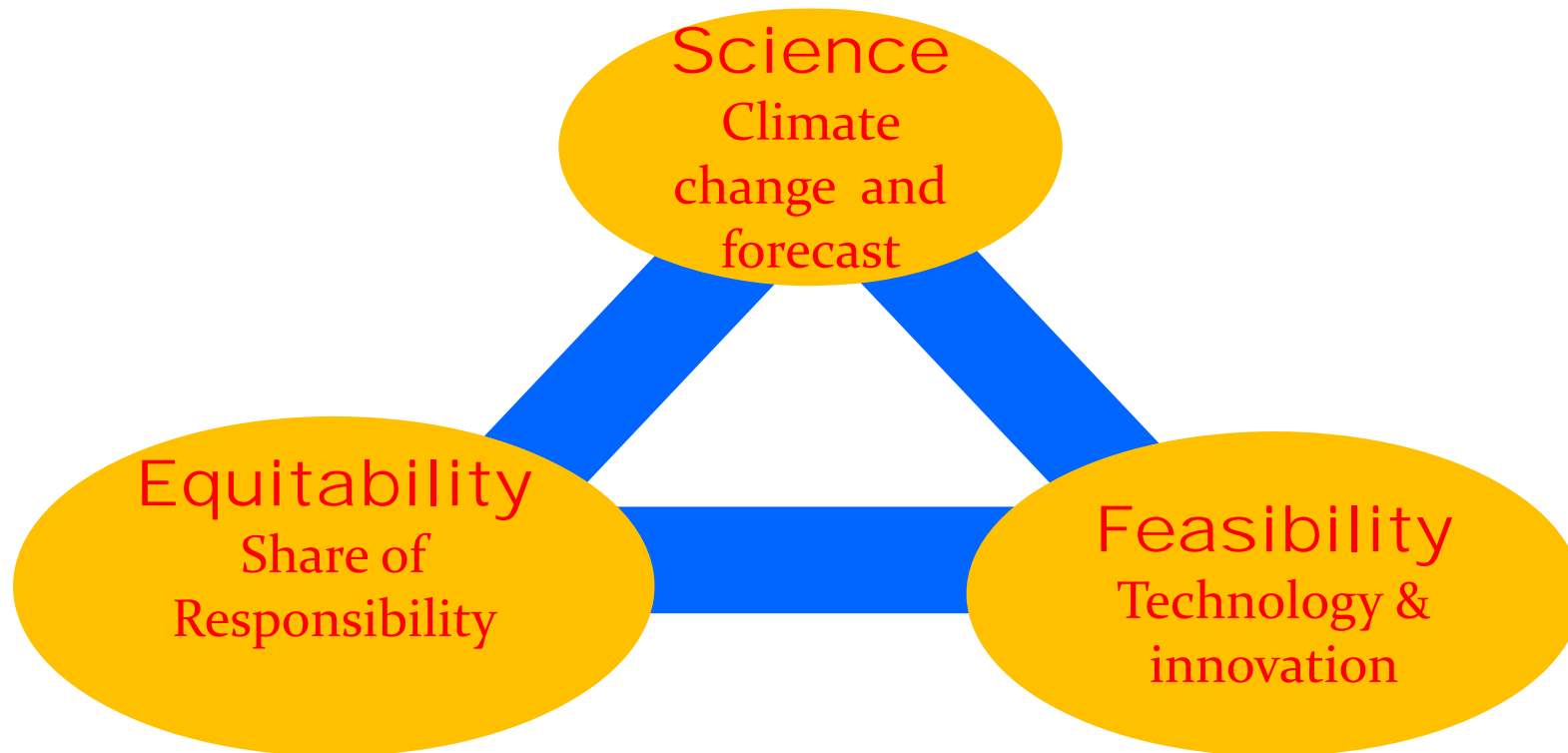


SUMMARY OF CIGS Intl. Symposium on climate change and energy issues
(#1/Nov. 2009. #2/Sept.2011 #3/Dec.2013 #4/Nov.2014)

