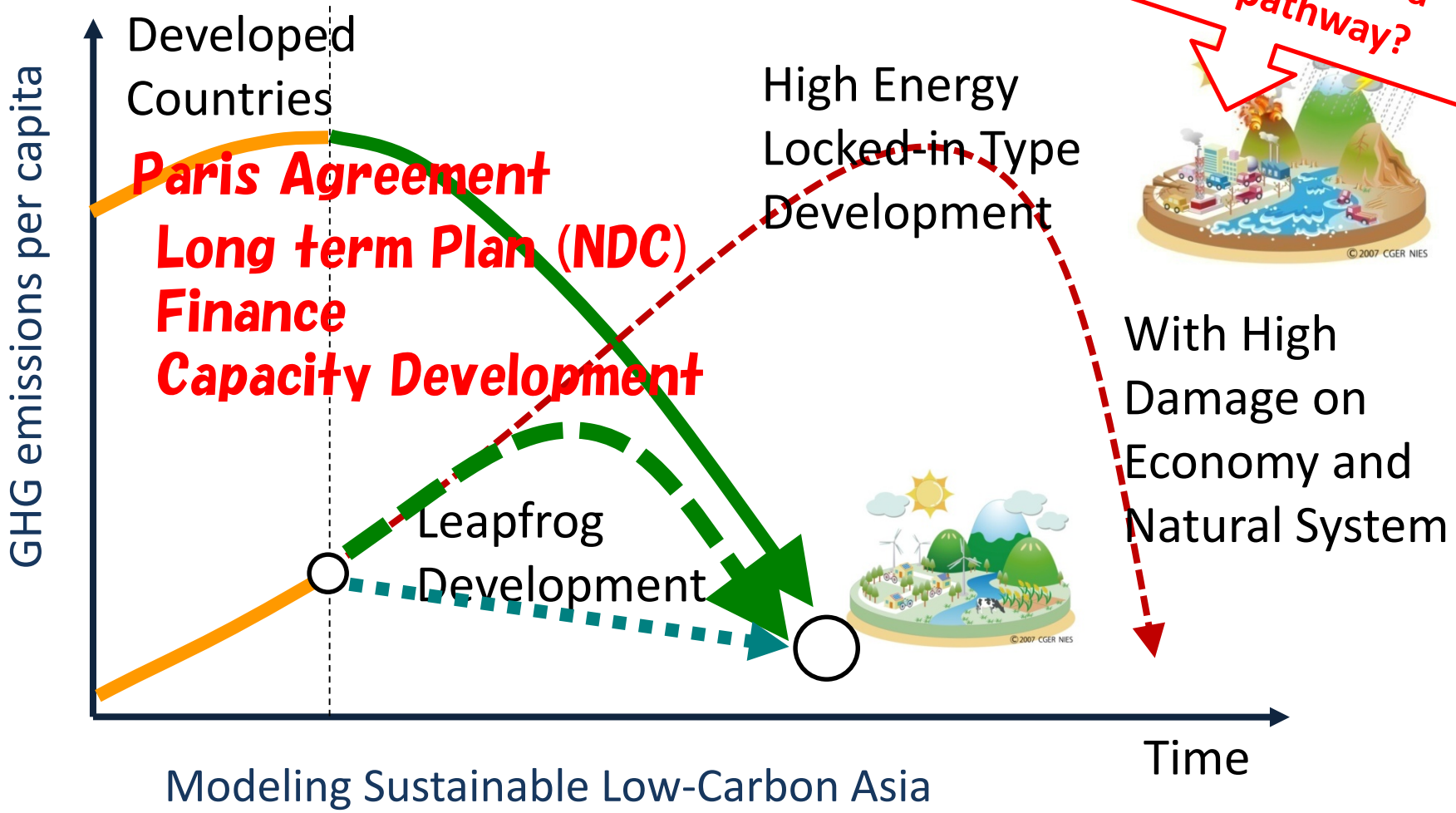
	FY2013	%	FY2030	%
Oil	216	40	145	30
LPG	16	3	13	3
Coal	136	25	123	25
NG	131	24	92	19
Nuclear	2	0.4	51-48	11-10
Renewable	41	8	64-67	13-14
Total	542	100	489	100

Post Fossil Energy Supply Technologies Cost Trends



Source: Grubler/Wilson, Cambridge University Press, 2014

LCS scenario in Asia



"Asian Low-Carbon Society Scenario Development Study" FY2009-2013, funded by Global Environmental Research Program, MOEJ

http://2050.nies.go.jp/index.html

What about Asian developing countries?

Asia (China, ASEAN, India, Japan,,) :

- Half of global emission in 2050 (BaU)
- Center of global economic growth, High investment in infrastructure & industry⇒lock-in to conventional high-energy consuming technologies, in coming next 30-50 years
- Already exceeded 2 ton/capita

- "leapfrogging": new development pathways?
- A good example: China's late comer's advantage

➢ Mobil-phone: difficulty in wired telephone, IT age, ⇒No.1 user and producer of mobile phone

➢ Renewable energy: vast national territory, low-carbon trends, energy security, air pollution by coal use⇒No.1 in the world producer of renewable energies and devices

➢ Electric Bike in Shanghai (good engineering capability, engine technology needed, air pollution, potential market in Asia

