

DC開発フォーラム・セミナーシリーズ「複眼で見る温暖化」

第1回「京都協定は温暖化を解決できるのか」

2008年5月19日

世界銀行Carbon Finance Unit

矢部 健太郎



Climate Risks and Development: The "Poor Countries' Danger"

Six Climate Threats
Top 12 Countries Most at Risk from Each

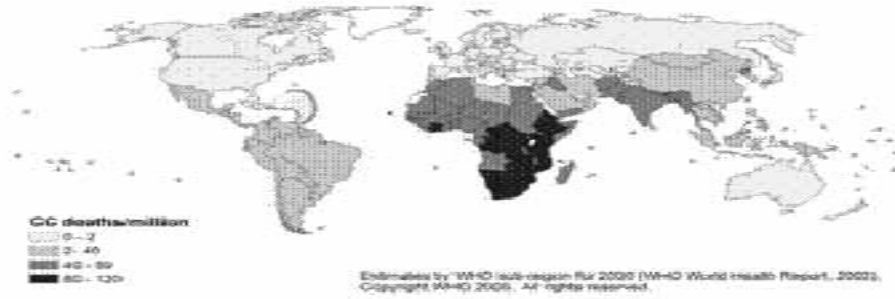
Low Income		Middle Income		High Income	
Drought	Flood	Storm	Coastal 1m	Coastal 5m	Agriculture
Malawi	Bangladesh	Philippines	All low-lying Island States	All low-lying Island States	Sudan
Ethiopia	China	Bangladesh	Vietnam	Netherlands	Senegal
Zimbabwe	India	Madagascar	Egypt	Japan	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Bangladesh	Mali
Mozambique	Mozambique	Moldova	Indonesia	Philippines	Zambia
Niger	Laos	Mongolia	Mauritania	Egypt	Morocco
Mauritania	Pakistan	Haiti	China	Brazil	Niger
Eritrea	Sri Lanka	Samoa	Mexico	Venezuela	India
Sudan	Thailand	Tonga	Myanmar	Senegal	Malawi
Chad	Vietnam	China	Bangladesh	Fiji	Algeria
Kenya	Benin	Honduras	Senegal	Vietnam	Ethiopia
Iran	Rwanda	Fiji	Libya	Denmark	Pakistan

Source: World Bank staff.

4

気候変動の影響

Deaths from climate change



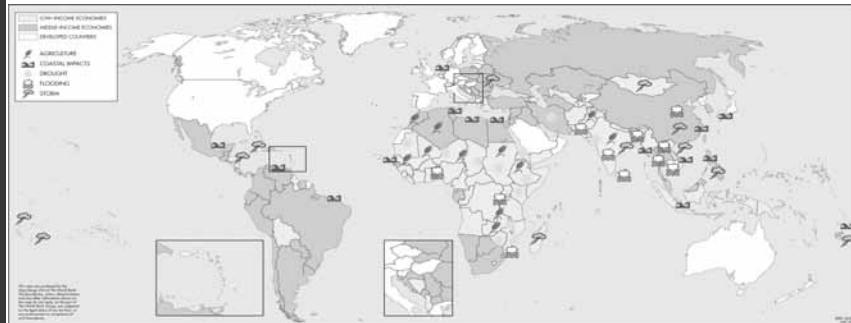
Disease/illness	Annual Deaths	Climate change component (death / % total)
Diarrhoeal diseases	2.0 million	47,000 / 2%
Malaria	1.1 million	27,000 / 2%
Malnutrition	3.7 million	77,000 / 2%
Cardiovascular disease	17.5 million	Total heat/cold data not provided
HIV/AIDS	2.8 million	No climate change element
Cancer	7.6 million	No climate change element

