世界共有ビジョンに向けた日米中の相互補完的協力

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-CIGSの世界共有ビジョン提案
- 排出パスウェー
- エネルギービジョン
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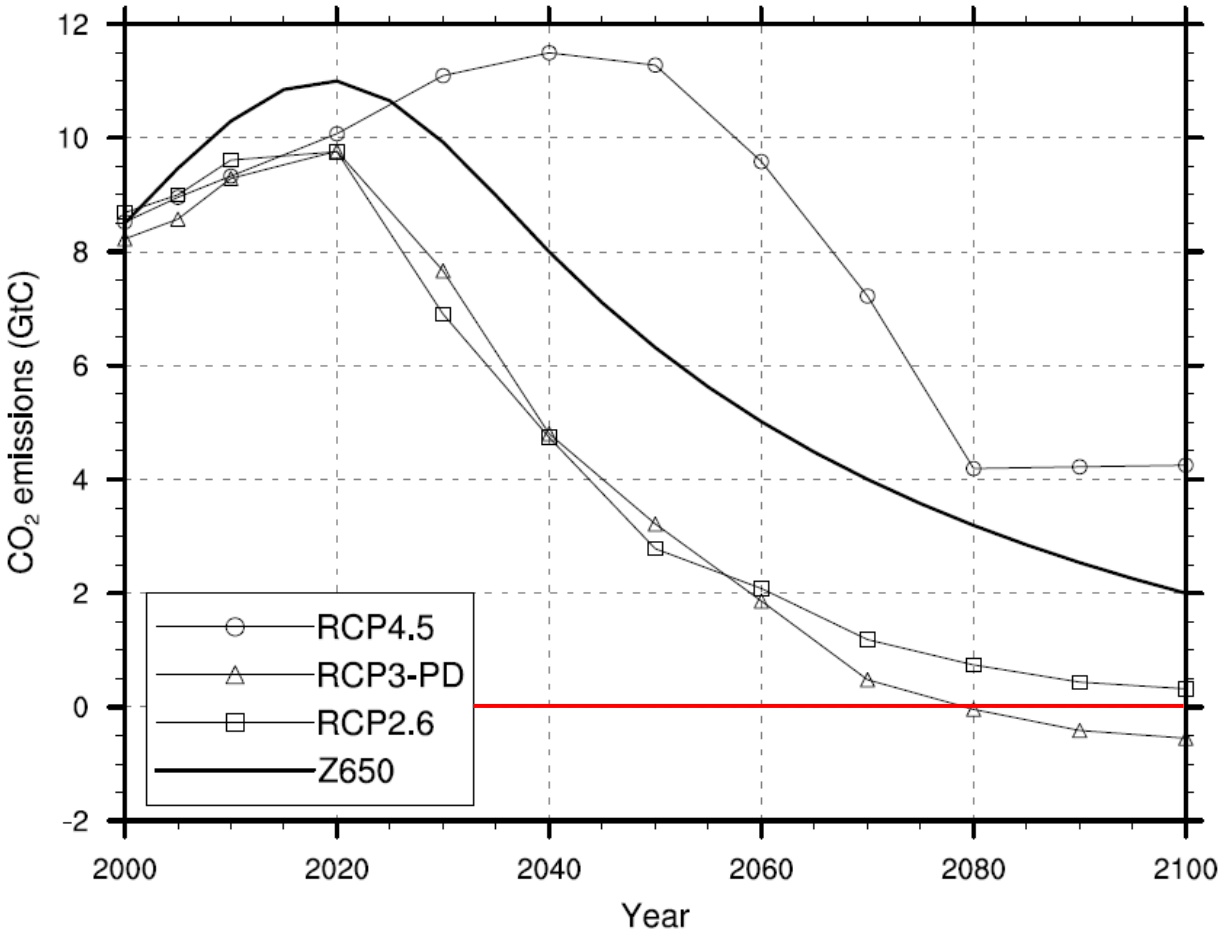
- CIGS国際シンポジウム
- CIGSワークショップ＠ワシントン
- 清華大学との共同研究
- 中国シンクタンクとの交流

-ビジョン実現に向けた日米中関係と協力

CIGSの世界共有ビジョン提案
排出パスウェー



Source: Matsuno et al., "Stabilization of the CO2 concentration via zero-emission in the next century", presented at the CIGS Symposium on Oct. 27, 2009

Z650 is located in the middle of the two RCP scenarios, therefore it could take the advantage of second best solution, i.e., to be more feasible than RCP2.6, and to have better climate performance than RCP4.5.

CIGSの世界共有ビジョン提案
排出パスウェー

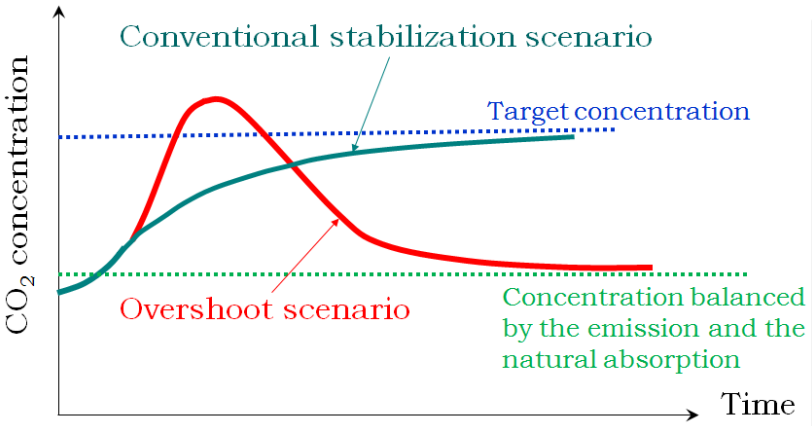
Scientific analysis based on

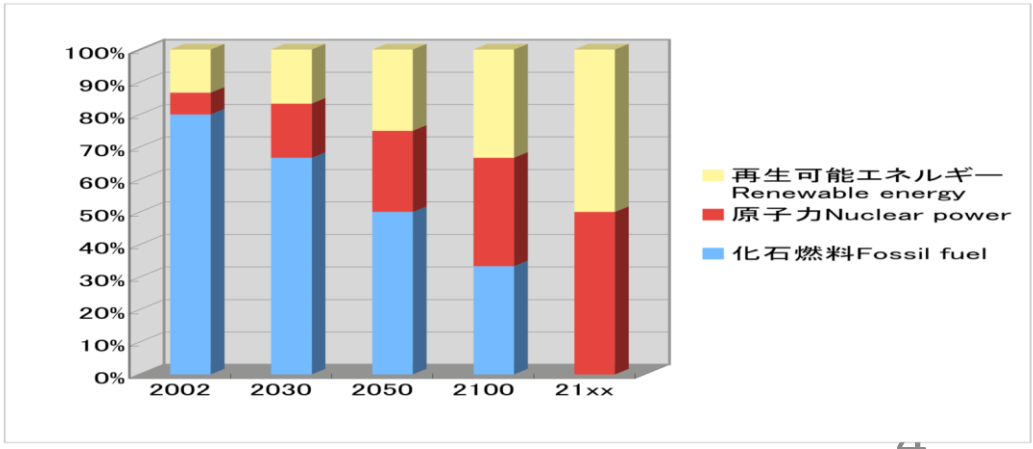
--- target of global mean temperature rise

to limit the global surface temperature rise to approximate 2℃ compared to pre-industrial levels

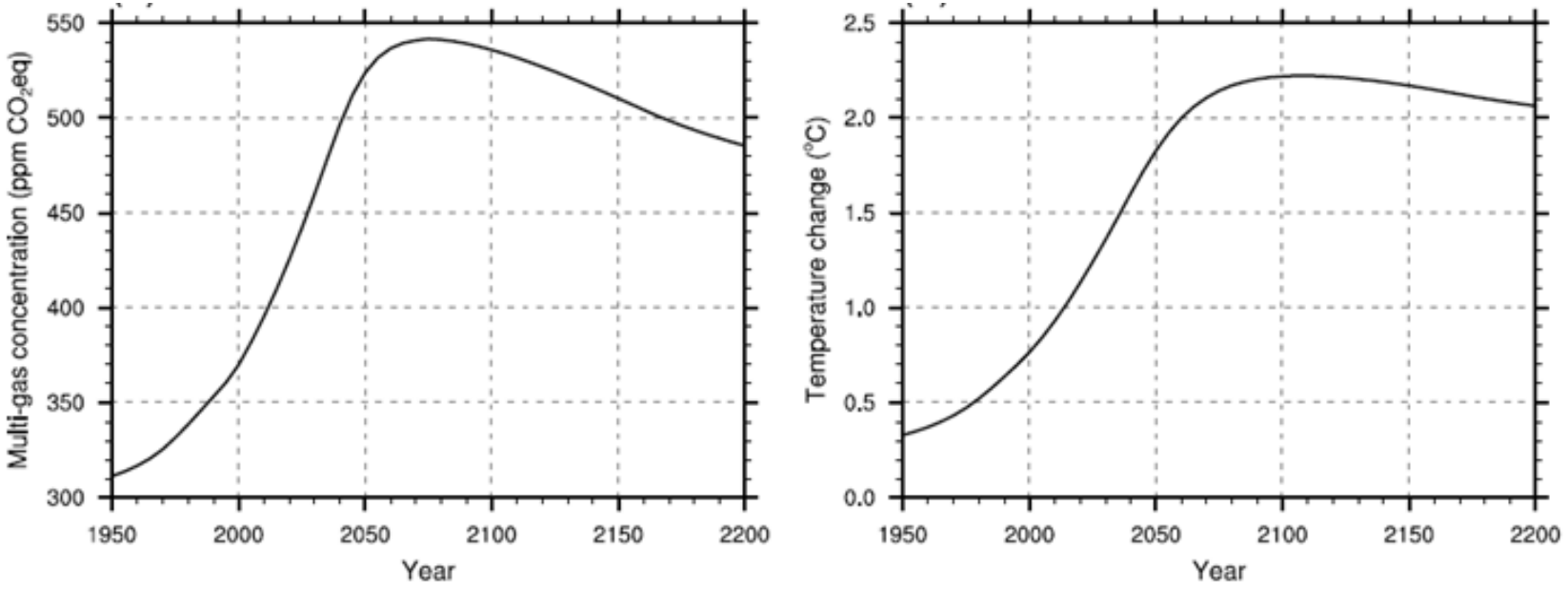
--- overshoot scenario with zero emission

to decrease the CO2 concentration by zero emission after a peak over the target concentration





CIGSの世界共有ビジョン提案
排出パスウェー



The environmental impacts taking into account of all the GHGs in the Z650 scenario.

