

Global warming and it's Solution (Kyoto mechanism)

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Mitsubishi Research Institute

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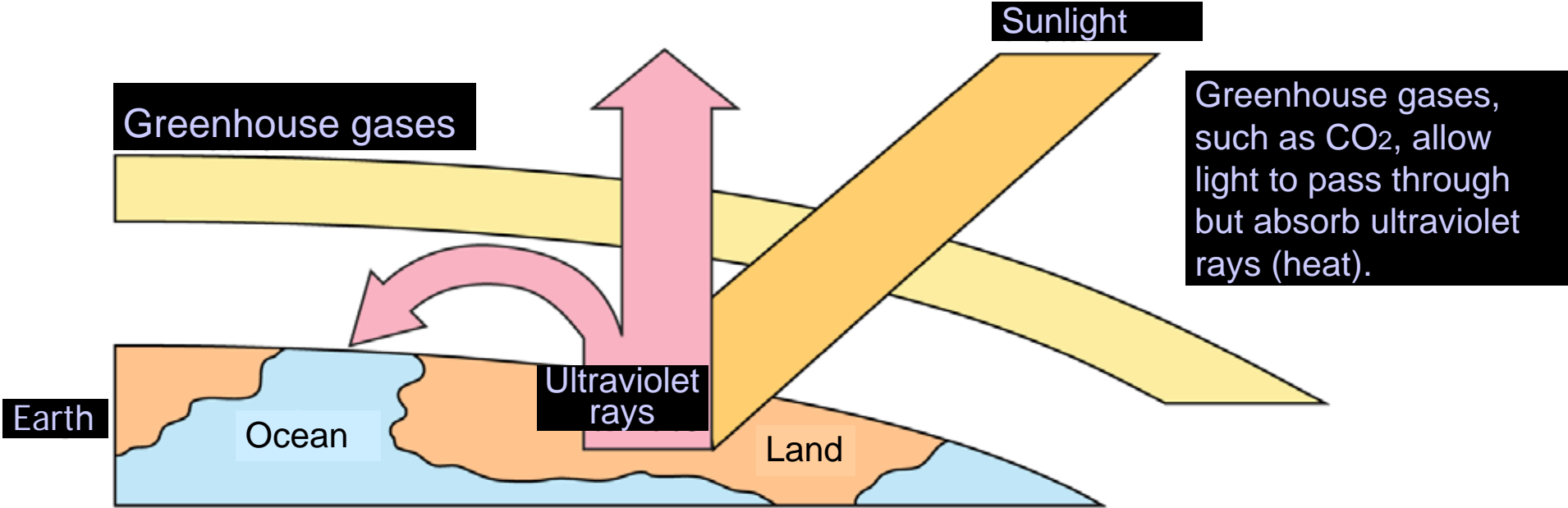
Agenda

- Global warming
- International discussion
- Ratification process of KM
- GHG emission in main countries
- Kyoto Mechanism (KM)
- Clean Develop Mechanism and Emissions trading
- Role of Private sector
- Japanese Situation
- Activities in Mitsubishi Research Institute