Workshop on climate change in Washington 16 JULY 2015

Globally Sharable Energy Vision against Global Warming (Summary)



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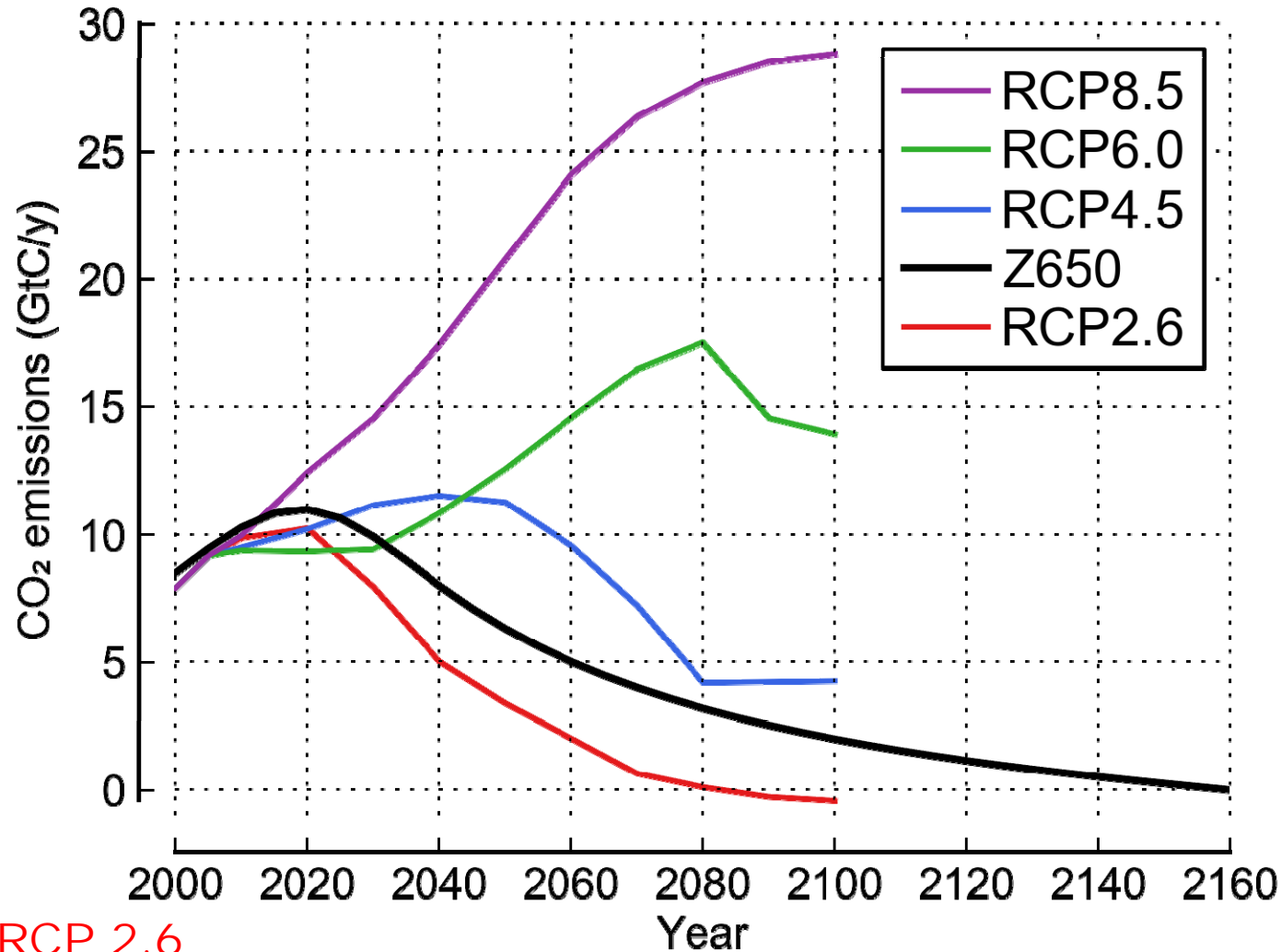
7 questions for global warming and energy issues