Source: Matsuno et al., "Stabilization of the CO2 concentration via zero-emission in the next century", presented at the CIGS Symposium on Oct. 27, 2009

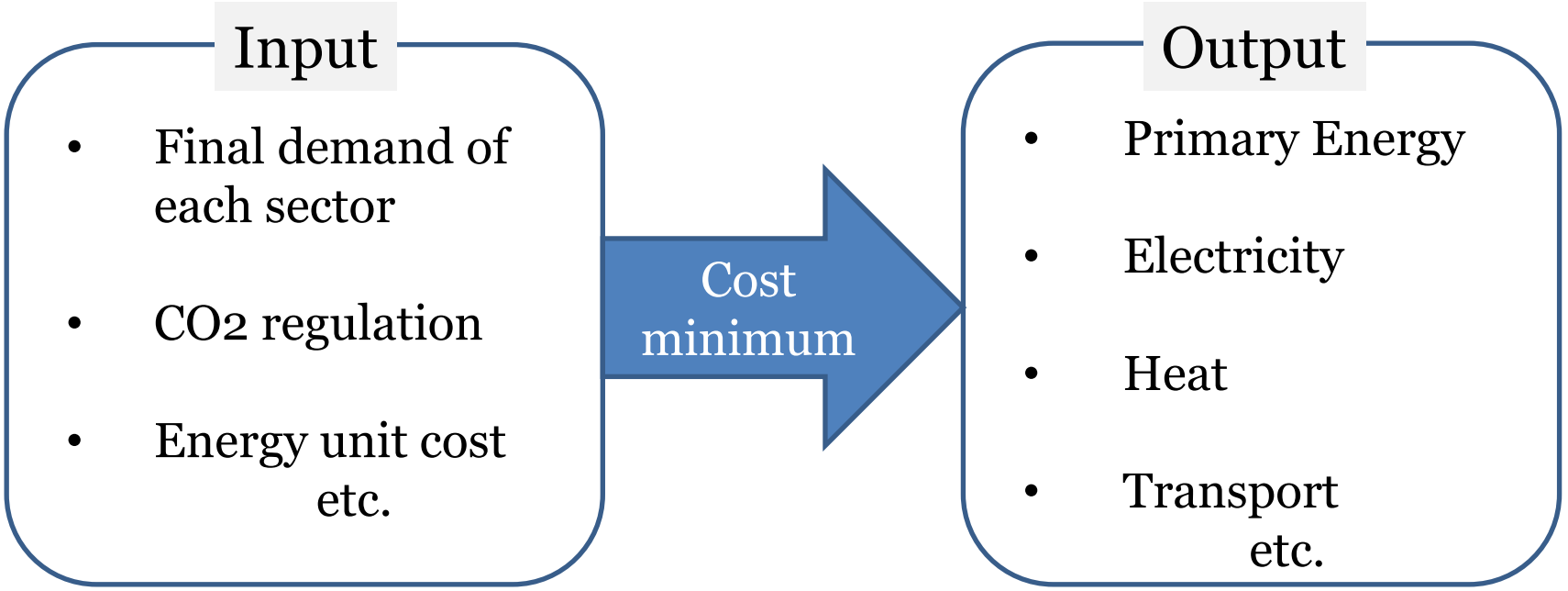
CIGSの世界共有ビジョン提案
エネルギービジョン

Methodology

Global Energy System Optimization

Model

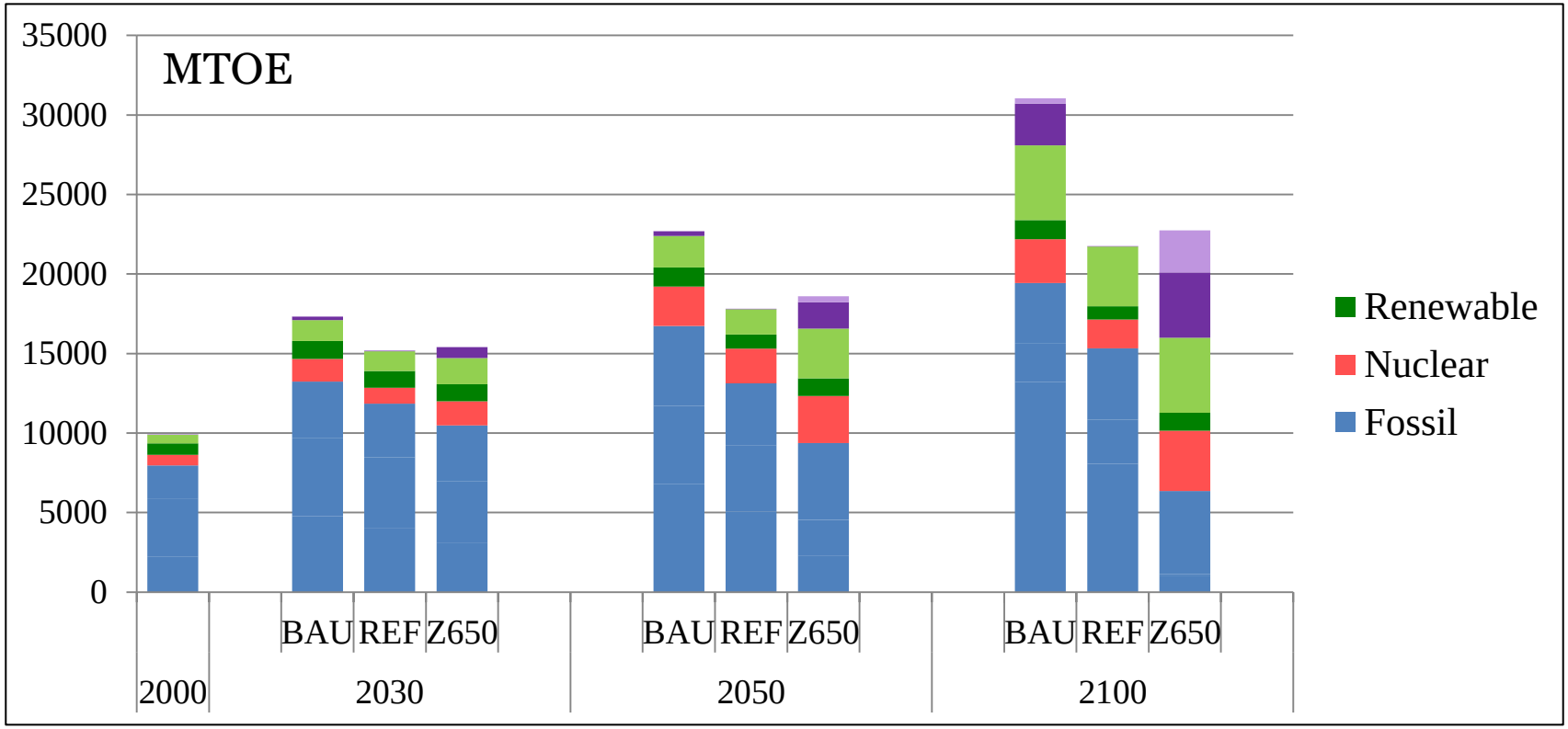
GRAPE* (Global Relationship Assessment to Protect the Environment)



* Kurosawa et.al., Energy Journal, 157-175 (Kyoto Special Issue)

CIGSの世界共有ビジョン提案
エネルギービジョン

Total Primary Energy continuously increases up to 2100
Less energy consumptions in REF and Z650
More clean energy combination in Z650



Changes of Primary Energy Mixture in Z650 (Fossil: Nuclear: Renewable)
7: 1: 2 (2030) → 5: 2: 3 (2050) → 3: 2: 5 (2100)

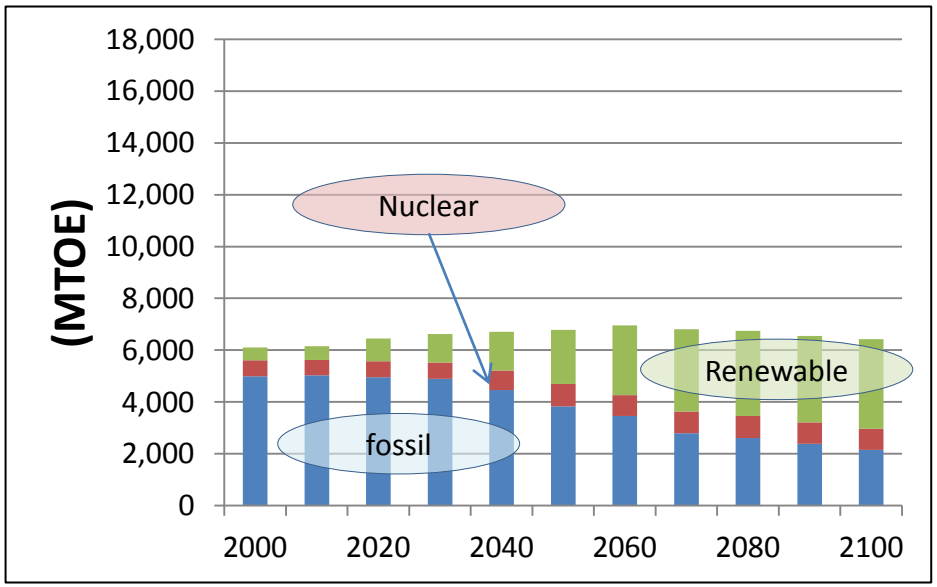
CIGSの世界共有ビジョン提案
エネルギービジョン

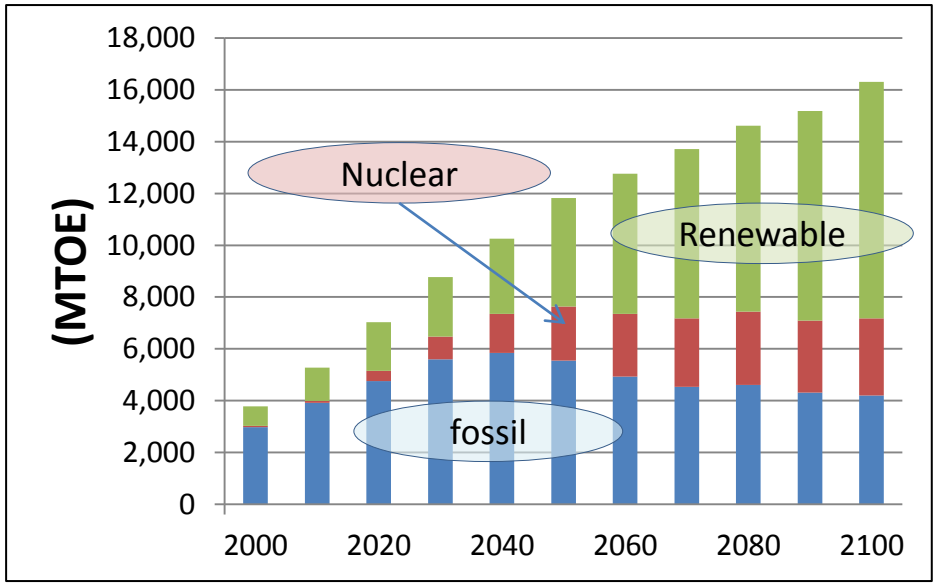
Industrialized countries

- Total Primary Energy is almost constant up to 2100.
- Share of fossil fuel gradually decreases
- Alternatively, share of renewable energy mainly increases

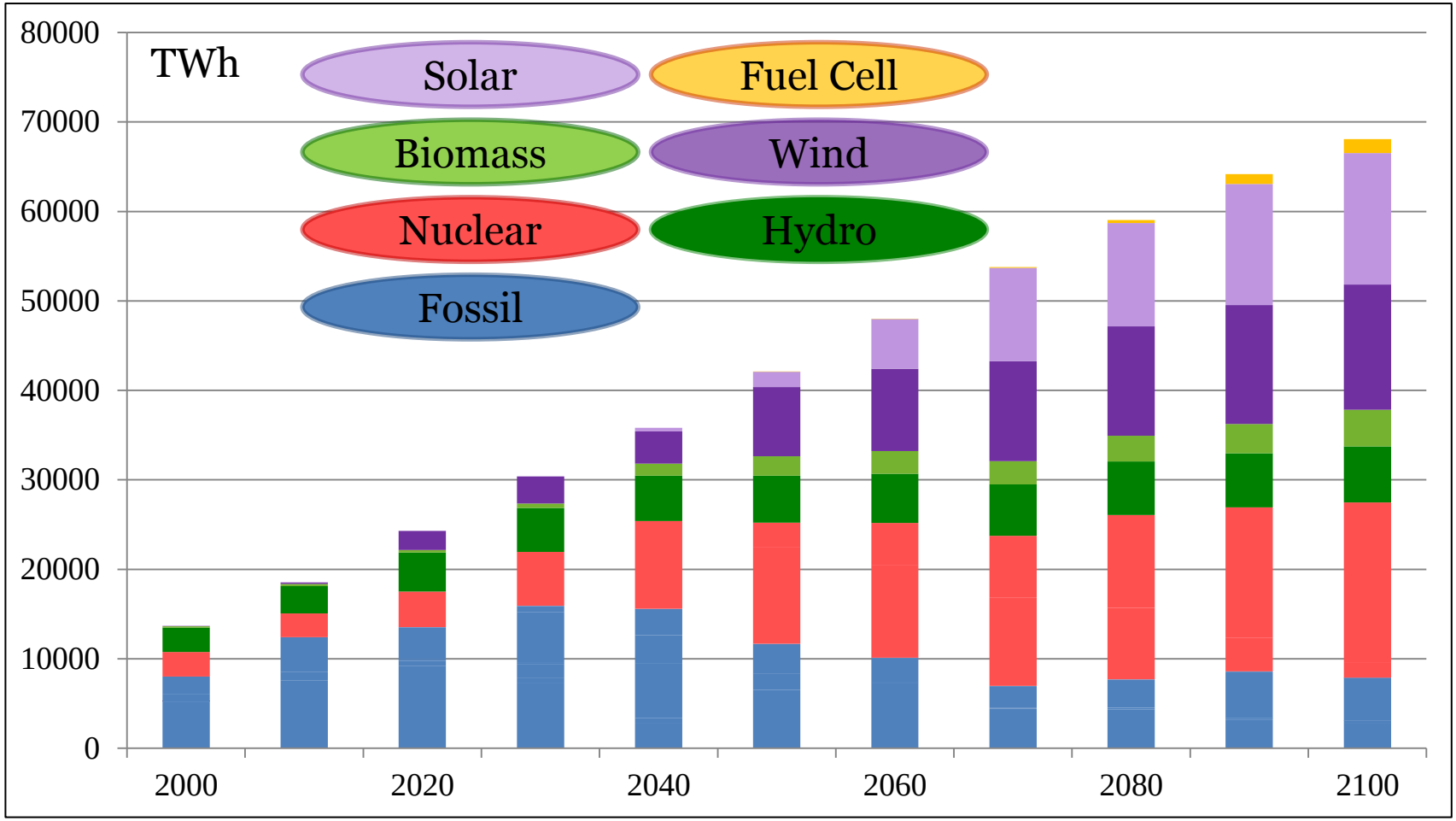
Developing countries

- Total Primary Energy continuously increases up to 2100
- Peak of fossil fuel consumption at 2040
- Both Nuclear and renewable energy increase remarkably