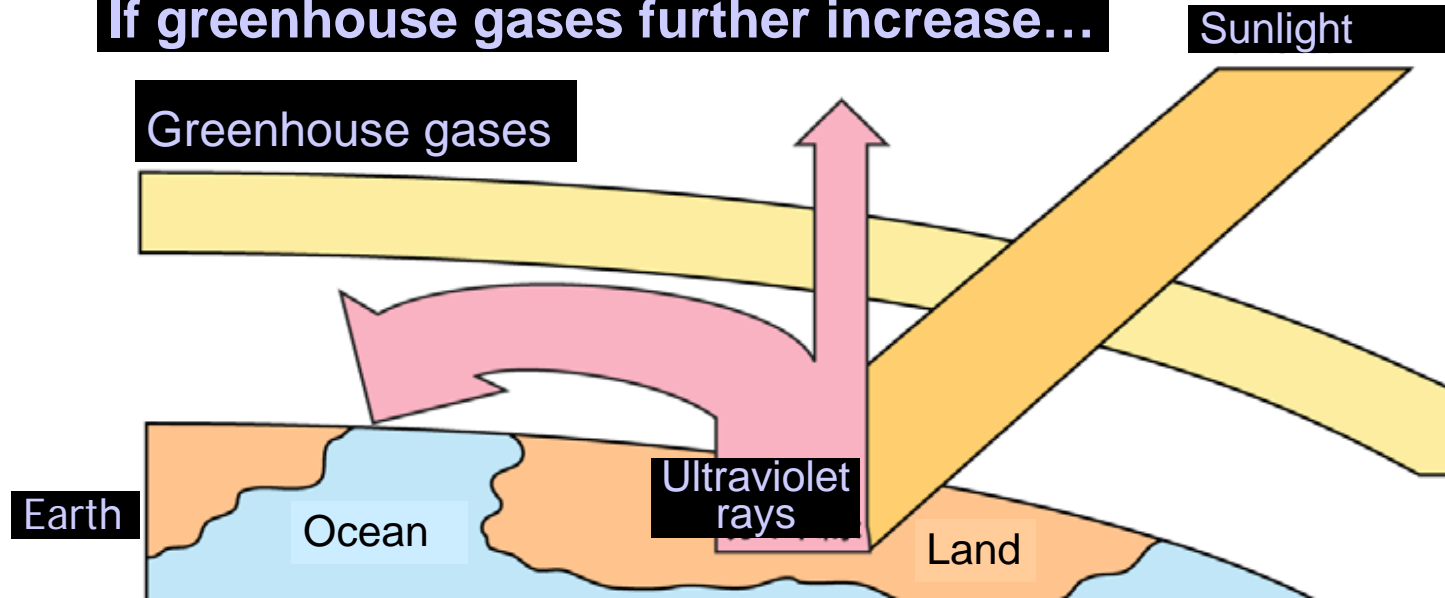
What is global warming

- Mechanism of global warming
 - Unbalance of heat-balance of the earth
- Founded in late 19th Century
 - Arrhenius (Swedish scientist)
- GHGs (greenhouse effect gases)
 - CO₂, methane, HFC, CFC, N₂O, SF₆
 - Global warming potential
- Several signs of warming

Mechanism of Greenhouse Gases



If greenhouse gases further increase...



International discussion for global warming (1)

- 1988 Toronto conference
 - Developed countries should commit 20% energy consumption reduction.
- Establishment of IPCC
- Second world climate conference(1990)
- 1992 Earth summit (UNCED UN conference on environment and development)
 - Framework convention on climate change
- Enter into the forth 1994

International discussion for global warming (2)

- COP1 (conference of the parties) 1995
 - Berlin mandate
- COP3 1997 Kyoto conference
 - Kyoto protocol
- COP7 2001 Marrakech conference
 - Marrakech accord
 - detail discussion on Kyoto protocol

IPCC report (Inter-governmental panel on climate change)

- First report(1990)
 - 60% ghgs reduction is needed for CO2 stabilization)
- Second report(1995)
- Third report T A R (2001)
- Contents
 - Forecast of warming
 - Cost for adaptation
 - Social impact of warming

Main result of IPCC report

- Future scenario of economic energy society
- Future energy consumption
- Future temperature raise
- Future sea level raise
 - GHGs are main contributors for last 50 years global warming
 - Average temperature raise at the end of 21st century is 1.5C, maximum 6.1C.

Framework convention on climate change

- Object
 - Stabilize ghgs concentration in the atmosphere
- Obligation of developed countries
 - Return the ghg emission to 1990 level in 2000
- Support developing countries in finance and technology (rich developed countries)
- Definition of countries
 - Developed countries Annex I OECD, EITs
 - Rich developed countries Annex II OECD
 - Developing countries

Road to Marrakech Accord

- COP1 (1995)
 - Berlin mandate, which requests Annex I countries to set their own reduction target by COP3
- COP2(1996) GHG reduction target must be legally binded

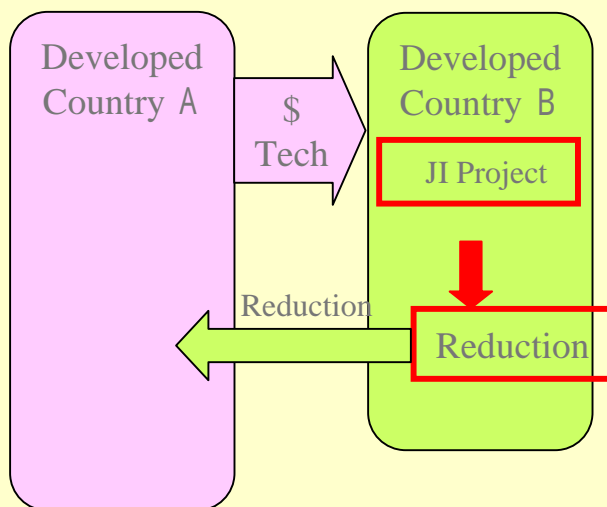
Kyoto protocol(COP3)