気候変動の影響 — 健康被害



気候変動の影響 — 生態系

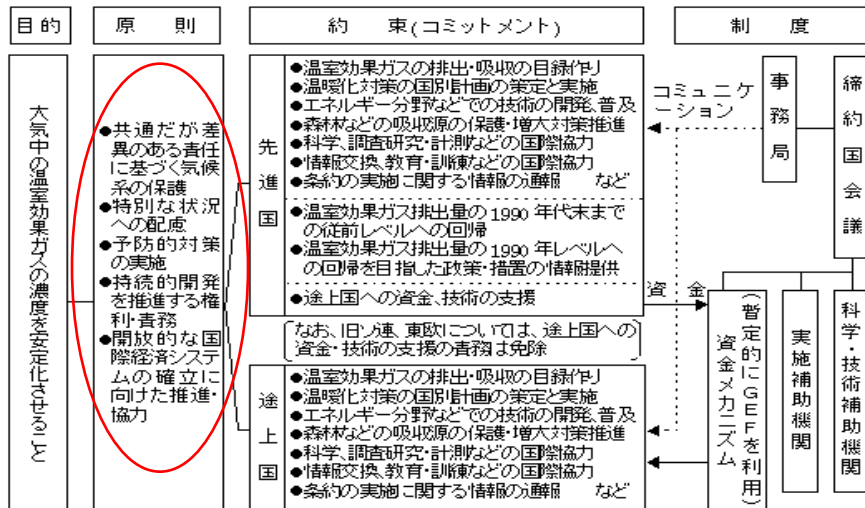
Climate Risks Are Higher for Poor Countries



Source: World Bank staff.

気候変動の影響 - 途上国

図-1 気候変動枠組条約の概要



資料「最新環境キーワード 第2版」
(環境庁長官官房総務課編、財団法人経済調査会発行)

UNFCCC概要 - 開発の観点

- ◆京都議定書は、1997年12月に京都で開催された「気候変動枠組条約第3回締約国会議(GOP3)」において採択された
- ◆気候変動枠組条約における附属書I国の温室効果ガス(GHG)排出量について、法的拘束力のある排出削減の数値目標を設定

温室効果ガスとして二酸化炭素(CO₂)、メタン(CH₄)、一酸化二窒素(N₂O)、HFC、PFC、SF₆の6種類を指定

気候変動枠組条約附属書I国は、主に先進国であるが、ロシア・東欧等(市場経済移行国)を含む

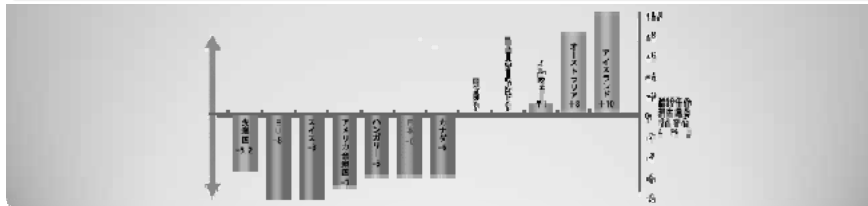
附属書I国は、2008～2012年の5年間(第1約束期間)に温室効果ガス排出量の上限が設定される

- ⇒ 各国の初期割当量(Assigned Amount)は、以下によって計算される
 - ⇒ 「基準年排出量」×「排出削減数値目標」×5年
 - ⇒ 基準年排出量は1990年の温室効果ガスの排出量(HFCs、PFCs、SF₆については1995年の排出量としてもよい)
 - ⇒ 市場経済移行国のCO₂の排出量については1990年以外の年を基準年としてもよい
 - ⇒ 国内での植林等の吸収源活動によるCO₂の吸収増大量については、排出枠として割当量に加えることが可能

- ◆附属書I国の排出削減目標を達成するための補足的な仕組みとして、市場原理を活用する京都メカニズム(3つ)を導入

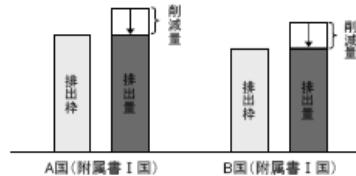


- ◆国だけでなく、事業者も京都メカニズムに参加することが可能 [CMP/2005/8/Add.2, p7 n°29][CMP/2005/8/Add.1, p13 n°33][CMP/2005/8/Add.2, p19 n°35]
- ⇒参加するためには、国が京都メカニズムへの参加資格を満たすことが必要 (23-1参照)