➢ Subway in Shanghai: 14 route after International Exhibition in 2010

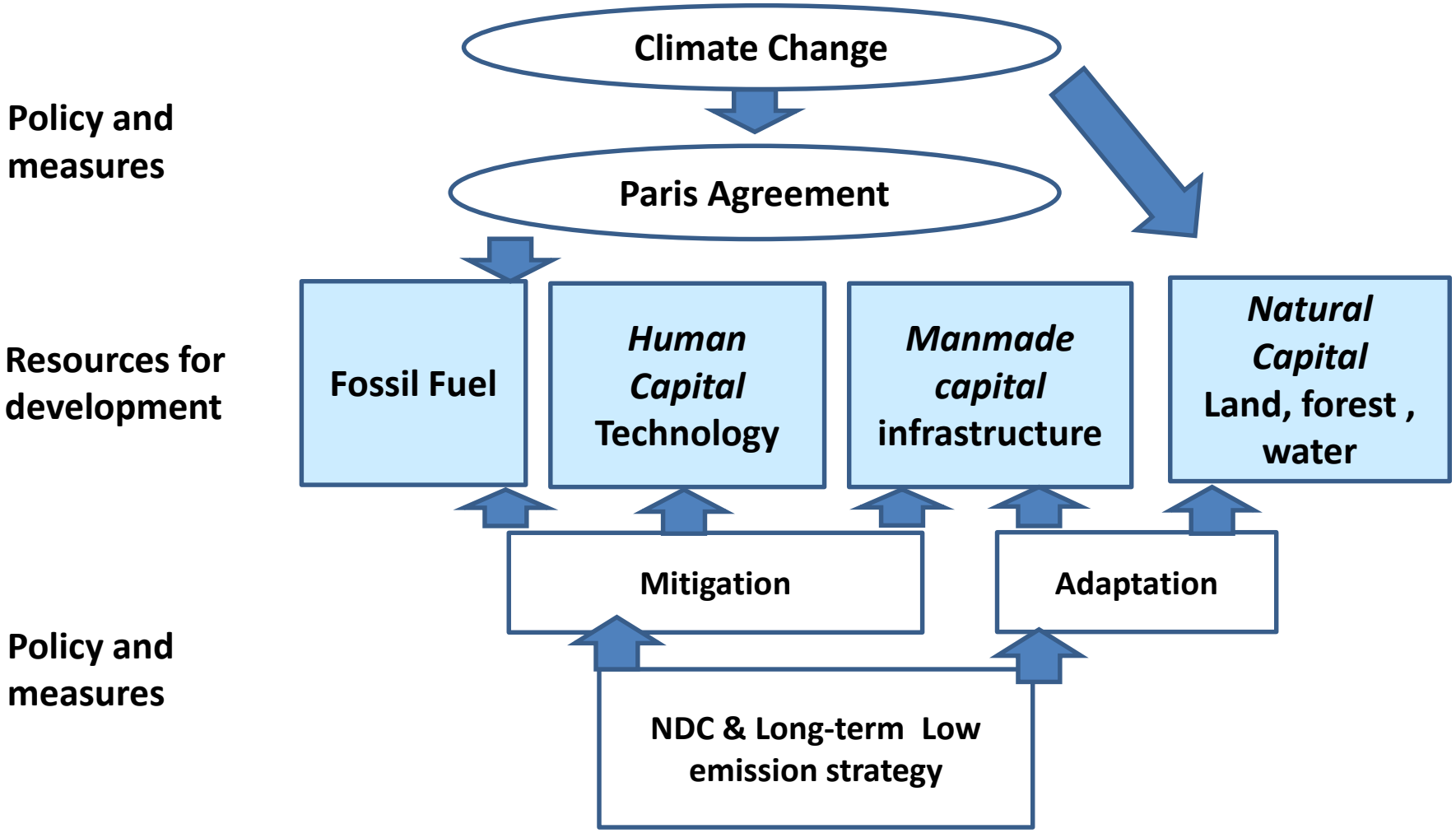
Different Pathways to Low Carbon Society

	Japan	Iran	Bhutan
Source of Revenue	Technology	Oil	Electricity to India
Emission/cap (ton) Absorption/cap (ton) Allowable emission	Now 2050 11 ⇒ 2 0 ⇒ 0 2	5.4 ⇒ 2 0 ⇒ 0 2	1 ⇒ 2 6 ⇒ 6 8
Obsoleting Asset	Highly energy depending Tech. & infrastructure (locked in)	Almost stranding fossil fuel	
Advantageous Asset	Saving energy - technologies Human resource	Historical Asset Broad land	Hydro-power Forest, Biodiversity Good governance
Vulnerable Asset		Fossil fuel reserve Water shortage Drought	Water shortage Forest damage Landslide by CC
New development path	R&D industry Sharing Society	?	Fully natural resource dependent society

Dependency of resources /capital (Subjective Judgement by SN)

Resource	Fossil Fuel	NG	Hydro power	Forest	Land/ Sea	Hi-Ene Infra	Financial Capital	Human Capital
Value Trend	−−−	−	++ −	++ −	++	−−−	+ −	+++
Bhutan			○○	○○				○
Iran	○○○				○○			○
Bahrain	○					○○	○○	○
Indonesia	○○	○	○+ Geo	○○○	○○	○		○
Thailand				○	○	○		○
Malaysia	○			○	○	○	○	○
Vietnam	○○			○	○			○
China	○○○	○	○	○	○	○○	○○	○○
Japan						○○○	○	○○

Climate Change:
Impact to Resources for Development



Conclusion

- The logic of the Paris Agreement is fully based on science (except 2 degree target which rather based on risk management consideration) ⇒Human being is only a part of nature, and cannot be free from the nature's rule
- Within this century, world needs transition to zero emission world
- We have to use our remaining small "carbon budget" wisely for this urgent transformation to zero emission world
- Paris Agreement is changing the value of existing national resources that worked advantageously to the development so far
- Each country has to re-examine its own asset available for low carbon development

Thank you very much for your attention!