- Dec 1997
- Introduction of flexibility concept due to the difficulty of emission reduction (energy usage is directly connected with economic activities)
 - Time flexibility, regional flexibility, reduction point flexibility ,gas flexibility)
- Reduction target for developed countries
- Legally binding close

Basic Features of Kyoto Mechanism

Joint implementation (JI) (Article 6 of Protocol)

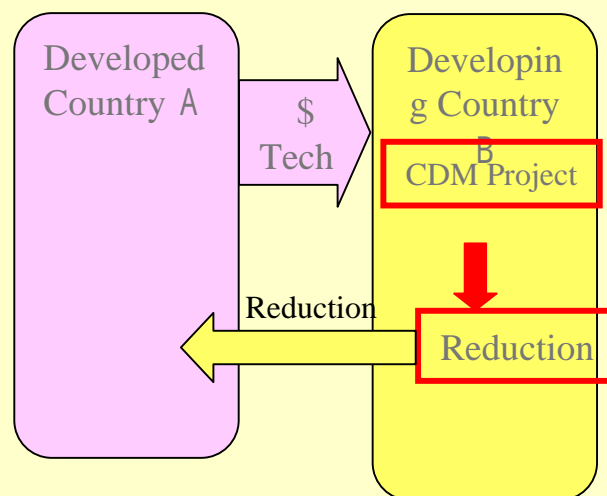
Developed country can receive "emissions reduction units" when it helps to finance projects that reduce net emissions in another developed country (including countries with economies in transition).



Clean Development Mechanism (CDM) (Article 12 of Protocol)

(Article 12 of Protocol)

Developed countries to finance emissions-reduction projects in developing countries and receive credit for doing so.

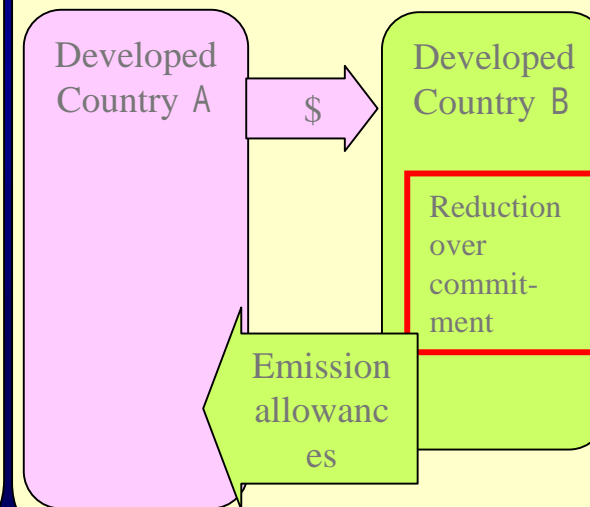


Credit gained for reductions
after 2000

Emissions Trading (Article 17 of Protocol)

(Article 17 of Protocol)

Parties with emissions commitments may trade their emission allowances with other Parties to achieve their commitments



Marrakech Accords Kyoto Mechanism

- Supplemental to domestic actions, domestic action thus constitutes a significant element of each Annex I Party's effort to meet the commitments
- Annex I Party may transfer/acquire AAUs, ERUs, CERs, and RMUs under Article 17

Basic Features of Clean Development Mechanism

Annex I countries implement projects to reduce emissions in a Non-Annex I countries, and the resultant reductions in emissions are shared between the participants of the project.