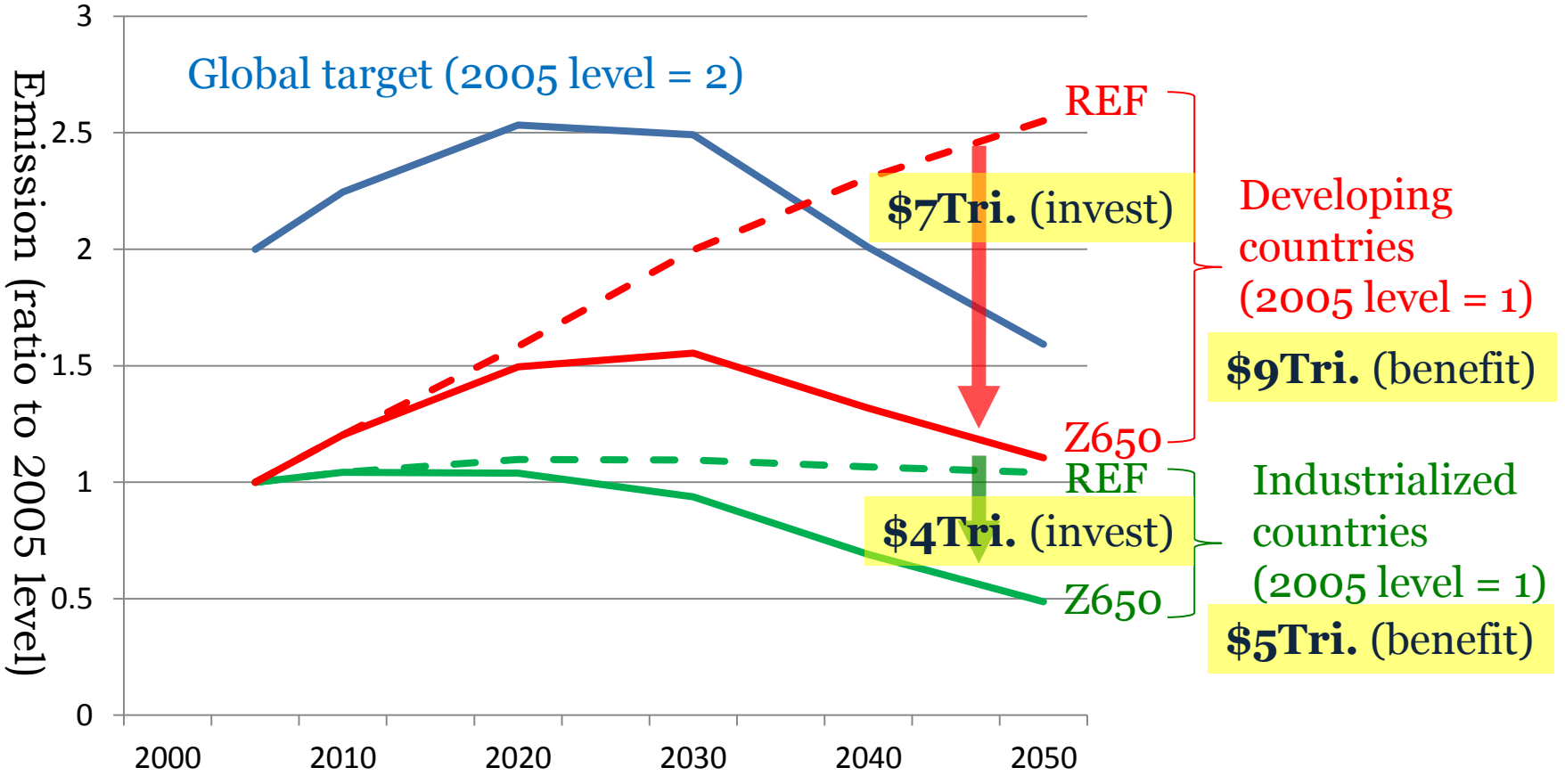
CIGSの世界共有ビジョン提案
エネルギービジョン



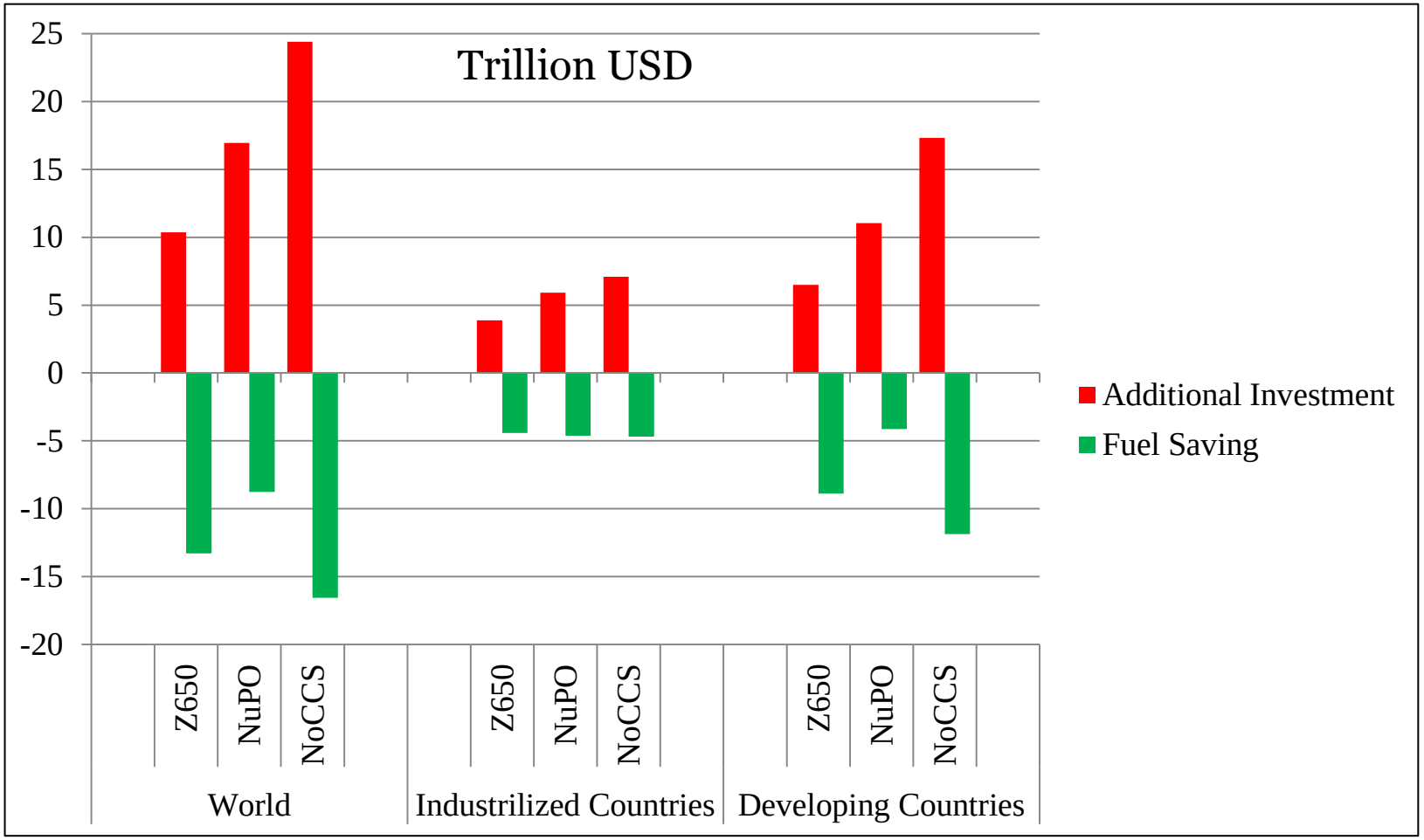
Nuclear Power Capacity (GWe)	2000	2030	2050	2100
	370	810	1,800	2,600

CIGSの世界共有ビジョン提案
実現可能性

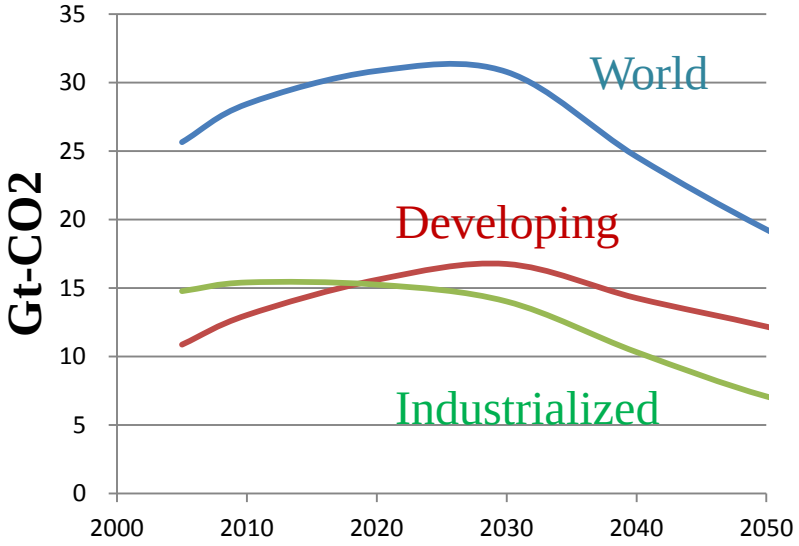
Additional Investments vs. Fuel Saving Benefits