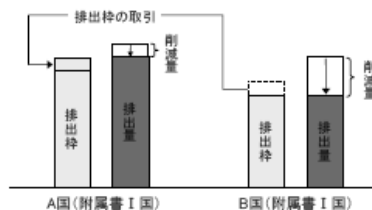
京都議定書の概要

国際排出量取引がない場合



	A国	B国	合計
取引前・総排出枠	10	8	18
排出枠の取引	-	-	-
取引後・総排出枠	10	8	18
削減前排出量	12	10	22
必要削減量	2	2	4
削減費用単価	\$200	\$100	-
削減費用	\$400	\$200	\$600
排出枠売買	-	-	-
目標達成費用	\$400	\$200	\$600

国際排出量取引がある場合

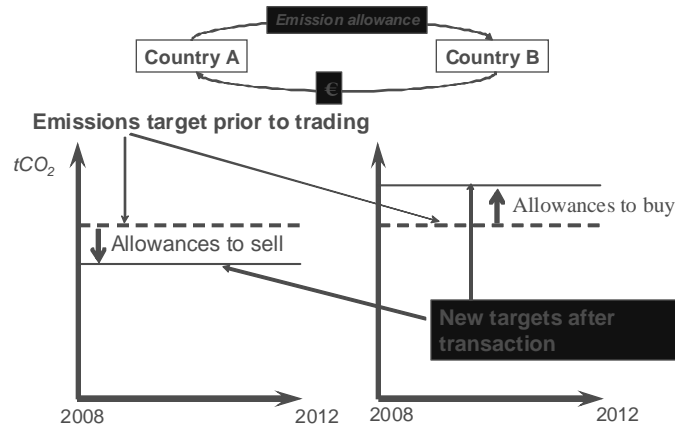


	A国	B国	合計
取引前・総排出枠	10	8	18
排出枠の取引	1	-1	0
取引後・総排出枠	11	7	18
削減前排出量	12	10	22
必要削減量	1	3	4
削減費用単価	\$200	\$100	-
削減費用	\$200	\$300	\$500
排出枠売買	150	-150	0
目標達成費用	\$350	\$150	\$500

(注) B国はA国に排出枠1単位を\$150で販売するとした。ただし、取引のために必要なコストは考慮していない。

排出権取引の経済学

Example of emissions trading



10

Cap-and-Trade

The Joy of Tech

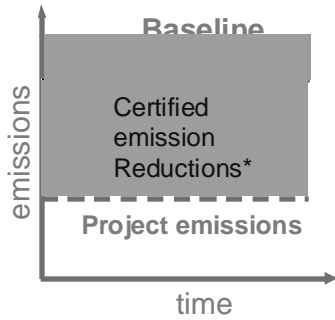
by Nitrozac & Sneggy



Baseline-and-Credit



How does the CDM Work?



Important Methodological Issues:

- Baselines are counterfactual/hypothetical
- Determining Additionality

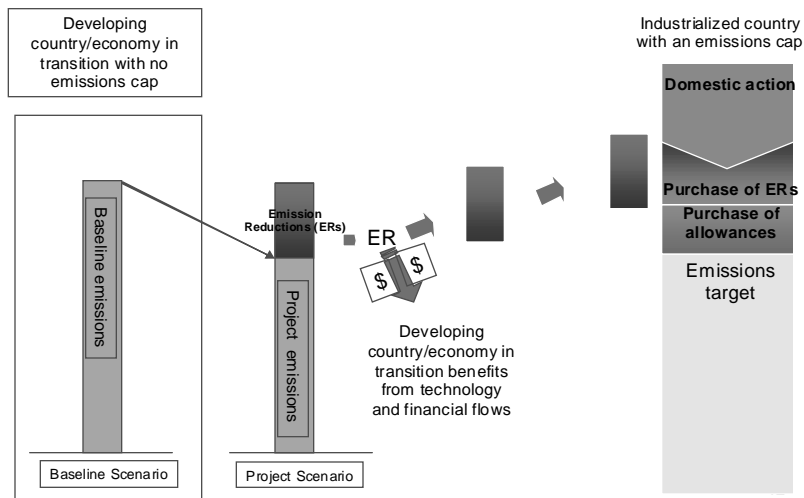
*The difference between the actual project emissions and the emission baseline constitute the volume of emission credits