Credits issued in CDM is called CER (Certified Emission Reduction)

Annex I countries can use CER for their obligations under the Kyoto Protocol

Developing country where the projects is undertaken is called "Host country", country financing the project is called "Investment Country"

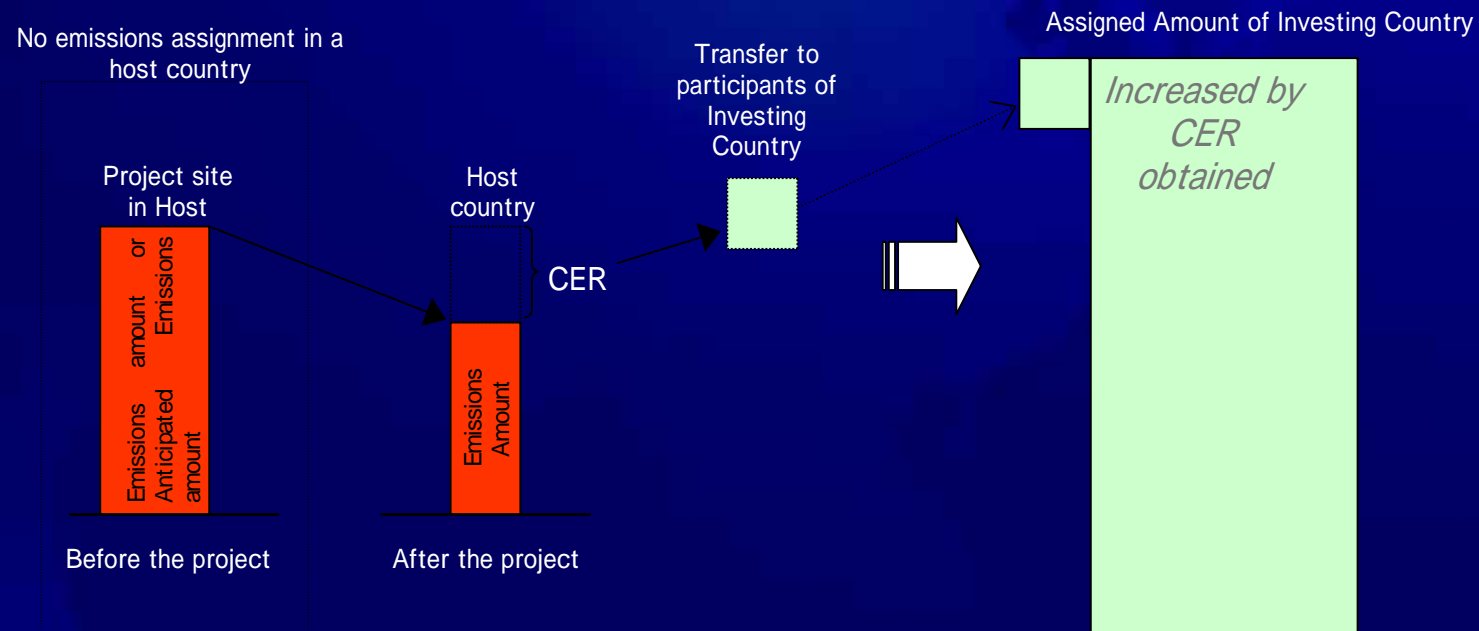
Example of GHG Reduction Projects : Renewable energy, Enhancement of energy efficiency, Fuel switch, Reuse of Methane

CO2 sink project : Afforestation and Reforestration

CDM allows developed country to increase its emission limit

Rigid examinations for credit issuance

CDM is only scheme in Kyoto Mechanism that credits can be obtained before the first commitment period (from 2000)



Clean Development Mechanism in Marrakech accords(1/6)

- Assist Annex I Parties to meet the targets
- Assist non-Annex I Parties to achieve sustainable development (transfer of technologies, financial assistance)

Marrakech Accords

CDM(2/6)

- it is the host Party's prerogative to confirm whether a CDM project activity assists it in achieving sustainable development;
- Annex I Parties are to refrain from using units generated from nuclear facilities to meet their commitments

Marrakech Accords

CDM(3/6)

- public funding for CDM projects is not to result in the diversion of ODA and is to be separate from and not counted towards the financial obligations of Annex I Parties
- share of proceeds for adaptation: 2% of issued for a project activity;
- CERs bankable up to 2.5% of a Party's assigned amount pursuant to Article 3.7 and 3.8

Marrakech Accords

CDM(4/6)

- CDM Executive Board established
10 members (Annex1 Parties-4, NonAnnex1 Parties-6)
- Simplified modalities and procedures for small-scale project activities agreed at COP8:
 - (a) Renewable energy project activities <15 MW,
 - (b) Energy efficiency improvement project activities <15 GWh/year; or
 - (c) Other project activities which emit <15 kt-CO₂/year