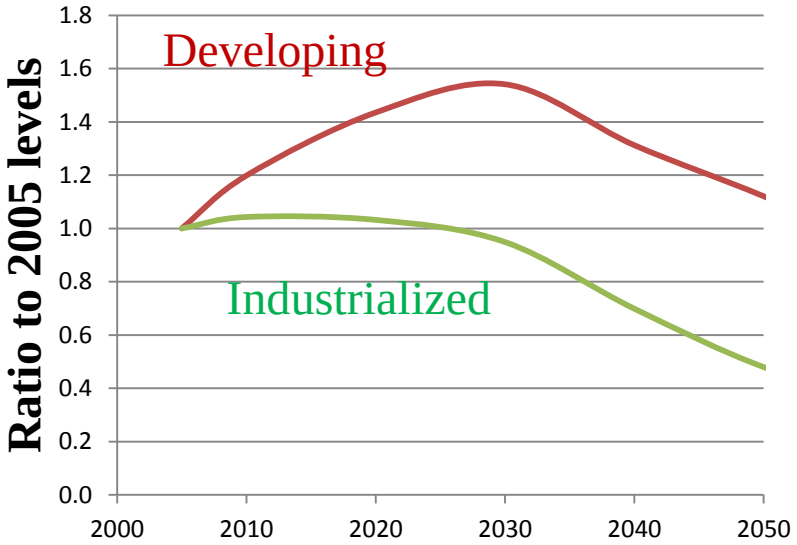
CIGSの世界共有ビジョン提案
実現可能性



CIGSの世界共有ビジョン提案
排出配分と衡平性



Amount of CO2 emission



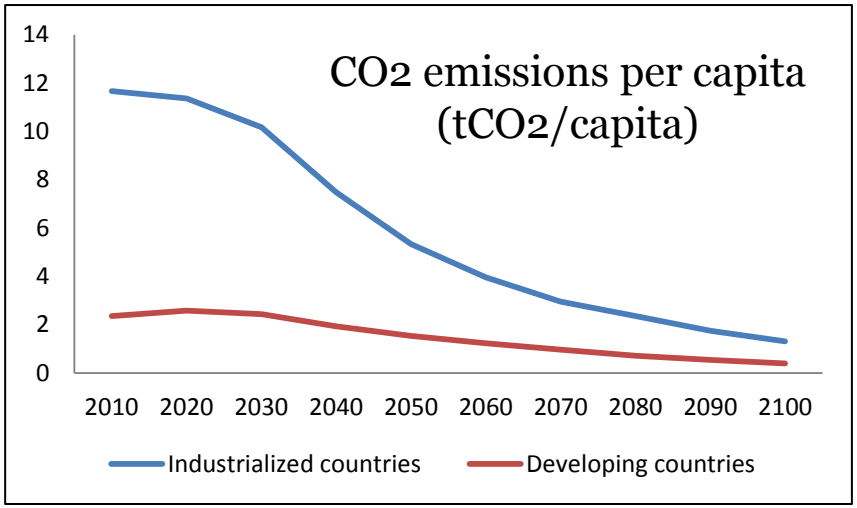
Ratio to 2005 levels

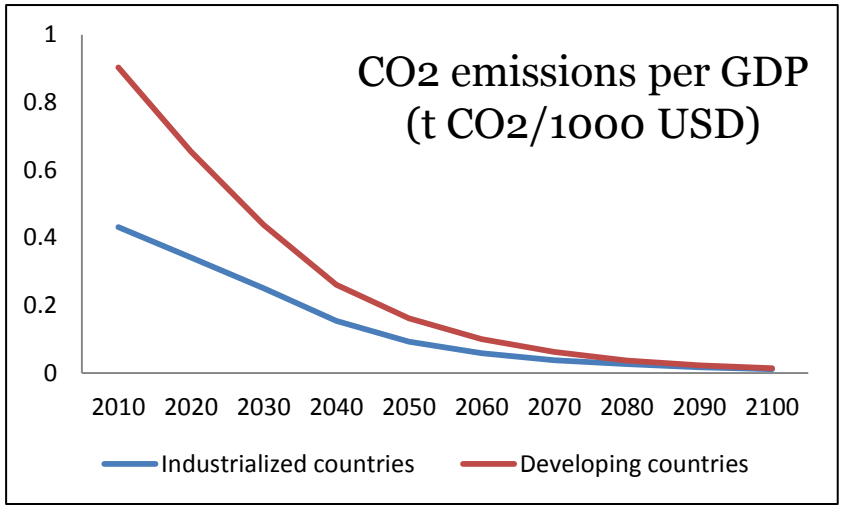
Industrialized countries peak out in 2010, and reduce their emissions by 50% in 2050 compared to the 2005 levels. Developing countries peak out in 2030, and their emissions increase by 10% in 2050 compared to the 2005 levels.

CIGSの世界共有ビジョン提案
排出配分と衡平性

Regional emissions and carbon intensities of Z650

Ratio to 2005 levels	2030	2050
World	1.20	0.75
Industrialized countries	0.95	0.48
Developing countries	1.54	1.12





Accumulative CO2 emissions per capita (2010-50)
Industrialized countries: 375t Developing countries: 89t
Accumulative CO2 emissions per GDP (1000USD) (2010-50)
Industrialized countries: 10t Developing countries: 19t

CIGSの世界共有ビジョン提案
排出配分と衡平性
Major industrialized and developing countries

Ratio to 2005 levels	CO_2 Emissions		CO_2 Emissions per capita	
	2030	2050	2030	2050
World	1.20	0.75	0.94	0.53
Industrialized countries	0.95	0.48	0.89	0.47
USA	0.96	0.47	0.79	0.35
EU15	0.86	0.45	0.82	0.43
Japan	0.79	0.47	0.87	0.63
Developing countries	1.54	1.12	1.18	0.74
China	1.48	0.82	1.34	0.77
India	1.91	1.57	1.43	1.08
ASEAN	1.64	1.50	1.24	1.00

CIGSの世界共有ビジョン提案
排出配分と衡平性
Major industrialized and developing countries

Region	CO2 Emissions					
	2030			2050		
	Ratio to 1990 levels	Ratio to 2005 levels	Ratio to REF of 2030	Ratio to 1990 levels	Ratio to 2005 levels	Ratio to REF of 2050
World	1.60	1.20	0.82	1.00	0.75	0.46
Industrialized countries	1.05	0.95	0.89	0.53	0.48	0.48
USA	1.16	0.96	0.90	0.57	0.47	0.47
EU15	0.89	0.86	0.91	0.46	0.45	0.53
Japan	0.93	0.79	0.90	0.55	0.47	0.66
Developing countries	2.82	1.54	0.77	2.05	1.12	0.45
China	2.77	1.48	0.74	1.53	0.82	0.37
India	3.42	1.91	0.72	2.83	1.57	0.37
ASEAN	3.74	1.64	0.80	3.41	1.50	0.57

CIGSの世界共有ビジョン提案
排出配分と衡平性
Regional additional investments

BAU to REF	Additional Investments T$ (2010-50)	Share in GDP (%)
World	11	0.28
Industrialized countries	2	0.09
Developing countries	9	0.55

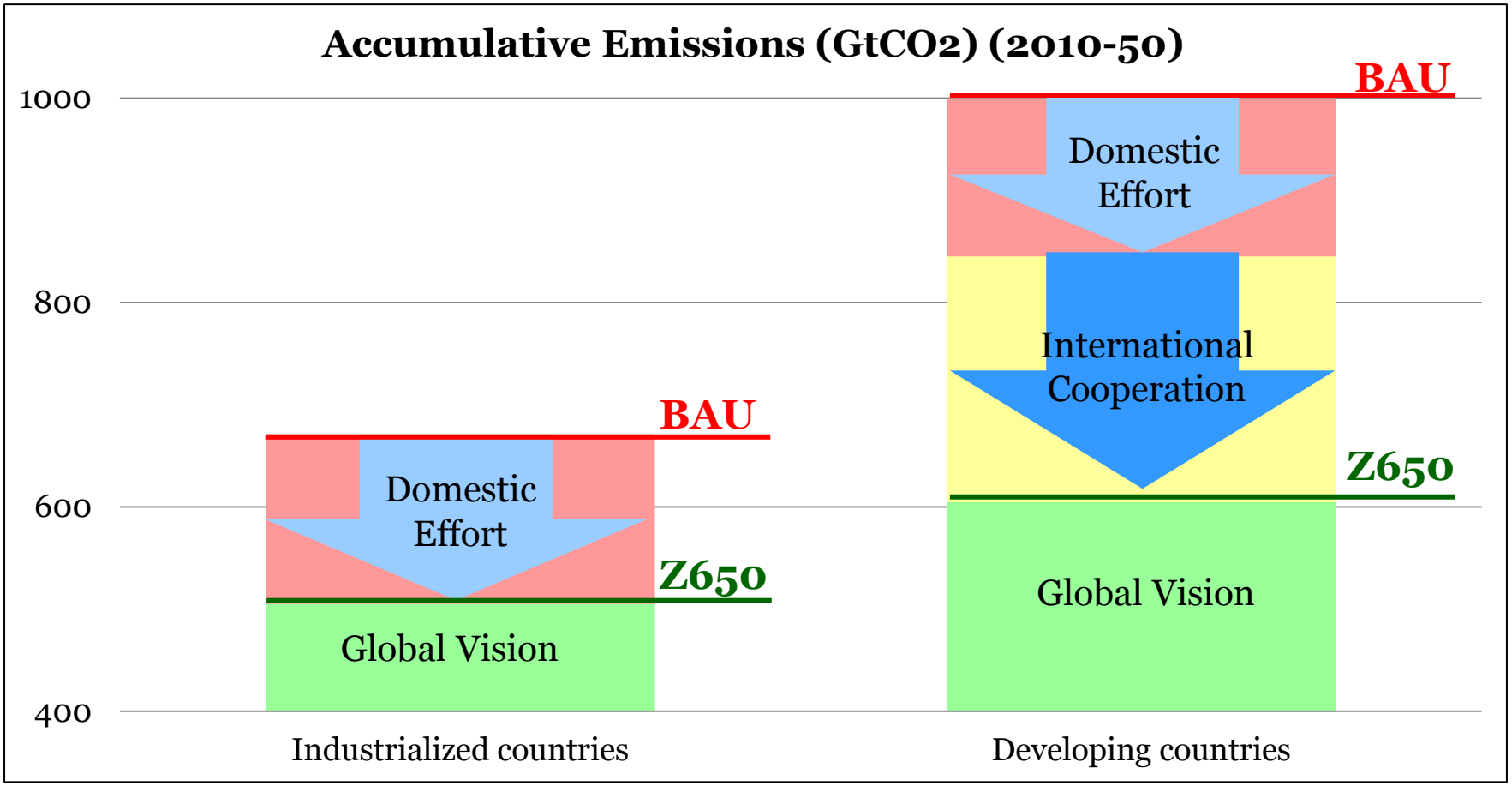
REF to Z650	Additional Investments T$ (2010-50)	Share in GDP
World	11	0.28
Industrialized countries	4	0.18
Developing countries	7	0.43

CIGSの世界共有ビジョン提案
実現する途

Ratios to 2005 levels		2005	2030	2050
REF	World	1.0	1.5	1.6
Z650	World	1.0	1.2	0.75
	Industrialized countries	1.0	1.0	0.5
	US		1.0 (0.8)	0.5 (0.4)
	EU15		0.9	0.4 (0.5)
	Japan		0.8 (0.6)	0.5 (0.2)
	Developing countries	1.0	1.5	1.1
	China		1.5 (2.1)	0.8 (2.3)
	India		1.9 (2.7)	1.6 (4.1)

Harmony in industrialized countries and Gap in developing countries

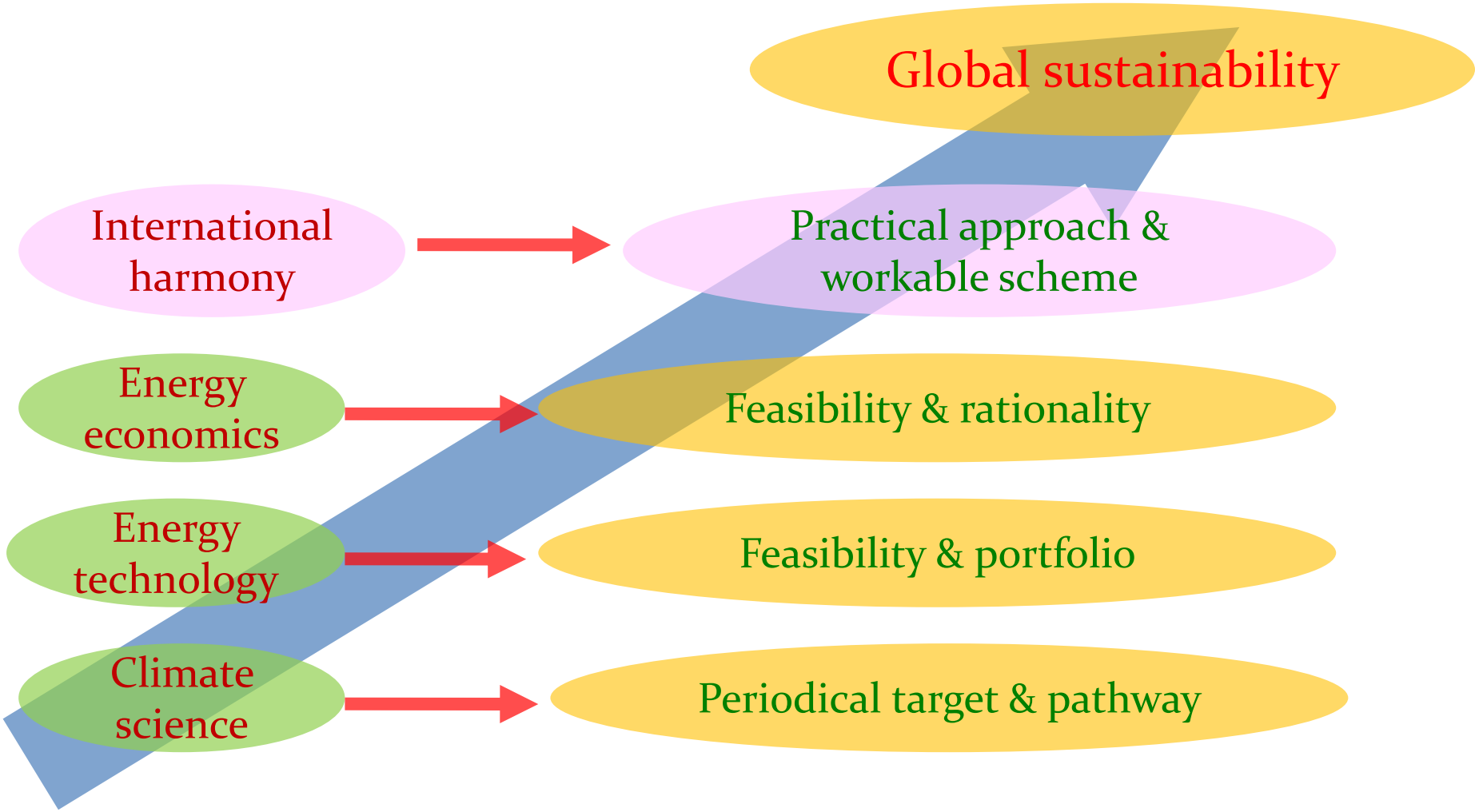
CIGSの世界共有ビジョン提案
実現する途



BAU: traditional development **REF:** energy conservation **Z650:** Low carbon vision