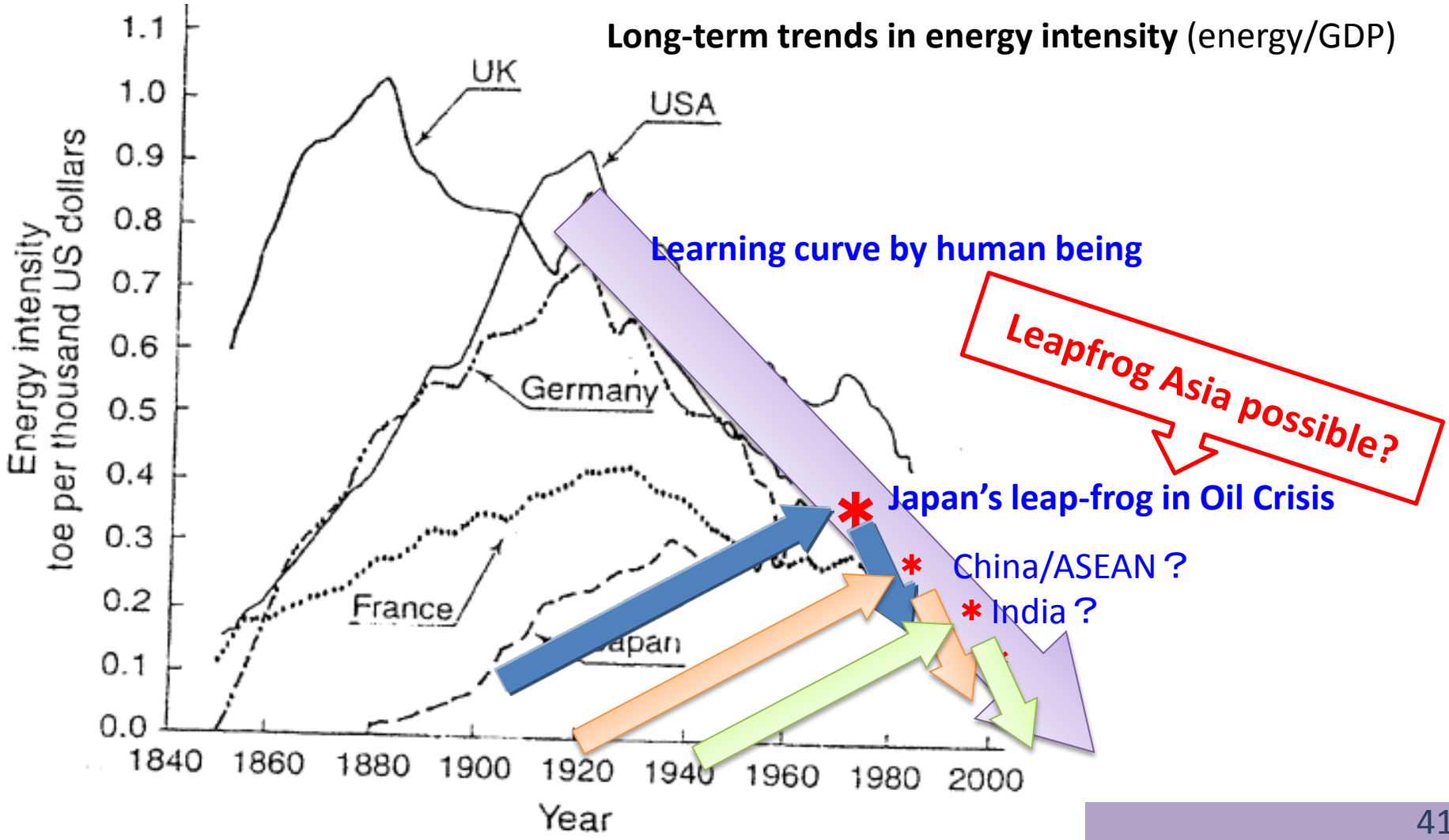
LCS-RNet/LoCARNet Secretariat
http://lcs-rnet.org/index.html

c/o Institute for Global Environmental Strategies (IGES)
2108-11 Kamiyamaguchi, Hayama, Kanagawa 240-0115, Japan