Marrakech Accords

CDM(5/6)

- Crediting period starts after the date of the registration of the project activities
- Credits for a project starting as of 2000-Nov11,2001 may be issued retrospectively but not earlier than Jan1,2000, if submitted for registration before Dec31, 2005

Marrakech Accords

CDM(6/6)

- Afforestation and reforestation projects shall be the only eligible LULUCF projects under the CDM during the 1st commitment period(CP)
- Each Annex I Party's net acquisition of CERs from A&R CDM projects for the 1st CP: not exceed 1% of base year emissions

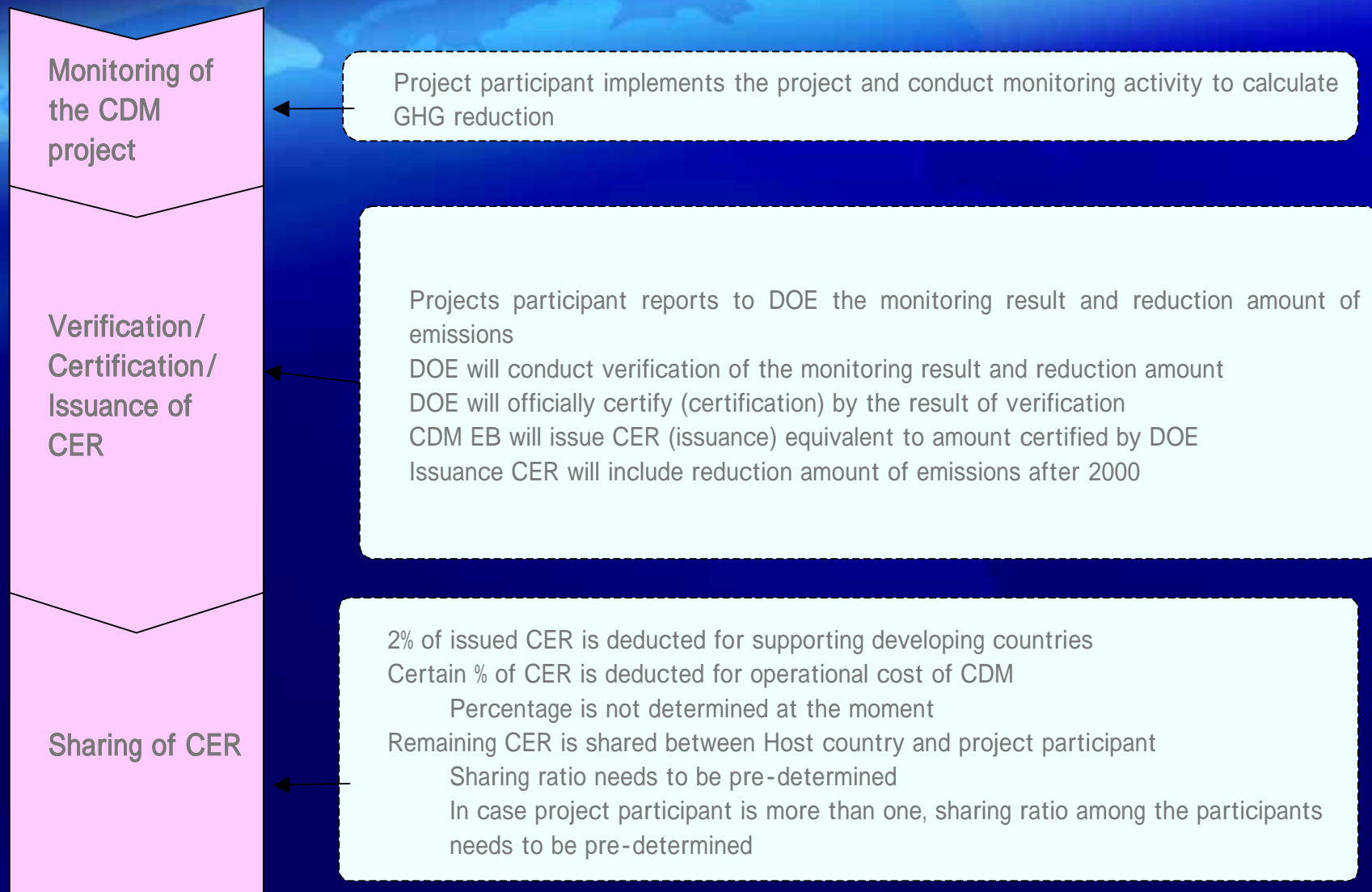
CDM project cycle

Flow of CDM project, where project participants implement emissions reduction or sink projects in developing country and obtain CER as a result of the project, is as follows.