*If project = baseline → no credits

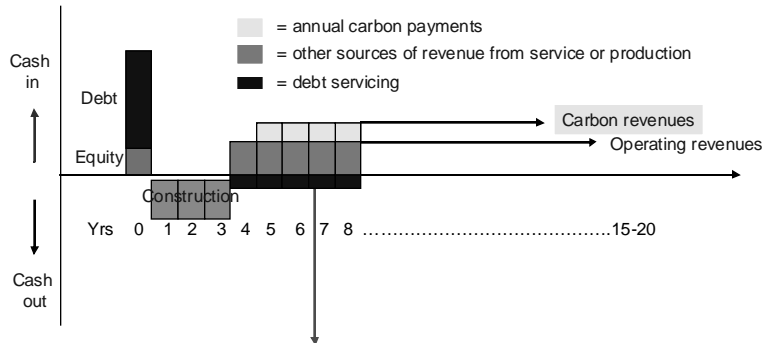
Baseline-and-Credit



Carbon credits



Carbon finance: payments for a stream of emission reductions



ERs created only after project is implemented and operational (Carbon finance is output-based). 30

Carbon Finance: 売買契約

Impact of Carbon Finance



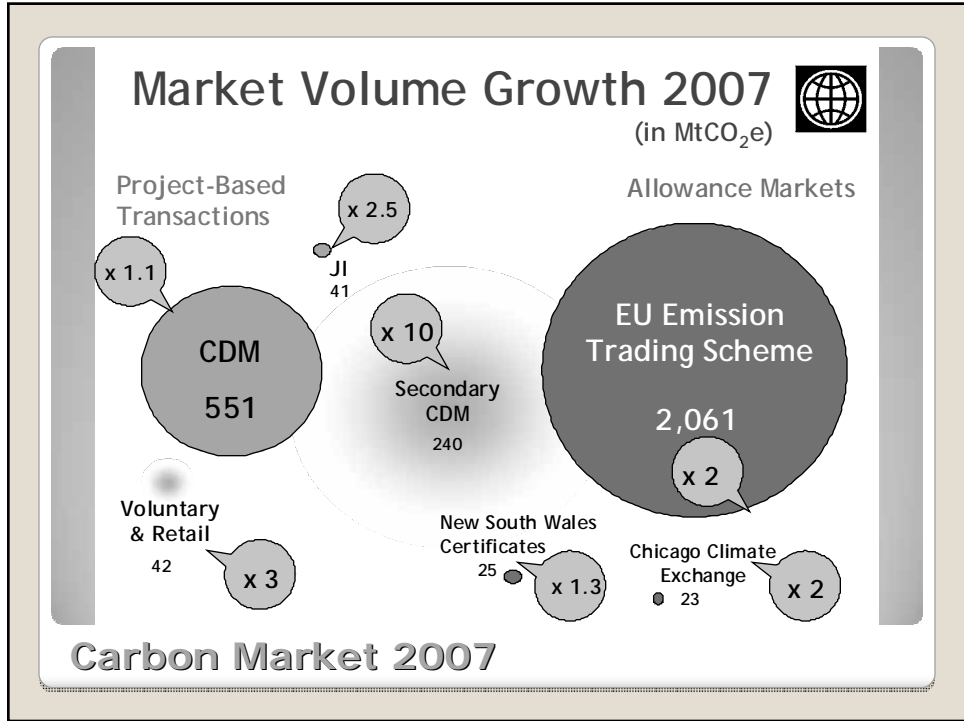
INCREMENTAL IRR - CARBON FINANCE						
Renewable Energy						
ER Prices	Purchase period					Impact per Unit
	5y ('08-'12)	7y	10y	14y	21y	
\$5.00	0.5%	0.6%	0.8%	1.0%	1.2%	\$3.16 / MWh
\$10.00	1.0%	1.4%	1.7%	2.1%	2.3%	\$6.33 / MWh
\$15.00	1.6%	2.1%	2.7%	3.1%	3.3%	\$9.49 / MWh
\$20.00	2.2%	2.9%	3.6%	4.1%	4.5%	\$12.65 / MWh