E-mail: lcs-rnet@iges.or.jp
Fax: +81 (0)46 855 3809

Opportunities for Asia: Leveraged by climate change

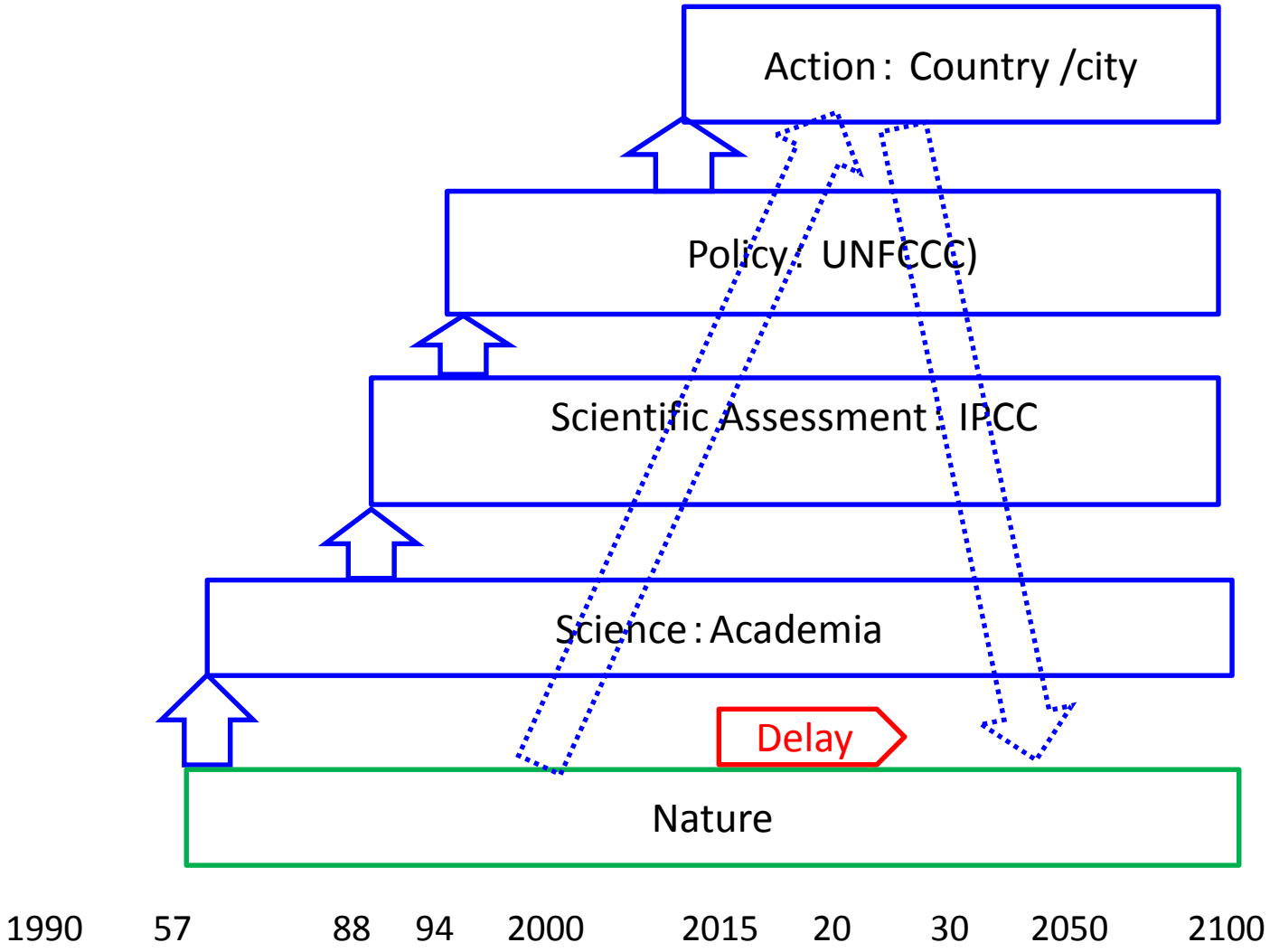
Long-term trends in energy intensity (energy/GDP)