1. What kind of long term GHG reduction pathway should be shared to combat global warming?
2. What kind of long term energy mix and the relative emission pathway for each country should be under the global limitation of CO₂ emission?
3. Is it balanced between the cumulative additional investment and the benefit to realize the long term energy mix?
4. What are the innovative technologies that support the low carbon industrial society to achieve the long term energy mix, and what is the deployment scheme of those technologies?
5. According to the IPCC AR5, Is the international cooperations toward the achievement of the long term energy mix possible?
6. What should the contributions to the economic growth and environment protection in Asia be?
7. What kind of long term energy mix should be for Japan and Asia? Is it enough to be the model of future industrial society?

CIGS 「Sharable global vision of GHG emission and long term energy mix against global warming」

1. Comprehensive proposal: a. new emission pathway; b. national energy mix and emission pathway based on global optimization; c. innovative technologies and their valances :d. development of low carbon technologies and the deployment scheme
2. Contents:
 - a. To set total global GHG emission (the energy related CO₂ as main) from “450 ppm concentration stabilization” to “Overshoot and Zero emission scenario”
 - with total emission 650GtC in 21th , 25% reduction in 2050 relative to 2005, temperature rise in 21th C within 2°C ⇒ Z650
 - b. Globally cost minimum optimized energy mix and the obtained emissions of each countries to achieve the global pathway
 - 50% reduction for industrialized countries and 10% increase for developing countries in 2050 relative to 2005
 - c. To maintain the balance between additional investment and energy saving benefit of the energy mix
 - d. The deployment scheme for low carbon energy technologies
 - technology transfer to aid development countries, removal of the additionality and speculation in current Kyoto Mechanism

GtC: Giga carbon ton



----- RCP 2.6
stabilization scenario
Target concentration 450ppm,
Temp.rise < 2°C
Total emission 420GtC,
Minus emission in 2080

----- Z650: OVERSHOOT—ZERO
EMISSION SCENARIO (Prof.Matsuno)
Total emission =650GtC, < 2°C
zero emission after 2160

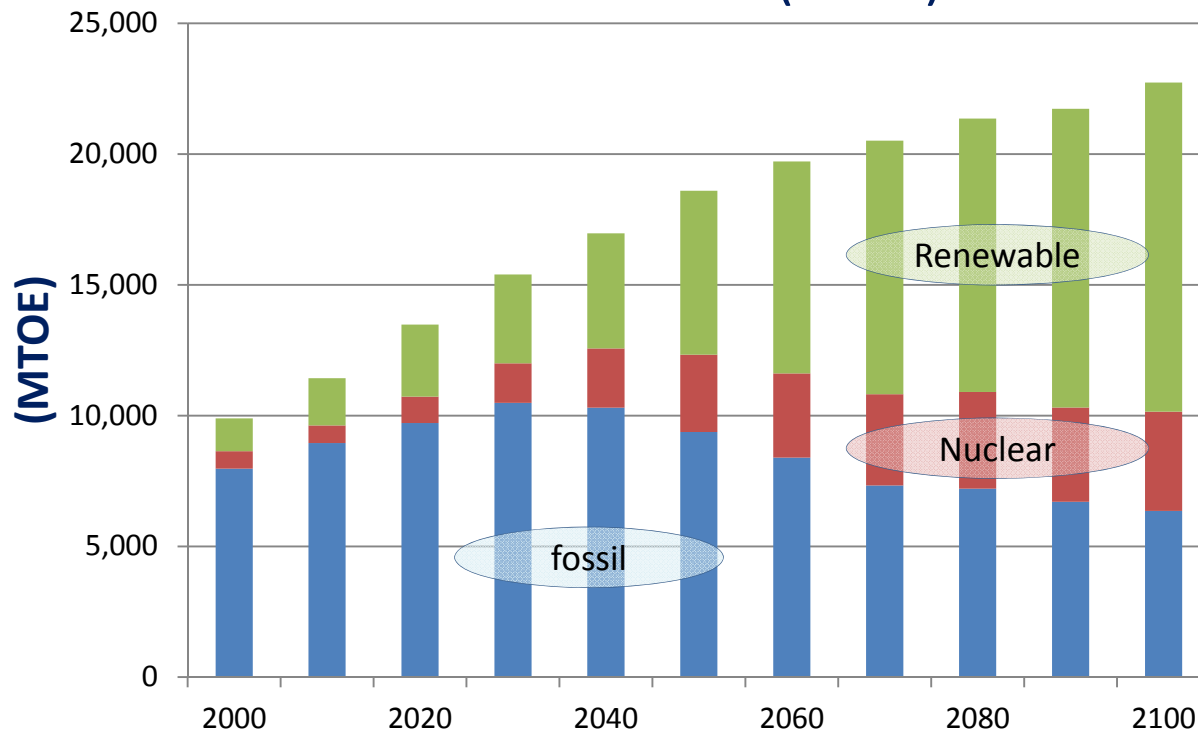
Result of simulation : cost minimum optimization under Z650 restriction all over the world