International cooperation is necessary to fill in the gap in developing countries from domestic initiative to low carbon vision

CIGSの世界共有ビジョン提案
パッケージ像



ビジョン共有のための専門家間討議

Second CIGS International Symposium (Sep. 16, 2011)

Main contributors

Country	Name	Position
China	Dadi Zhou	Former Director-General, ERI, NDRC
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France	William Ramsay	Senior Research Fellow, IFRI
USA	Susan Slolomon	Professor, MIT Former Co-Chair of IPCC WGI
Japan	Taroh Matsuno	Principal Scientist, JAMSTEC, IPCC WGI
	Yoichi Kaya	Director, RITE
	Masakazu Toyota	Chairman and CEO, IEE
	Mitsutsune Yamaguchi	Professor, the University of Tokyo, IPCC WGIII
	Taikan Oki	Professor, the University of Tokyo, IPCC WGII
	CIGS working group	

ビジョン共有のための専門家間討議

Common understanding

Considering the absence of clear vision on international agreement to combat global warming, we, specialists and persons in charge, came together with a sense of crisis. Through discussions on the new scientific knowledge on climate change and its suggestion, the new scenario of greenhouse gases emissions and the new international mechanism for realizing the scenario, we have reached the following common understandings.

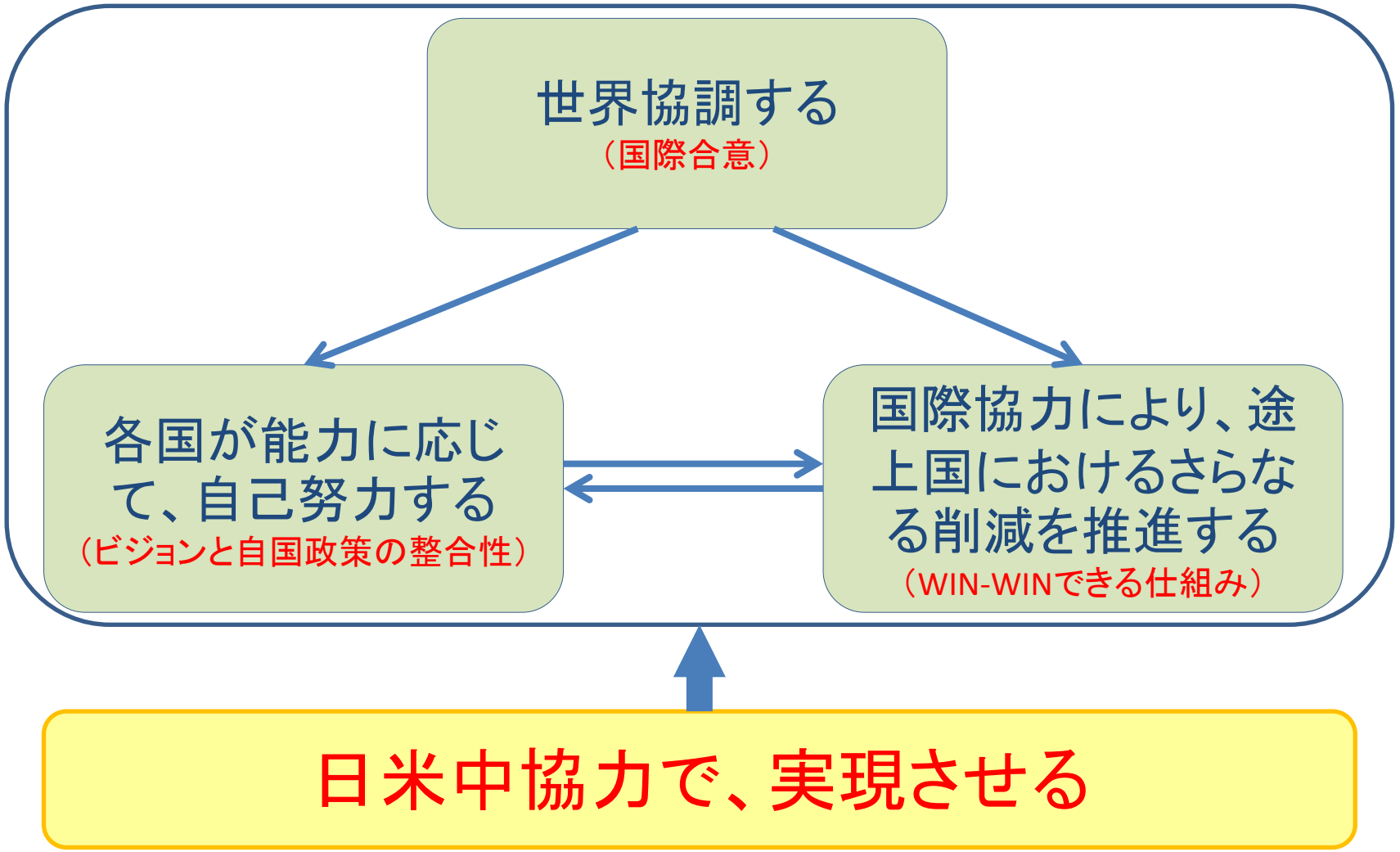
1. To support the feasible scenario of greenhouse gas emissions on the basis of the climate change science while taking into account over shoot scenario.
2. To pursue the long-term global energy vision by the global optimization of mitigation costs of carbon dioxide under the energy related low carbon dioxide emission scenario. To welcome the vision that is balanced between additional investments and fuel saving benefits.
3. To promote the deployment of low carbon technologies through international cooperation based on an open, fair and efficient international mechanism. To share the will of realizing the energy vision in which economic growth and global warming control would co-exist.
4. The vision is to be shared through international discussions.

ビジョン共有のための専門家間討議

- 中国
  - 政策レベル
    - 国家イノベーション発展戦略研究会
  - 施策レベル
    - 国務院参事室
  - 共同研究
    - 清華大学

- 米国
  - CIGSワークショップ＠ワシントン
    - CSIS、C2ES、Eurasia、EDF

ビジョン実現のために

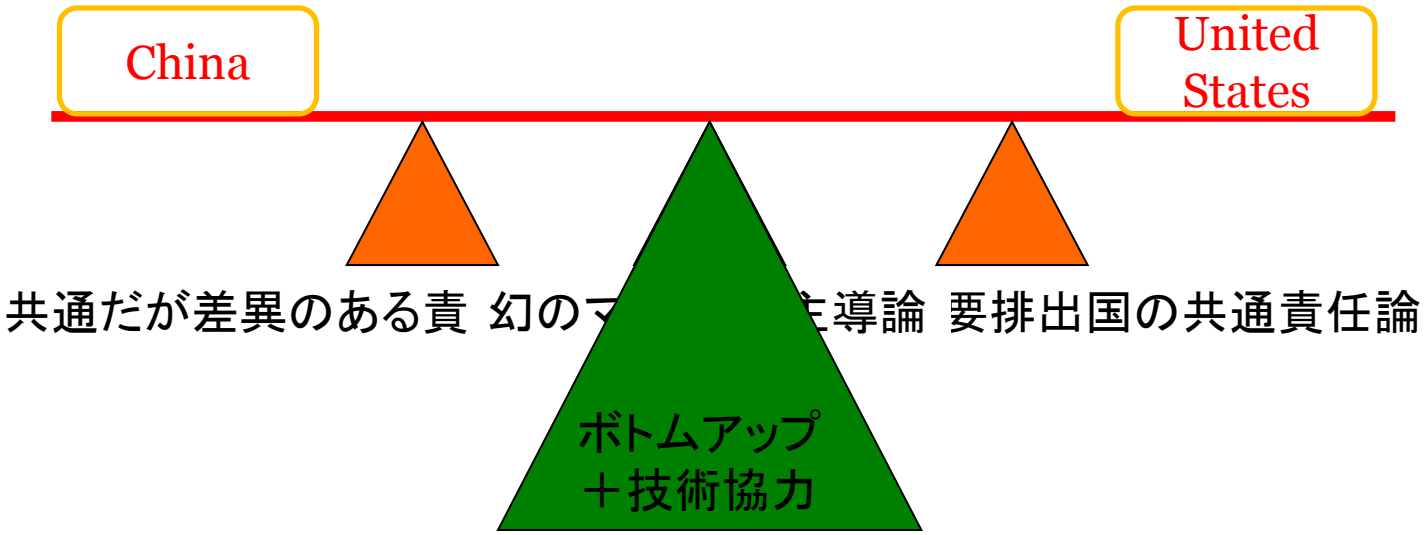

世界協調する
（国際合意）
各国が能力に応じて、自己努力する
（ビジョンと自国政策の整合性）
国際協力により、途上国におけるさらなる削減を推進する
（WIN-WINできる仕組み）
日米中協力で、実現させる