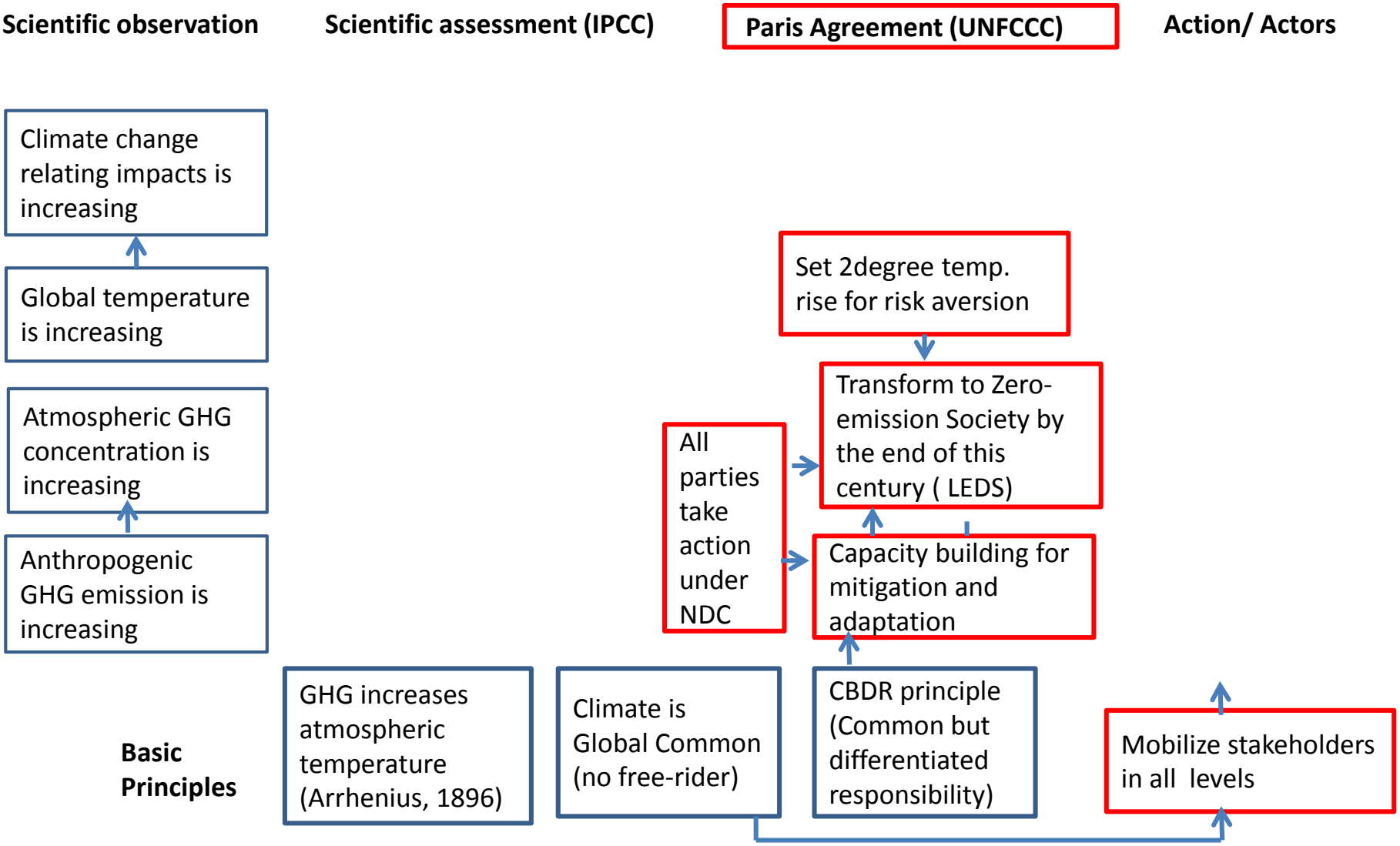
Example of Leap-frogged Asia

	Country	*Domestic factors*	*External factors*
Industrial structure	**India:** **IT industry**	**Education/ human resources**	**Soft technology** **Globalization**
Energy structure	**Japan:** **Low energy intensity**	**Technology** **Rapid growth**	**Oil crisis** **Energy security**
Urban structure	**Singapore:** **Transportation, water, housing** **Tokyo:** **Public transportation**	**Small land area** **Strong leadership** **Rapid urbanization**	**Relationship with Malaysia** **In advance of auto age**
Distributed energy	**India:** **Renewable energy, biomass** **Brazil: Ethanol**	**Poor power grid investment; land area** **Sugar cane, scarce oil**	
Information	**China:** **Mobile phones**	**Rapid economic growth, big land area,** **Not enough com-grid**	**IT technology**
Renewable energy system	**China:** **Wind/solar energy**	**Vast land area**	**Climate change**
Agriculture	**Low energy use**	**Self sufficiency**	**Energy price**

Climate change response: From science to action



Scientific Logic of Paris Agreement



LoCARNet

Low Carbon Asia Research Network:

Researchers community dedicating to scientific policy making process towards Low Carbon World

Shuzo Nishioka
Secretary General of LCS-RNet
Institute for Global Environmental Strategies (IGES)

Low Emissions Development Policy Implementation
July 13, 2011, World Bank Headquarters


Rizaldi BOER
Indonesia


Bundit
LIMMEECHOKCHAI
Thailand


Jiang KEJUN
China


Ho Chin
SIONG
Malaysia


Sirintornthep
TOWPRAYOON
Thailand


Mikiko
Kainuma
Japan


Hak MAO
Cambodia


Yutaka
MATSUZAWA
Japan


Mohamad Bin
SA'ELAL
Malaysia

INSTITUT PERTANIAN BOGOR

国家发展和改革委员会能源研究所
Energy Research Institute National Development And Reform Commission

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

環境省
Ministry of the Environment

ISKANDAR
REGIONAL DEVELOPMENT AUTHORITY

환경부 국립환경과학원

IGES

KMUTT SIIT-TU KMITNB CNU PSU
JGSEE
The Joint Graduate School of Energy and Environment

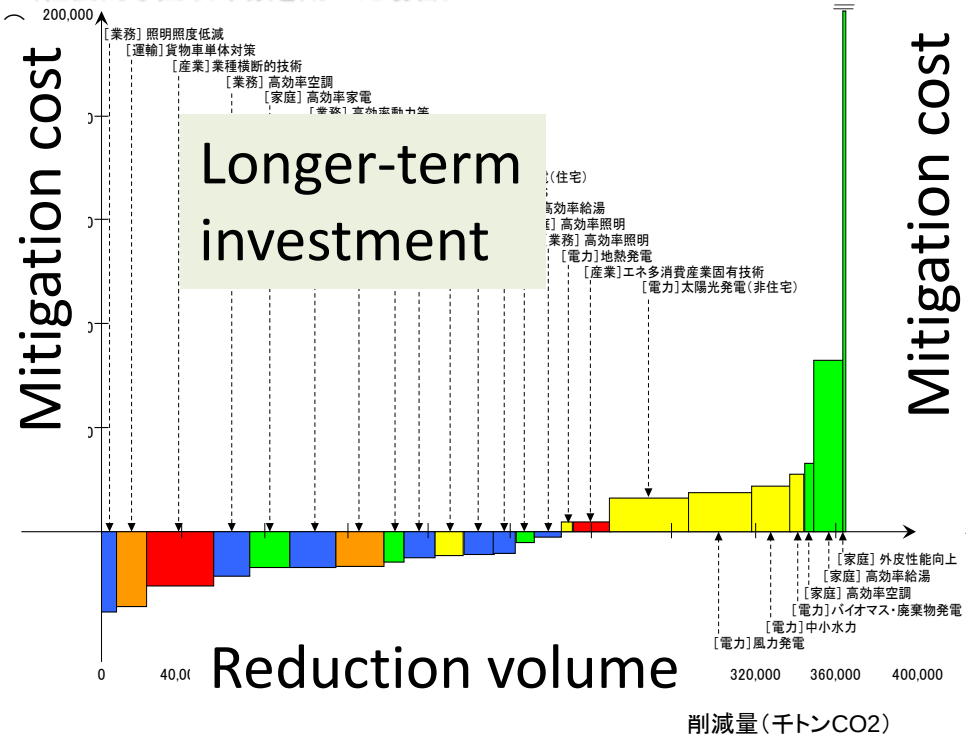
NIES JAPAN

Mitigation cost curve in Japan to take aggressive emissions reductions options by 2030