Total Primary Energy for Z650

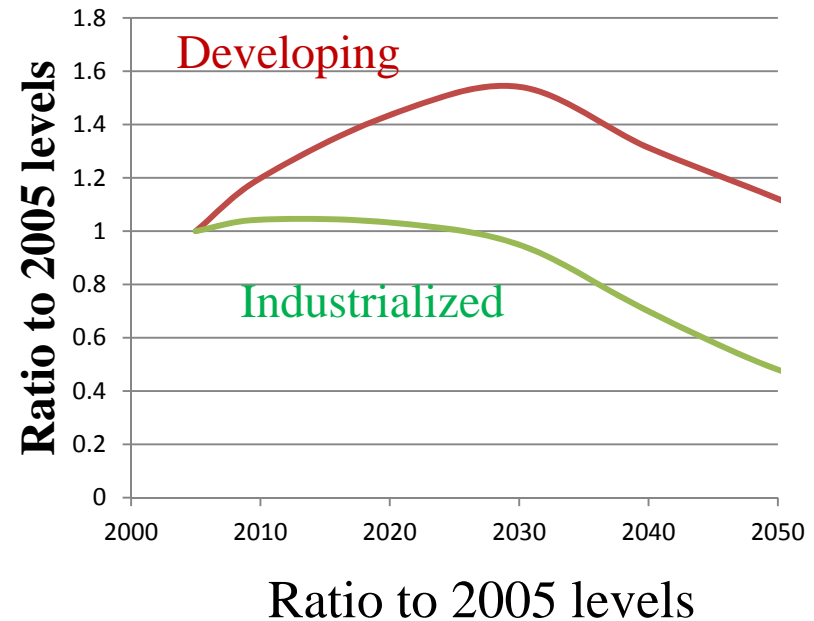
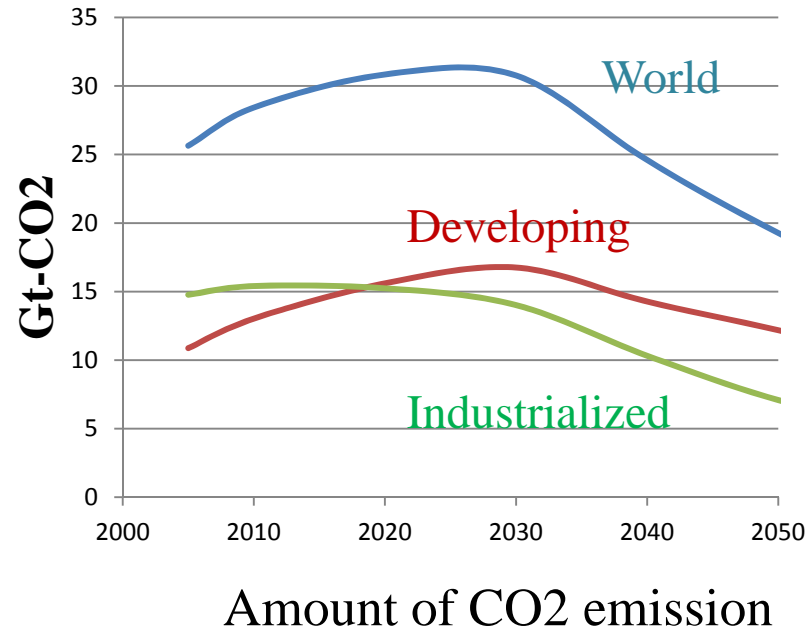
- Total Primary Energy continuously increases up to 2100
- Peak of fossil fuel consumption ~2030
- Both Nuclear and renewable energy increase