世界協調のために

-中心課題

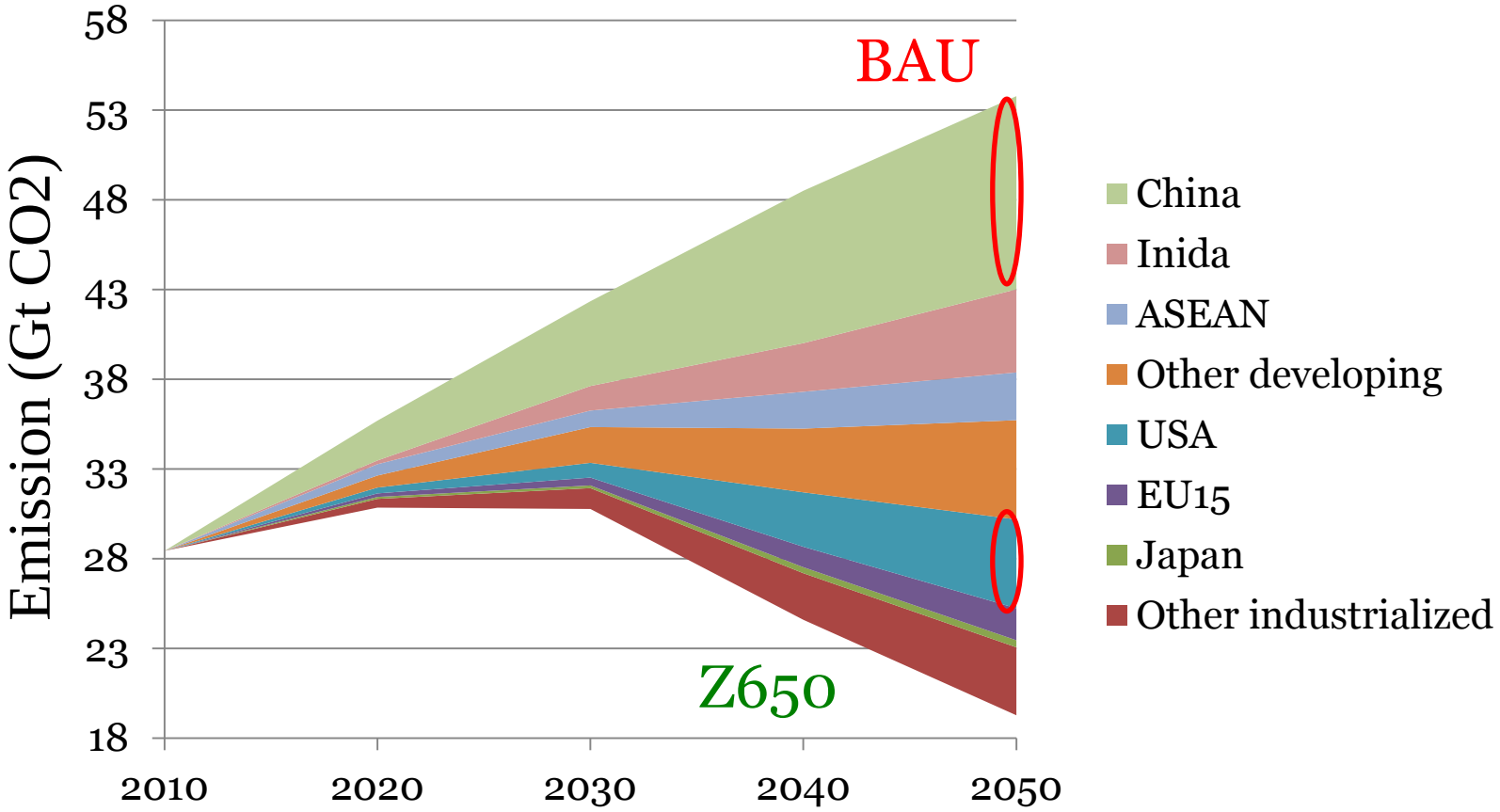
如何に中国と米国を動かす

バランスを取る支点が必要



日米中三カ国が、キーとなる

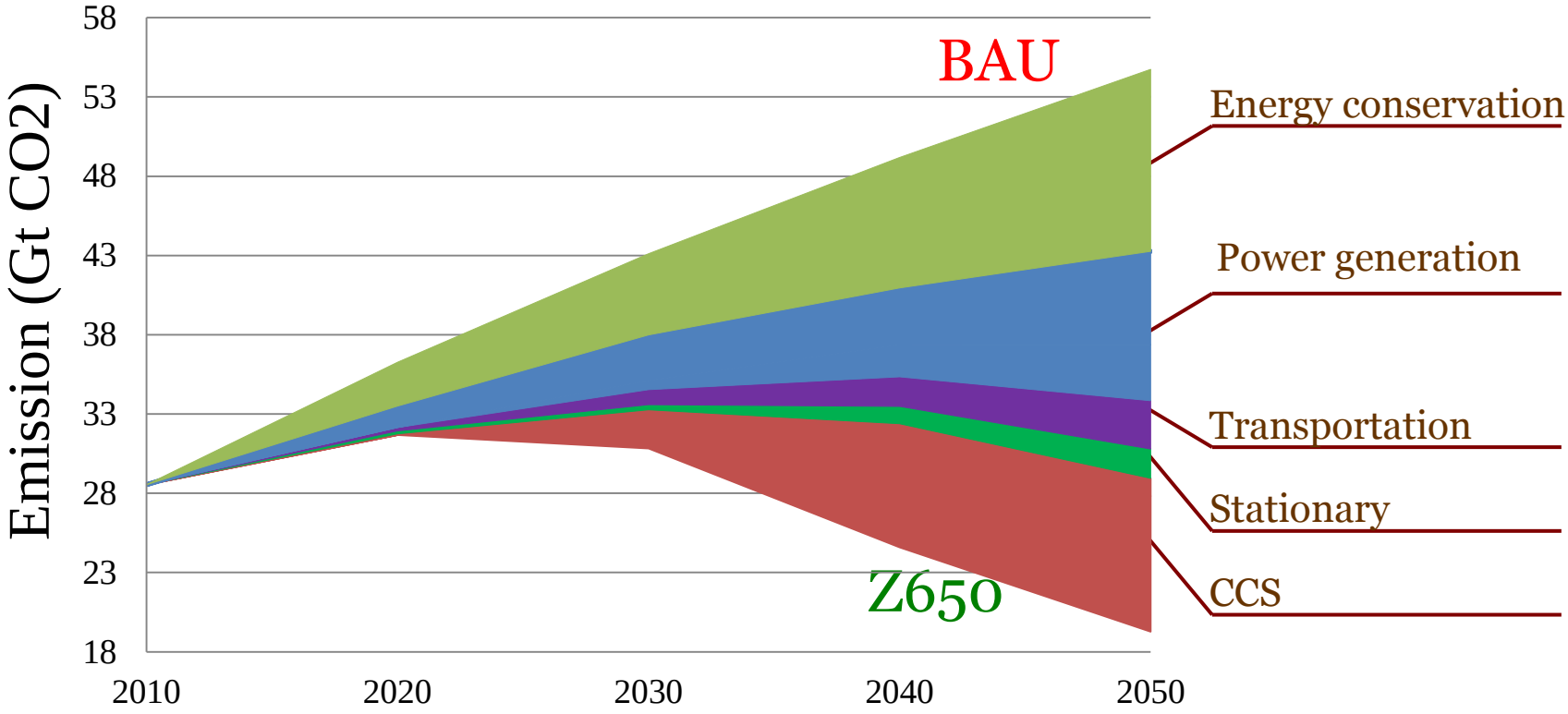
ビジョン実現のために（モデル計算より）



Regional reduction

China and USA are the key regions

ビジョン実現のために（モデル計算より）



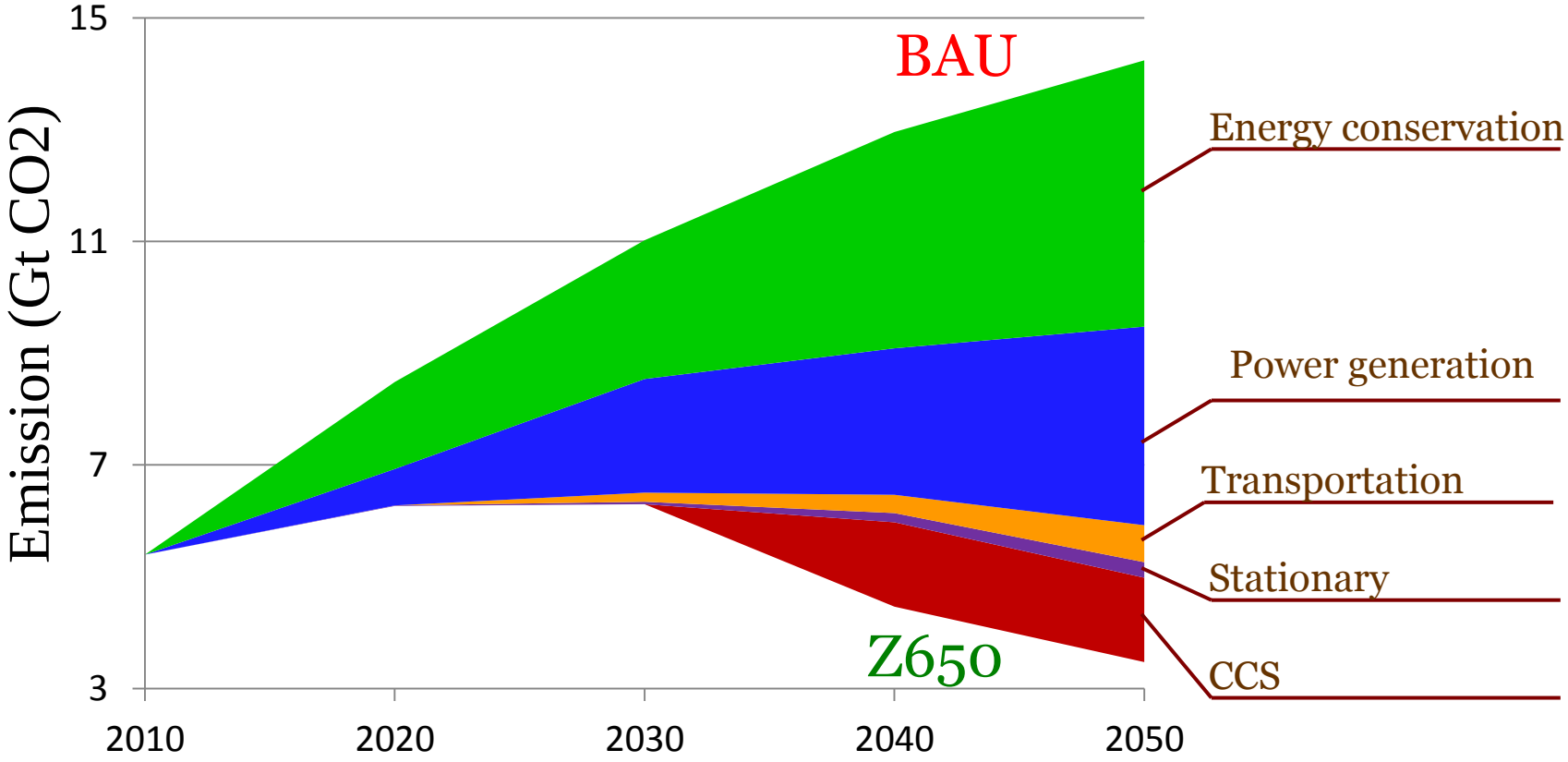
Sectoral reduction

Energy saving, Power generation and CCS are the key technologies

ビジョン実現のために（モデル計算より）

Target	United States		Japan		China	
	2030	2050	2030	2050	2030	2050
CO2 Emission (Ratio to 2005 levels)	0.96	0.47	0.79	0.47	1.48	0.82
Emission Intensity (tCO2/GDP)	0.28	0.09	0.12	0.06	0.40	0.12
Energy Intensity (TOE/GDP)	0.12	0.09	0.05	0.04	0.20	0.13
Energy Mix (FF: NE: RE)	8: 1: 1	5: 2: 3	7: 2: 1	6: 2: 2	6: 2: 2	4: 3: 3
Power Generation (FF: NE: RE)	7: 2: 1	3: 4: 3	4: 4: 2	3: 4: 3	4: 3: 3	2: 4: 4
Portfolio	Energy Conservation Energy Conversion CCS		Energy Conservation Energy Conversion		Energy Conservation Energy Conversion CCS	