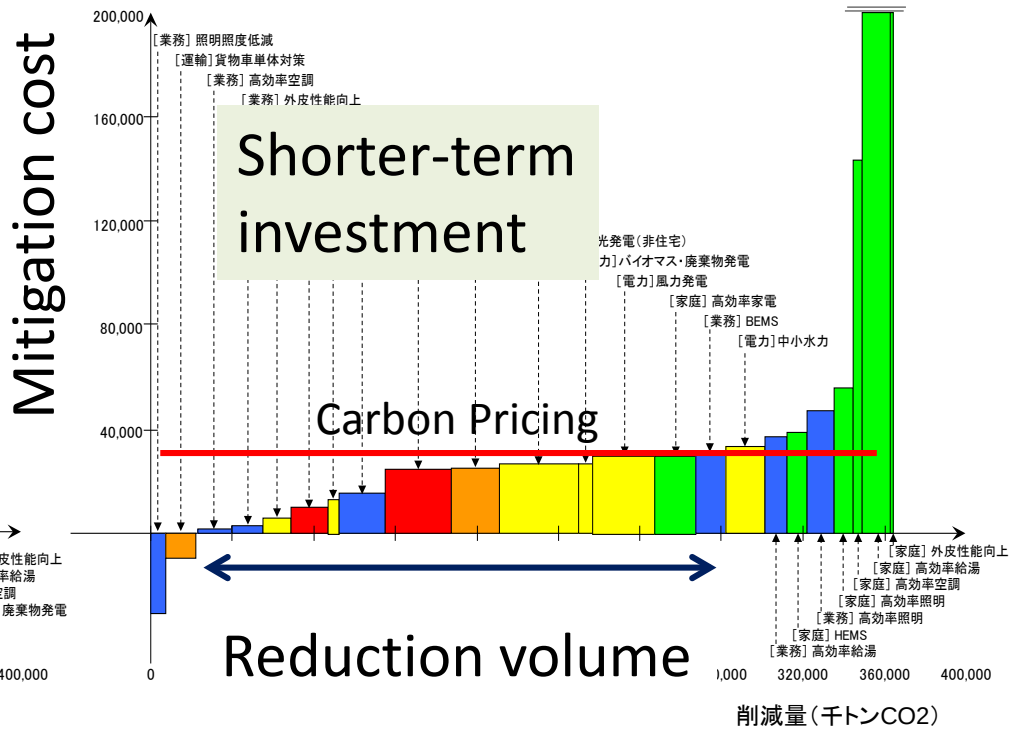
Longer-term investment

われるようにすると
場合には、家庭部門
運輸部門で原則3年

●政策による後押しなどによって長期の回収年を前提に投資が行われる場合
（社会的な回収年数を用いた場合）



●各主体が短期の回収年を念頭に投資を行う場合
（主観的な回収年数を用いた場合）



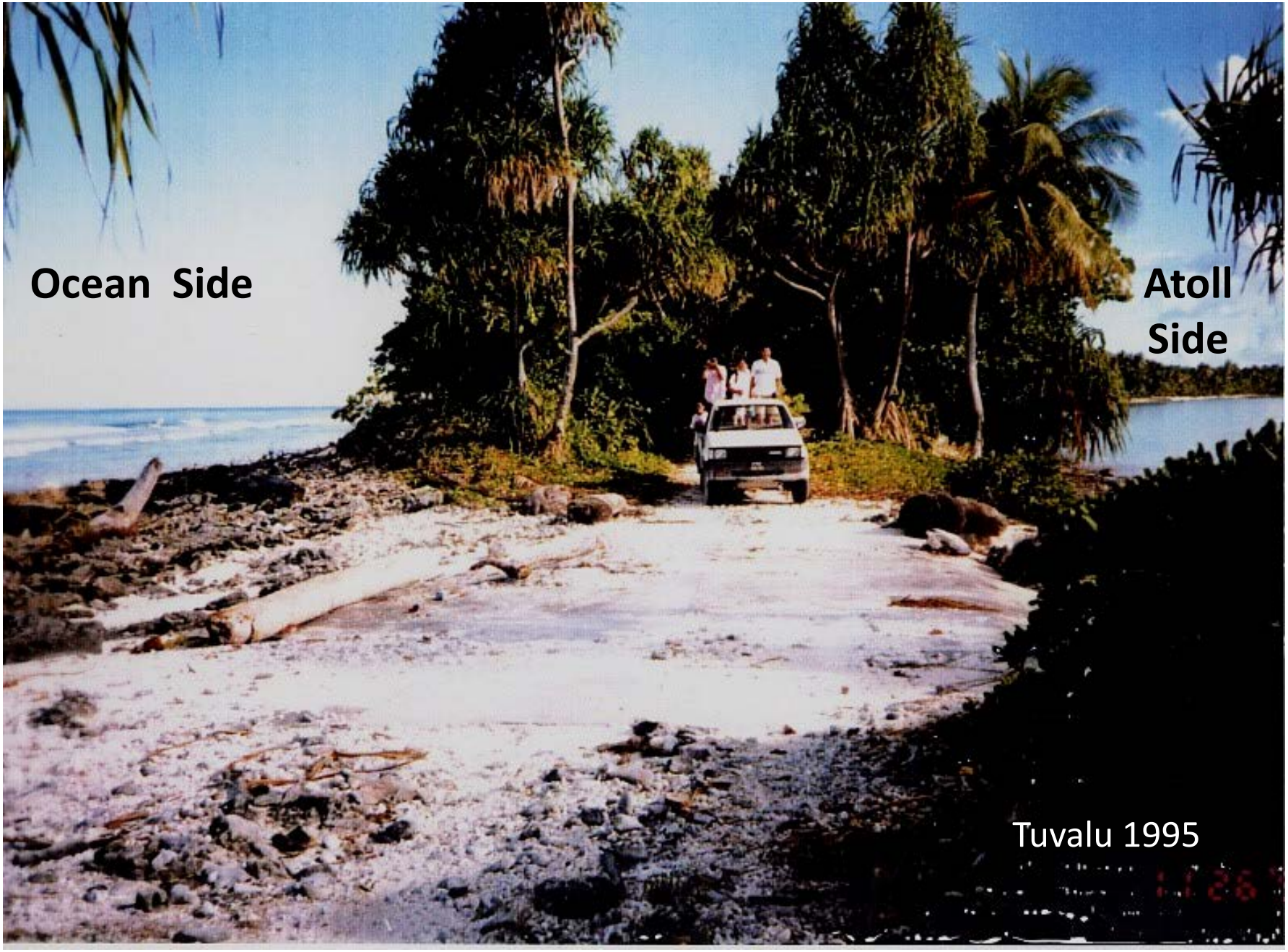
産業部門・投資回収年数 12～15年
家庭部門・投資回収年数 8年（*2）
業務部門・投資回収年数 8年（*3）
運輸部門・投資回収年数 8年
再エネ発電・投資回収年数 12年
*2 住宅は17年，*3 建築物は15年