INCREMENTAL IRR - CARBON FINANCE						
Solid Waste						
ER Prices	Purchase period					Impact per Unit
	5y ('08-'12)	7y	10y	14y	21y	
\$5.00	17.9%	24.1%	29.2%	31.7%	32.8%	\$41 / MWh
\$10.00	52.3%	59.1%	62.4%	63.5%	63.8%	\$82 / MWh
\$15.00	88.2%	93.3%	95.4%	95.9%	96.0%	\$124 / MWh
\$20.00	123.7%	127.3%	128.6%	128.8%	128.9%	\$165 / MWh

*tSW = ton solid waste

INCREMENTAL IRR - CARBON FINANCE						
HFC23						
ER Prices	Purchase period					Impact per Unit
	5y ('08-'12)	7y	10y	14y	21y	
\$5.00	110.8%	112.3%	112.7%	112.7%	112.7%	\$112.7%
\$10.00	176.7%	177.3%	177.4%	177.4%	177.4%	\$177.4%
\$15.00	227.3%	227.6%	227.7%	227.7%	227.7%	\$227.7%
\$20.00	270.0%	270.2%	270.2%	270.2%	270.2%	\$270.2%

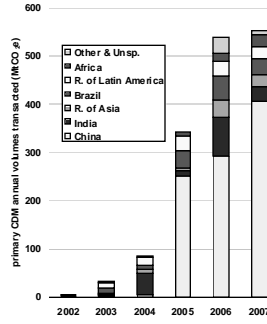
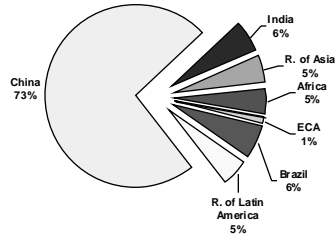
*65% tax applied on carbon revenues



China consolidates lead, Africa emerges



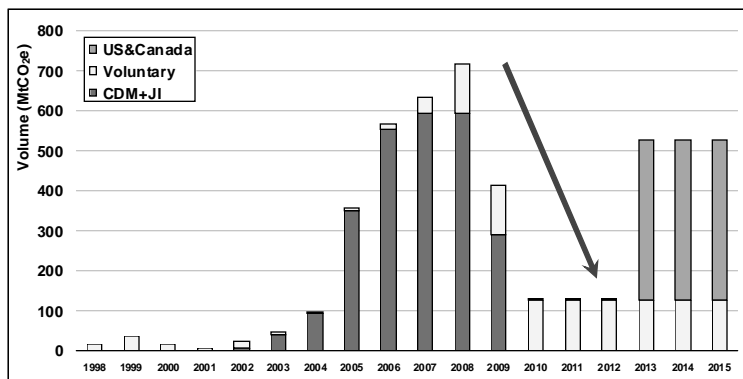
(share of volumes)



Jan. 2007 to Dec. 2007

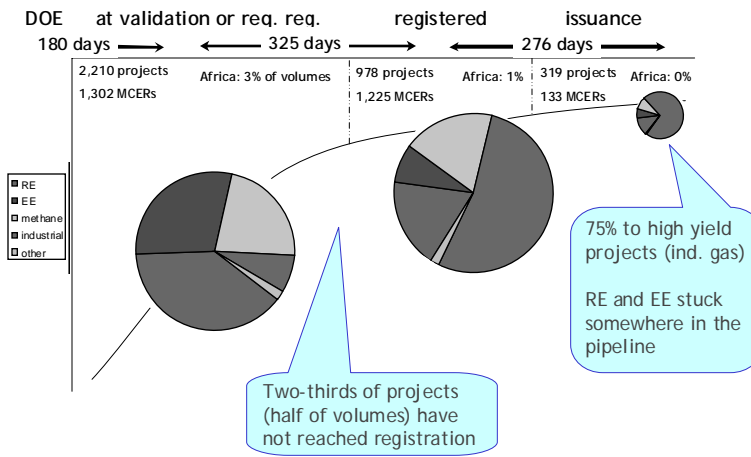
China Development Mechanism?

Right direction?



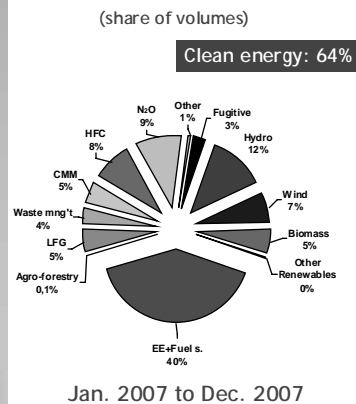
CDM at a Crossroads...