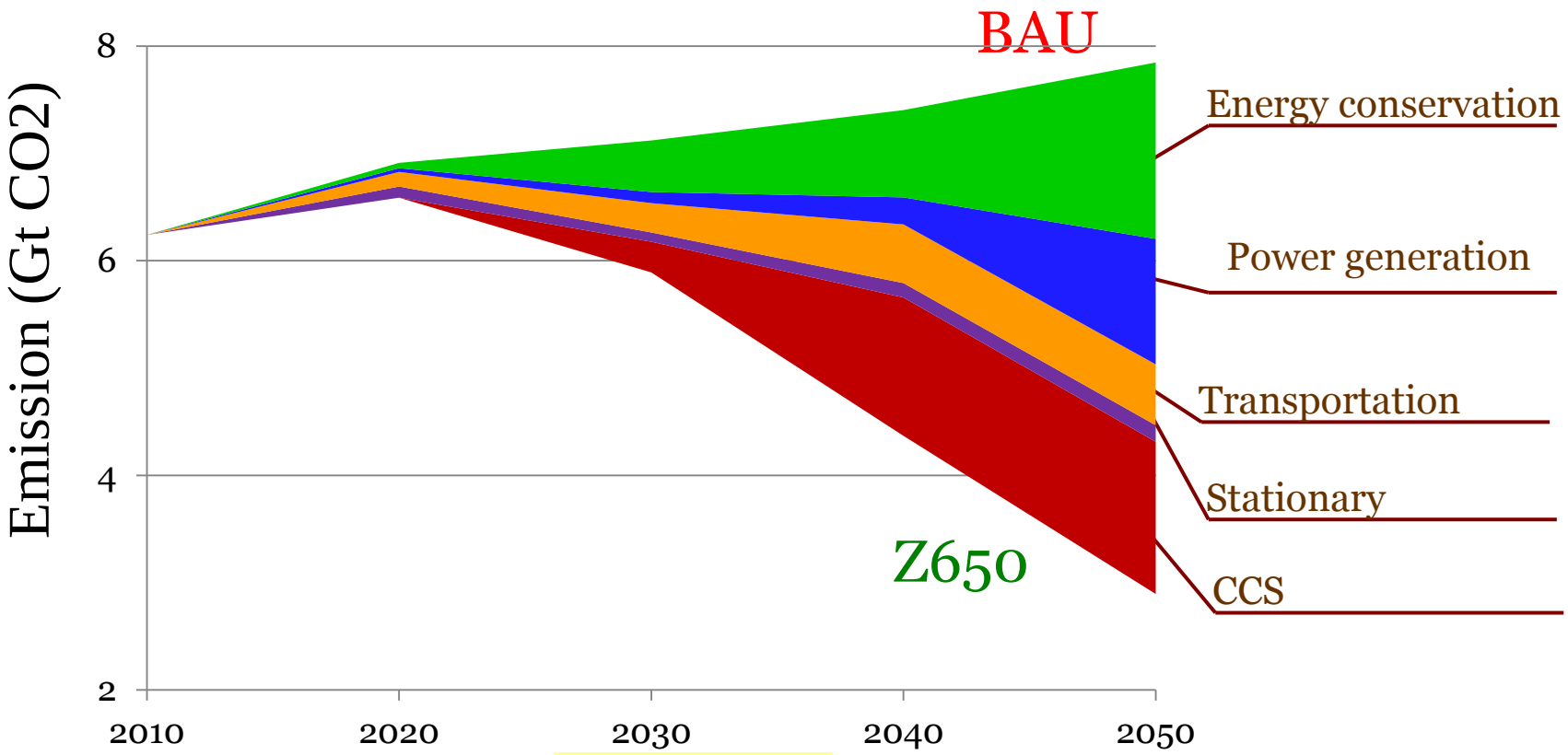
ビジョン実現のために（モデル計算より）



China

Reduction rate in 2050	Energy Saving	Power Generation	Transportation	Stationary	CCS
	44	33	6	3	14

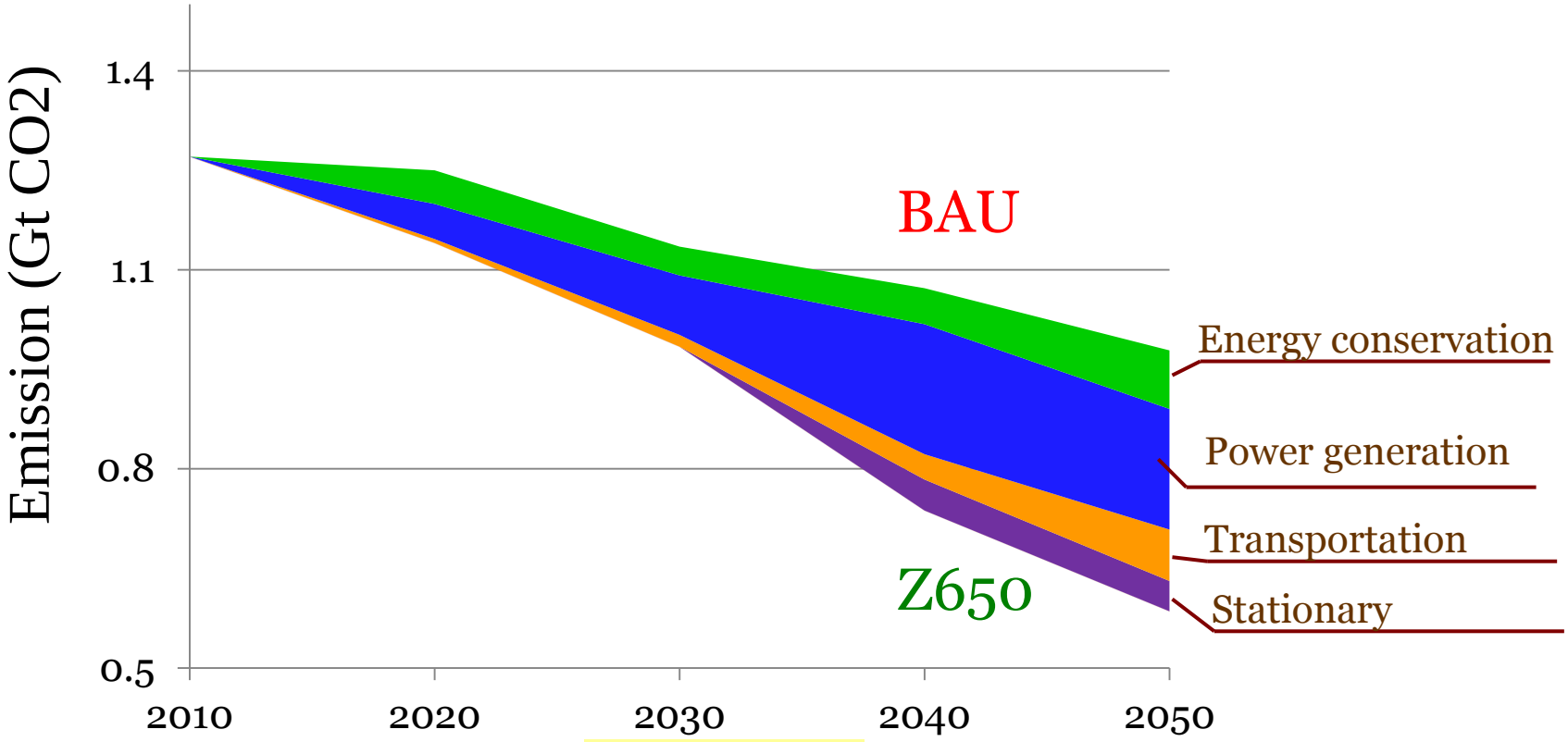
ビジョン実現のために（モデル計算より）



USA

Reduction rate in 2050	Energy Saving	Power Generation	Transportation	Stationary	CCS
	33	24	11	3	29

ビジョン実現のために（モデル計算より）



Japan

Reduction rate in 2050	Energy Saving	Power Generation	Transportation	Stationary	CCS
	22	46	18	12	0

自己努力のモチベーション
（日本）

- 製造業中心の産業構造
  産業競争力＝技術力＋省エネ

- エネルギー事情
  資源が乏しい（海洋開発？）

自己努力のモチベーション
（米国）

- 産業構造調整
  - エネルギー輸出産業振興
  - 省エネによる産業競争力向上

- 生活スタイルの維持
  - クリーンエネルギーによる多消費を支え

自己努力のモチベーション
（中国）

- ローカル環境汚染の抑制
  環境被害の甚大さ（GDPの7%）（曲格平2005による）

- エネルギー事情
  資源単一（石炭）
  自給率低下

自己努力の限界
（日本）

	Baseline (△4% from 1990)	Previous Target (▲7% from 1990)	Current Target (▲25% from 1990)
Real GDP	Based on an assumption of a 1.3% annual growth of Real GDP	▲0.6% in 2020 (depressing)	▲3.2% in 2020 (depressing)
Unemployment rate		△0.2% (rise)	△1.3% (rise)
Private plant investment		△0.1%	▲ 0.4%
Disposable income		▲40,000JP¥/yr Per household	▲220,000JP¥ /yr Per household
Utility costs		△30,000JP¥ /yr Per household	△140,000JP¥ yr Per household
Marginal abatement cost	35-62 US$/tCO2 Cannot be compared simply due to the different models	15,000YP¥/tCO2 If putting the cost into energy price, it would make a rise by 30JP¥/l for gasoline	82,000YP¥/tCO2 If putting the cost into energy price, it would make a rise by 170JP¥/l for gasoline

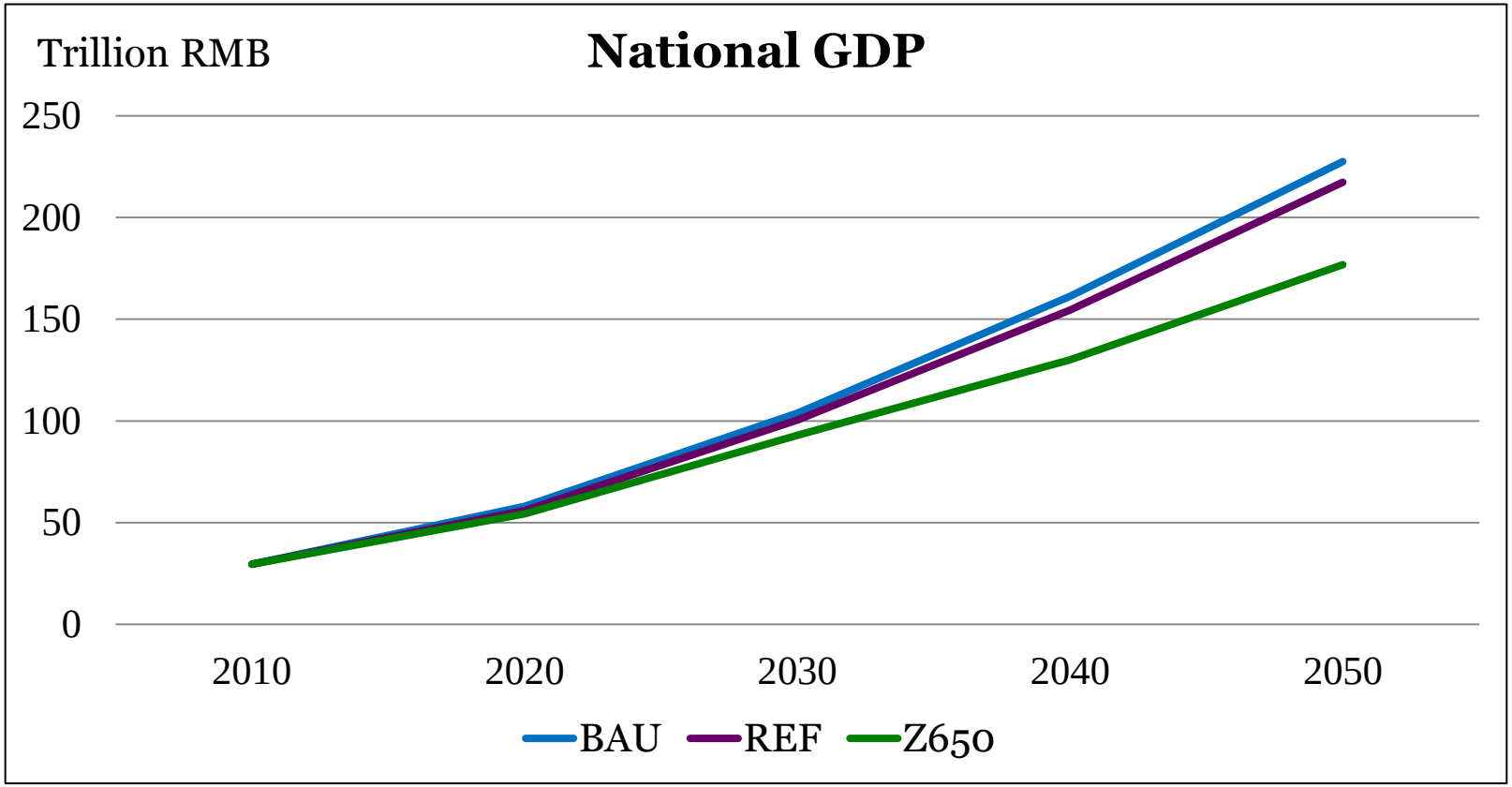
Source: “Long term outlook for energy demand and supply”, METI, Aug. 2009

自己努力の限界
（米国）

Scenarios	Average costs (allowance prices) (2005 $/ton CO2)		
	2020	2030	2050
Cap and trade (APA)	24	39	102
Without international offsets	49	80	209

Data source: “EPA analysis of the American Power Act”

自己努力の限界
（中国）



清華大学との共同研究により

WIN-WINの可能性
（日米中の補完関係）

-Parties

United States: Natural Resources Power, Number One Economy
China: Human Resources Power, Number Two Economy
Japan: Technology Power, Number Three Economy