産業部門・投資回収年数 3年/10年（*1）
家庭部門・投資回収年数 3
業務部門・投資回収年数 3

The result by AIM/Enduse[Japan]

※ 上記グラフが示す削減量は固定ケースと対策ケースの差である。本試算に用いたモデル内では、固定ケースと対策ケースでは原子力発電 …た場合には、火力発電の発電電力量が低減すると想定した。そのため、火力発電の排出係数として0.54kgCO2/kWh（使用端）を仮に用いて …力設備の運用では電力需要の動向に応じてあらゆる電源で対応することから、全電源平均の係数を用いて電力削減によるCO2削減効果を算定する方法もあるため、実際の削減量はモデルの試算とは必

Anthropogenic GHG emissions continue: climate is changing: A rising sense of crisis to human system


Ocean Side
Atoll Side
Tuvalu 1995

Sea level rise

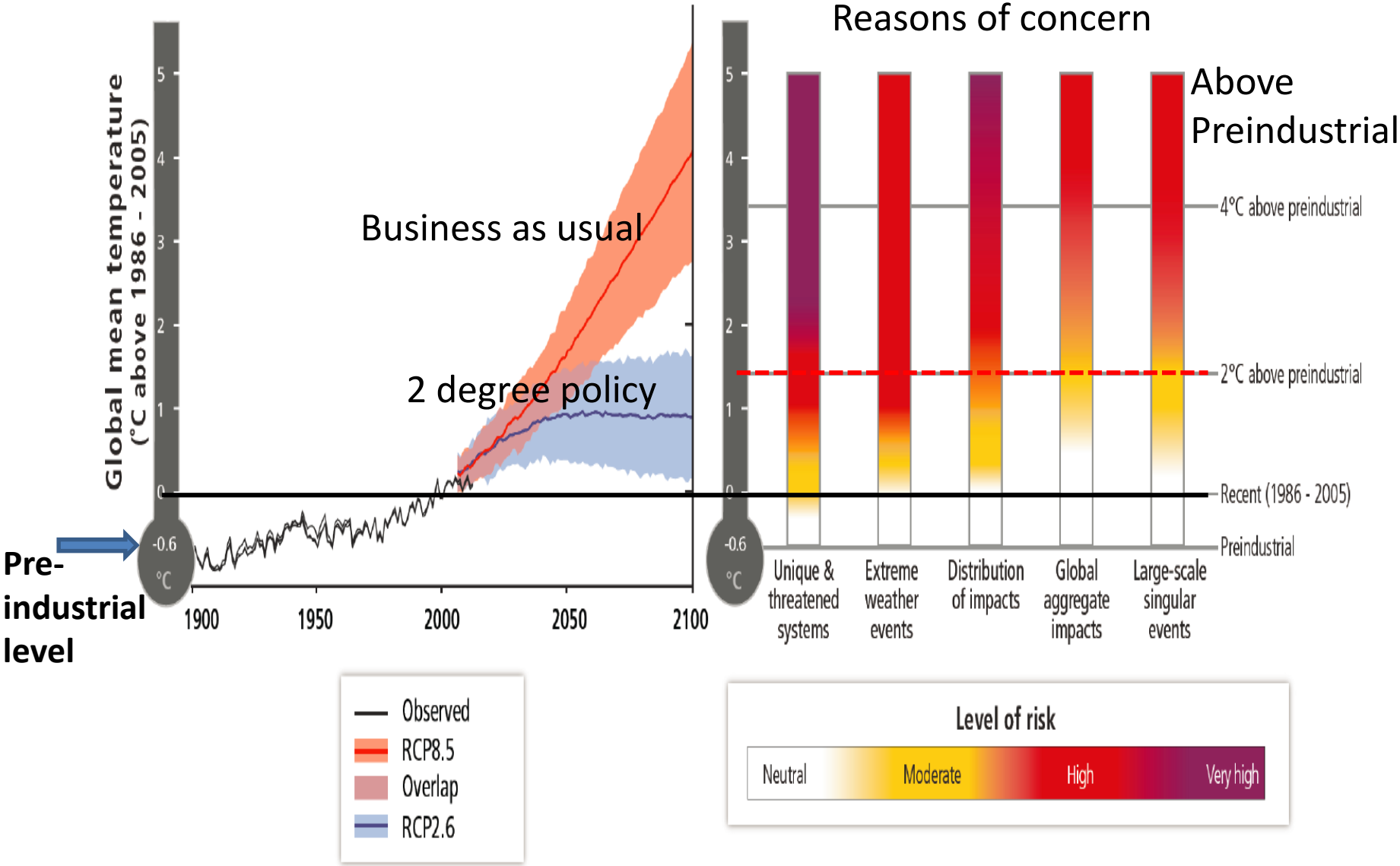
Simple measurement

Highest point : 3m

Habitat area: 2m


Water resource
Home reservoir of rain water
Ground water reservoir shrinks by sea level up
Rain water
basin