Fossil : Nucl : Renew = 5 : 2 : 3 (2050)

3 : 2 : 5 (2100)

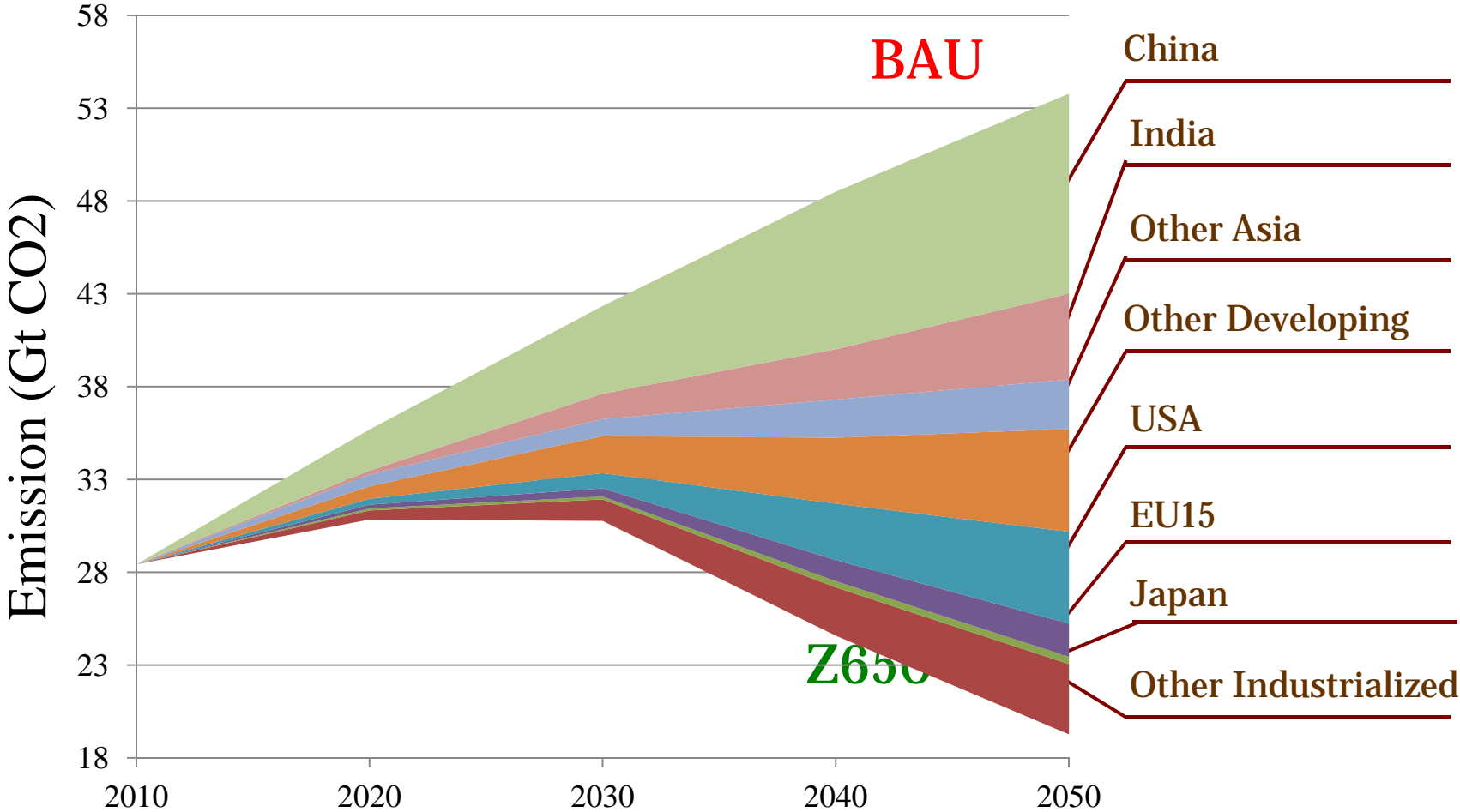


CO₂ emissions of Z650 scenario



Industrialized countries peak out in 2010, and reduce their emissions **by 50% in 2050 compared to the 2005 levels**.
Developing countries **peak out in 2030**, and their emissions **increase by 10% in 2050 compared to the 2005 levels**.

CO₂ emission reductions by region



Innovative Technologies for low carbon society

1. High efficient, power generations of gas and coal

- **Combined cycles** of natural gas with-SOFC and gas turbine
- Clean coal technology "**IGCC** "**IGFC** " Zero emission plant
- **Triple cycle** system

2. Nuclear energy and spent-fuel recycle systems

- New generation(**Generation 3.5**) of Light Water Reactor system
- Fast Breeder Reactor system with sustainable fuels cycles without high level radioactive waste
- **High Temperature Gas Reactor for supply of process heat to industrial sector**
- Next generation nuclear energy system with no meltdown and with no high level radioactive waste

3. Renewable energy stabilized with battery innovation

- Advanced **battery systems**- from hybrid vehicle to electric vehicle, toward fuel-cell vehicle
- **Thermal energy storage** system(solar thermal power)
- Combination of battery to solar power and wind power in smart grid system
- Geothermal cogeneration system (small and local)
- Advanced process and system for biomass energy and biomass fuels
- Ocean energy tide and current, **offshore wind farm** etc.

4. Energy conservation systems

- **Process innovations in Iron-steel industries** and chemical industries.
- Industrial complex of energy, supplying thermal and electricity to factories
- Co-generation and co-production plant systems

5. Carbon capture and storage

Conclusion

A new step will begin after COP21 in Paris to strengthen international corporations against global warming **toward 2050**. Main subjects are science on climate change , development of innovative technology and their deployment system .

It is important for experts to share the target and in common through the following procedures:

1.Emission pathway in this century: realistic and feasible pathway within 2°C in this century , for example, “Overshoot and zero emission scenario Z650 “

2.Energy mix in 2050; share of energy mix due to cost minimum optimization all over the world under emission scenario . For example fossil 50%,nuclear 20%, renewable 30% in energy mix in 2050 is obtained under Z650.

3. Innovative energy technology: with the order of the priority, developments and deployments of:

- ① high efficient and clean thermal power with combined and triple cycle by coal and gas
- ② New-type nuclear power (LWR, FBR) and multi-purpose HTGR
- ③ Stable and stabilized renewable energy system with battery and thermal storage

4. Low-carbon society: support system to developing countries towards low carbon industrial society with well balanced energy system between investment and benefit

The experts and specialists with influences on climate change and energy policy will play the important roles on the basis of science and technology.

Through the international workshop and symposium we continue the exchanges of comprehensive proposals.