-Technology capacities

United States: Shale Gas, SMR, Battery
Japan: End Use Efficiency, Clean Coal

-Natural Resources capacities

United States: Coal, Shale Gas
China: Coal

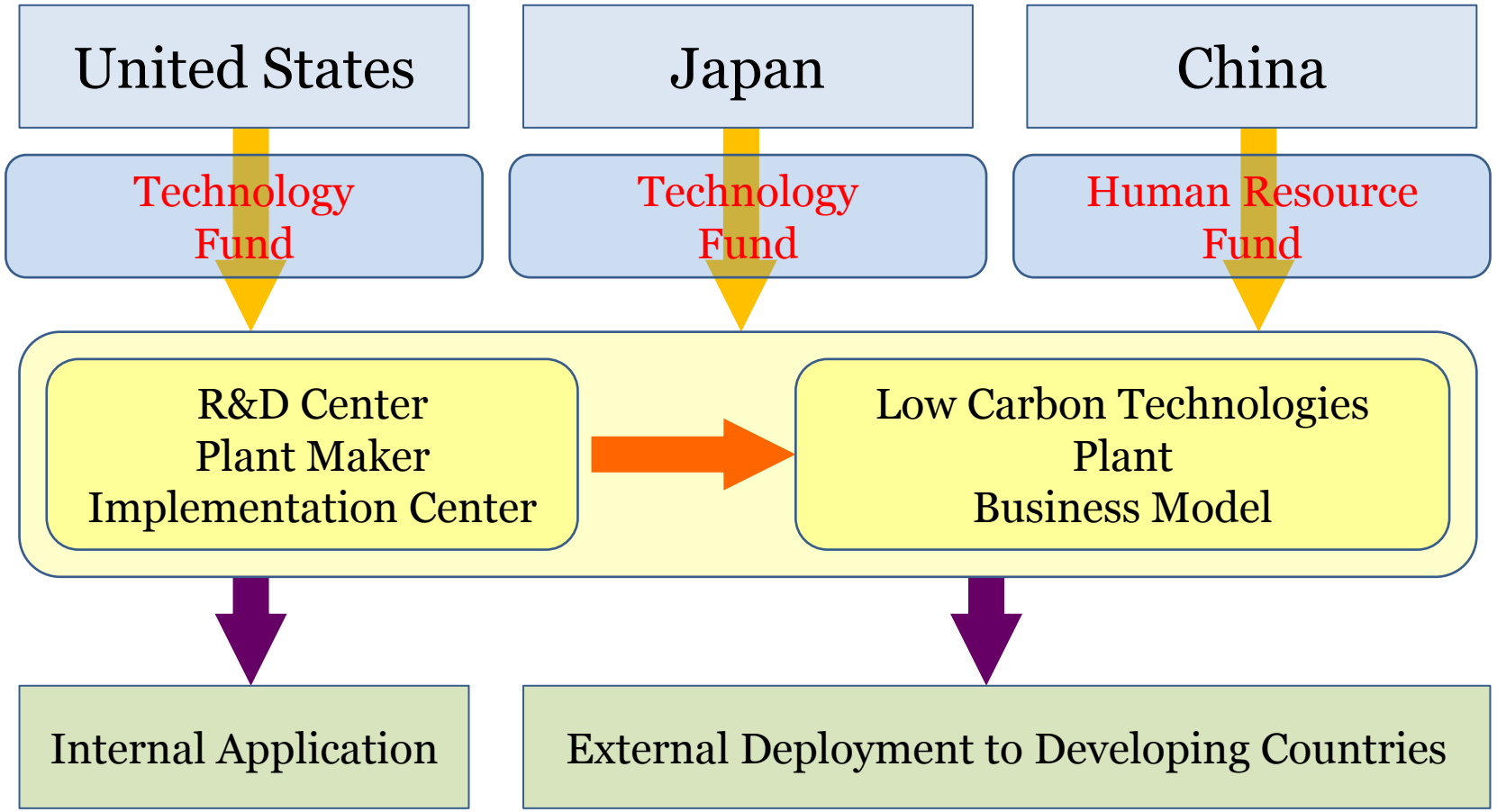
-Human Resources capacities

China: annual 4,000,000 graduates of science and engineering

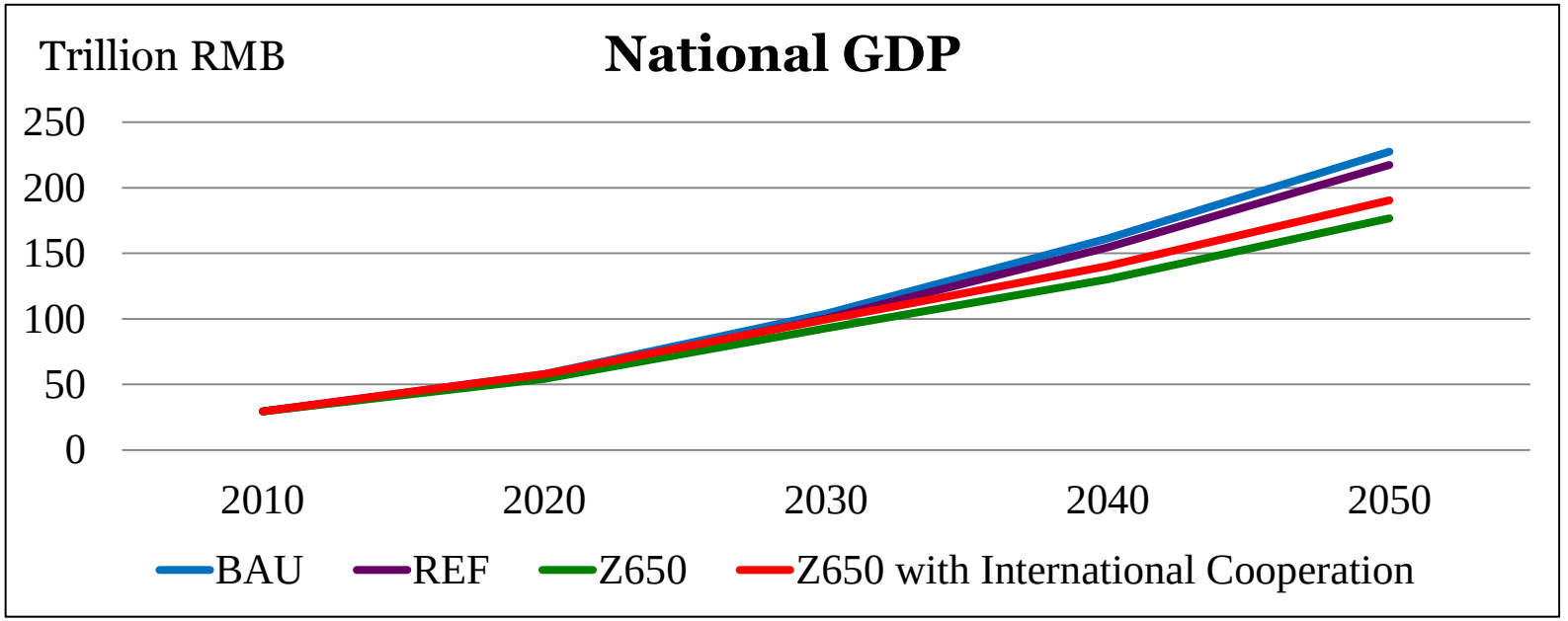
WIN-WINの可能性
（日米中の補完関係）

	China	Japan	United States
Resources Potential	△	×	○
Technology Capacity	×	○	△
Human Resources	○	×	△
Economic Capacity	○		

WIN-WINに向けて
（日米中の補完的協力イメージ）



WIN-WINに向けて
（協力の中国国内効果例）



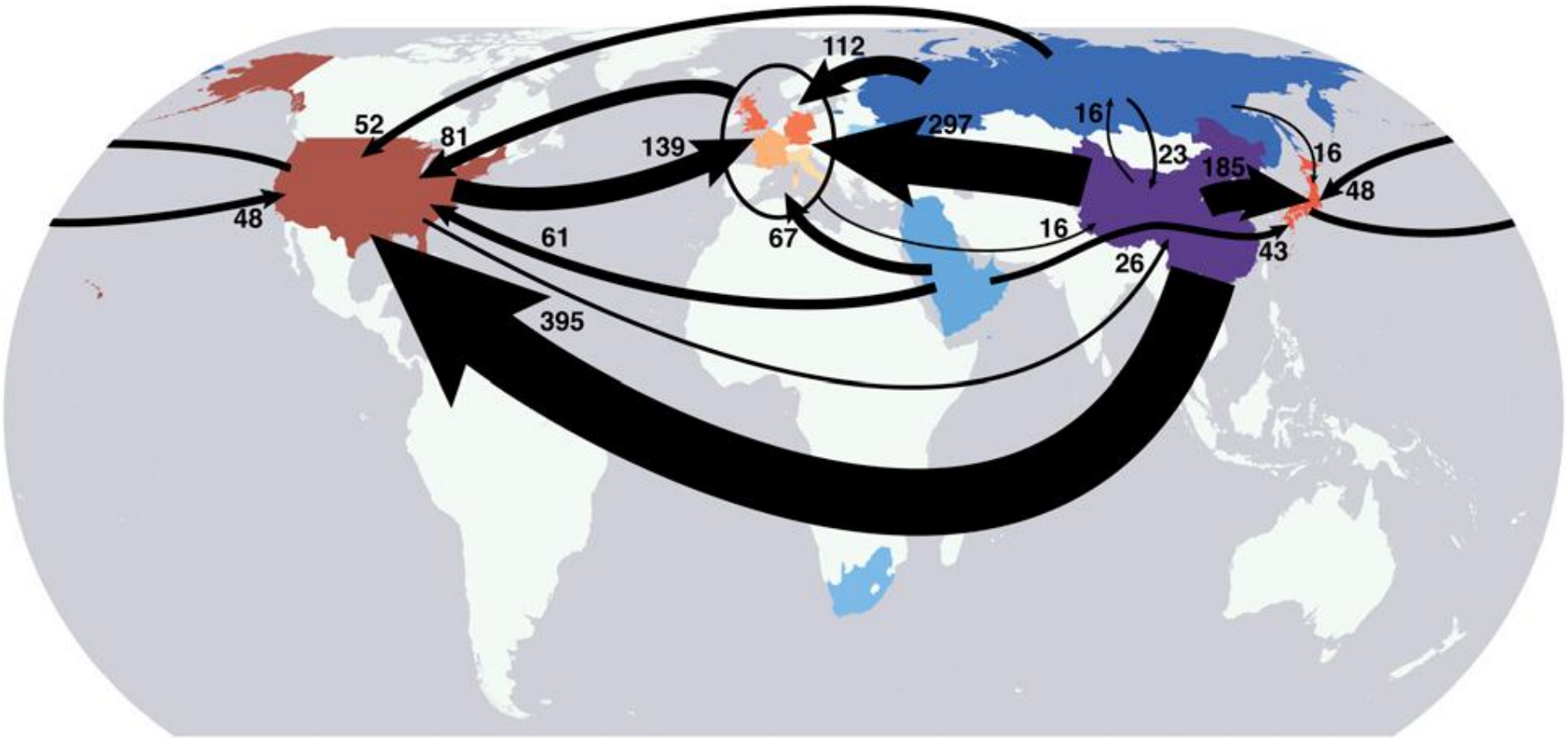
Scenario	2020	2030	2040	2050
REF	-3.6	-3.3	-4.2	-4.5
Z650	-6.4	-10.6	-19.3	-22.3
Z650 with International Cooperation	0.2	-4.2	-13.1	-16.3

清華大学との共同研究により

WIN-WINに向けて
（協力の期待する効果）

- 日本
  - 産業立国→技術立国
  - エネルギーセキュリティの確保
- 米国
  - 産業活性化（資源産業と製造業）
- 中国
  - ローカル環境改善
  - 産業構造の調整（ローカーボン産業）
  - エネルギーセキュリティの確保
- 国際
  - 温暖化抑制
  - アジア太平洋地域の安定
  - 途上国支援（ローカーボン成長方式の確立）

なぜ日米中なのか
（相互依存関係）



Source: Steven J. Davis and Ken Caldeira (2010), “Consumption-based accounting of CO2 emissions”, PNAS , vol. 107, no. 12, 5687–5692

結論

-CIGSの世界ビジョン提案について、専門家間が討議を通じて、共有しつつある。

-その実現する途において、国際協力がキーとなる。

-温暖化抑制に向けて、日米中に相互依存と相互補完関係がある。

-日米中のWIN-WIN協力スキームの構築は、世界ビジョンの実現に大きく貢献できる。

-協力スキームの構築に向けて、専門家間のさらなる討議が期待される。