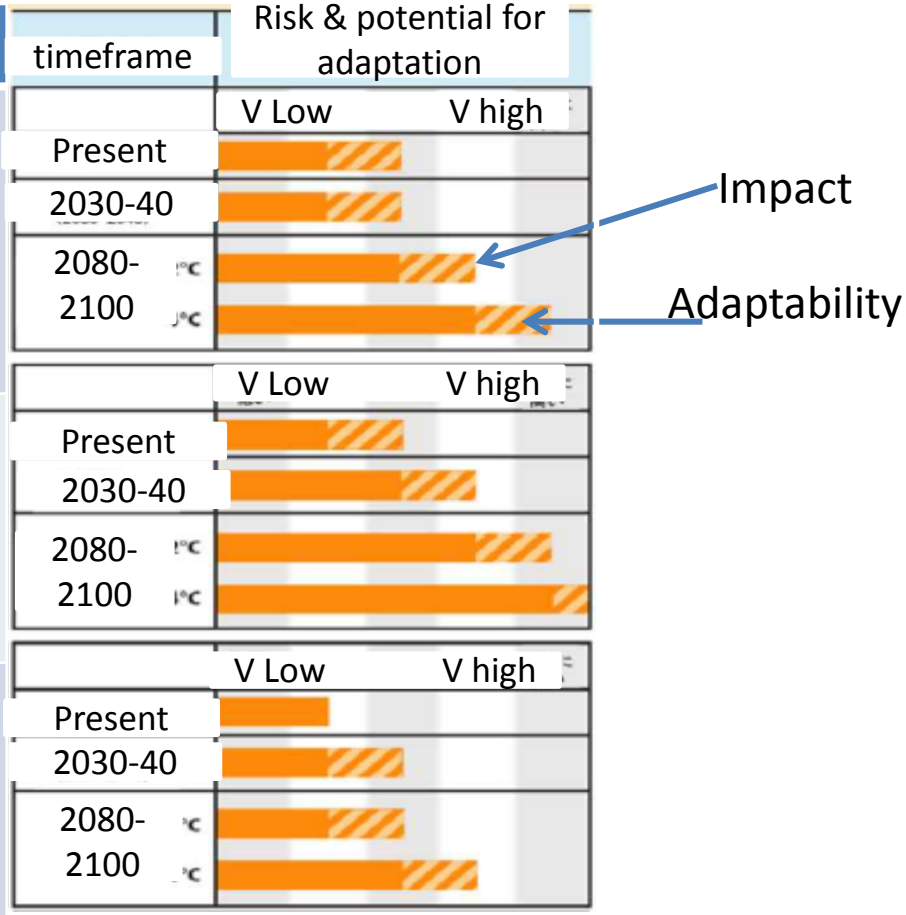
Increasing risk with a temperature rise



⇒ **2 degree above preindustrial level : Internationally agreed target of risk aversion**

Risk increases as temperature rises, but adaptability is limited

Key Risk In Asia
Increased riverine, coastal, and urban flooding leading to wide spread damage to infrastructure, livelihoods, and settlements (medium confidence)
Increased risk of heat related mortality (high confidence)
Increased risk of drought-related water and food shortage caused mal- nutrition (high confidence)



Adaptation: issues, policy and measures

- Basically , Adaptation measures : locally done, under national guidance
- International level : how to compromise mitigation and adaptation, Loss & damage, responsibility sharing

- National level: Issue finding, vulnerability assessment, guidelines for impact assessment and adaptation, national budget:
- Ecosystem preservation, agriculture, health, infrastructure, economic evaluation, mainstreaming of adaptation. Compensation/ insurance system design. Monitoring Network, promotion of research for cc forecast and assessment, establishment of early warning (long and short)system , revise standards for infrastructure, social campaign

- Local scale: hazard map, vulnerable assessment, long and short time scale adaptation plan fit to local environment, mainstreaming adaptation into local development plan, budget allocation, collaborative action in local community, maintenance of adaptation measures
- Mitigation is the most effective adaptation. We cannot adapt to continuing change.

Japan's energy and climate policies

- 2007 Heiligendamm G8 Summit, PM Abe: "Cool Earth 50" concept of halving global emissions by 2050
- 2008 Toyako Summit, PM Fukuda: 60-80% reduction by 2050, concept of low carbon society
- 2014 Basic Environment Plan: Set 2050 target at an 80% reduction

- 2015 COP21 Summit PM Abe announced "Actions for Cool Earth 2.0 (ACE2.0)"
  Japan's INDC:
  26% GHG reduction in 2030 compared to 2013
  Energy conservation: 13% reduction from BaU
  35% improvement in energy efficiency (=E/GDP)
  Reduce dependency on nuclear power as low as possible

- Global Warming Prevention Headquarters (cabinet members) decided:
  Formulate a global warming response implementation plan by spring of 2017
  Enhance public movements, support developing countries and encourage technological innovation
  Strengthen "climate security" including "energy security" through contributing to climate change measures around the world
  Reduce energy demand as much as possible
  Promote shift to low-carbon energy/ enhance electrification

Japan's long-term strategy to reduce GHGs

Recommendations of "Round Table on Climate Change Long-term Strategy" for Ministry of the Environment (2016)

- Innovations in the structures of society are indispensable: simultaneous solutions to drastic reductions and socio-economic challenges

- Economic growth: Realizing economic growth through "Creation of new green markets" and "Environmental value as an opportunity for high economic added value"

- Regional revitalization: Supporting regional revitalization through "energy revenue surplus" by utilizing "regional natural capital" for renewable energies

Thank you very much for your attention!

LCS-RNet/LoCARNet Secretariat
http://lcs-rnet.org/index.html

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