Success masks challenges



Challenge

CDM Delivers on Clean Energy



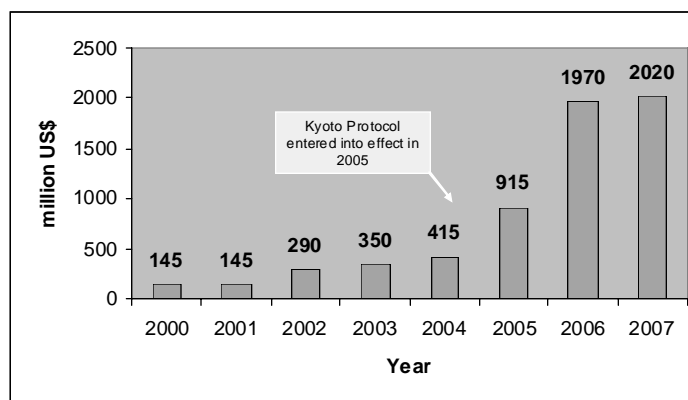
- ❖ US\$1 of carbon leverages US\$9 financing of renewable energy
- ❖ US\$33 billion (€24 billion) clean energy leveraged in 2007
- ❖ Cumulative (02-07) leverage US\$52 billion (€39 billion) expected

"Climate change is a development, economic, and investment challenge. It offers opportunity for economic and social transformation...That is why addressing climate change is a critical pillar of the development agenda"

Robert Zoellick, UN Climate Change Conference, Bali, December 2007

気候変動と世銀

Total Volume of Carbon Funds Managed by the World Bank



Funds are entrusted to the Bank by interested parties with commitments under the Kyoto Protocol. Participants are governments and private sector.

- **BioCarbon Fund**

- The World Bank has mobilized a fund to demonstrate projects that sequester or conserve carbon in forest and agro-ecosystems. The Fund, a public/private initiative administered by the World Bank, aims to deliver cost-effective emission reductions, while promoting biodiversity conservation and poverty alleviation. The Fund is composed of two Tranches: Tranche One started operations in May 2004, has a total capital of \$53.8 million; Tranche Two was operationalized in March 2007 and has a total capital of \$ 38.1 million. Both Tranches are closed to new fund participation.
- The BioCarbon Fund can consider purchasing carbon from a variety of land use and forestry projects; the portfolio includes Afforestation and Reforestation, Reducing Emissions from Deforestation and Degradation and is exploring innovative approaches to agricultural carbon.

- **Community Development Carbon Fund**

- The CDCF provides carbon finance to projects in the poorer areas of the developing world. The Fund, a public/private initiative designed in cooperation with the International Emissions Trading Association and the United Nations Framework Convention on Climate Change, became operational in March 2003. The first tranche of the CDCF is capitalized at \$128.6 million with nine governments and 16 corporations/organizations participating in it and is closed to further subscriptions. The CDCF supports projects that combine community development attributes with emission reductions to create "development plus carbon" credits, and will significantly improve the lives of the poor and their local environment.

世銀Carbon Funds – Underserved Marketへの対応

1. 緩和 (Mitigation)
2. 適応 (Adaptation)
3. テクノロジー (Technology)
4. 融資 (Financing)

- WB: Capital inflows to developing countries reached US\$571 billion in 2006, a 19% increase from 2005 (primarily equity from private sector). Three previous yearly increase rates averaged 40%.
- UNEP2: Only US\$21 billion were allocated to Renewable Energy and Energy Efficiency technologies in developed countries (i.e., 21% of the US\$100 billion global investments to the sector in 2006).



気候変動への取組みにおける課題

- “UN-managed projects to curb pollution could bring \$100 billion annually to developing countries.”
- “Carbon is a new commodity, a new currency.”
- “To believe that market forces can be used to fix climate change is to believe in magic.”
- “Carbon trading is really not the most effective way of lowering GHG emissions, by outsourcing emission reductions, you may or may not be doing anything to help lower the risk of climate change.”

Carbon Financeは温暖化を解決するか