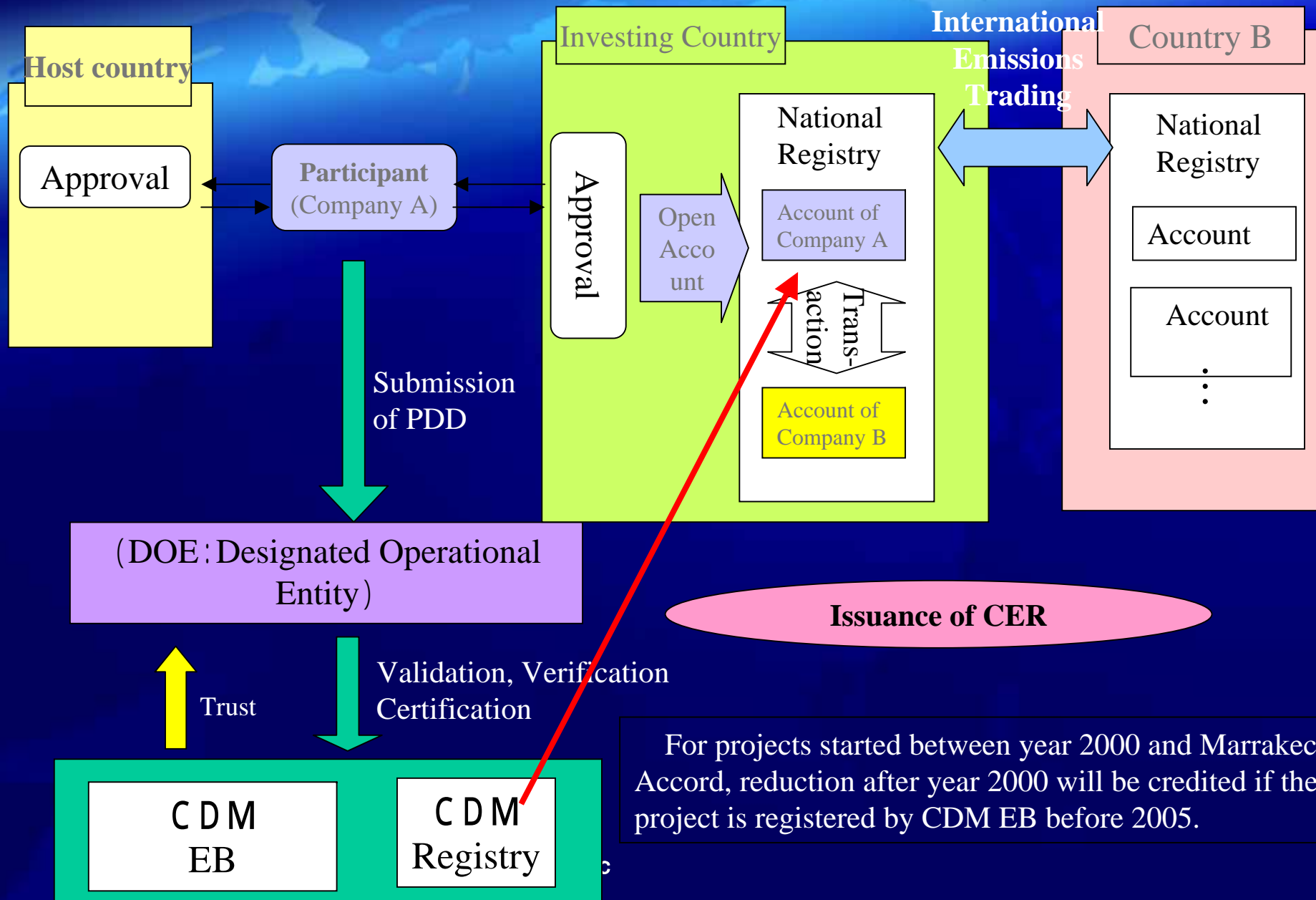


Implementation of the Project

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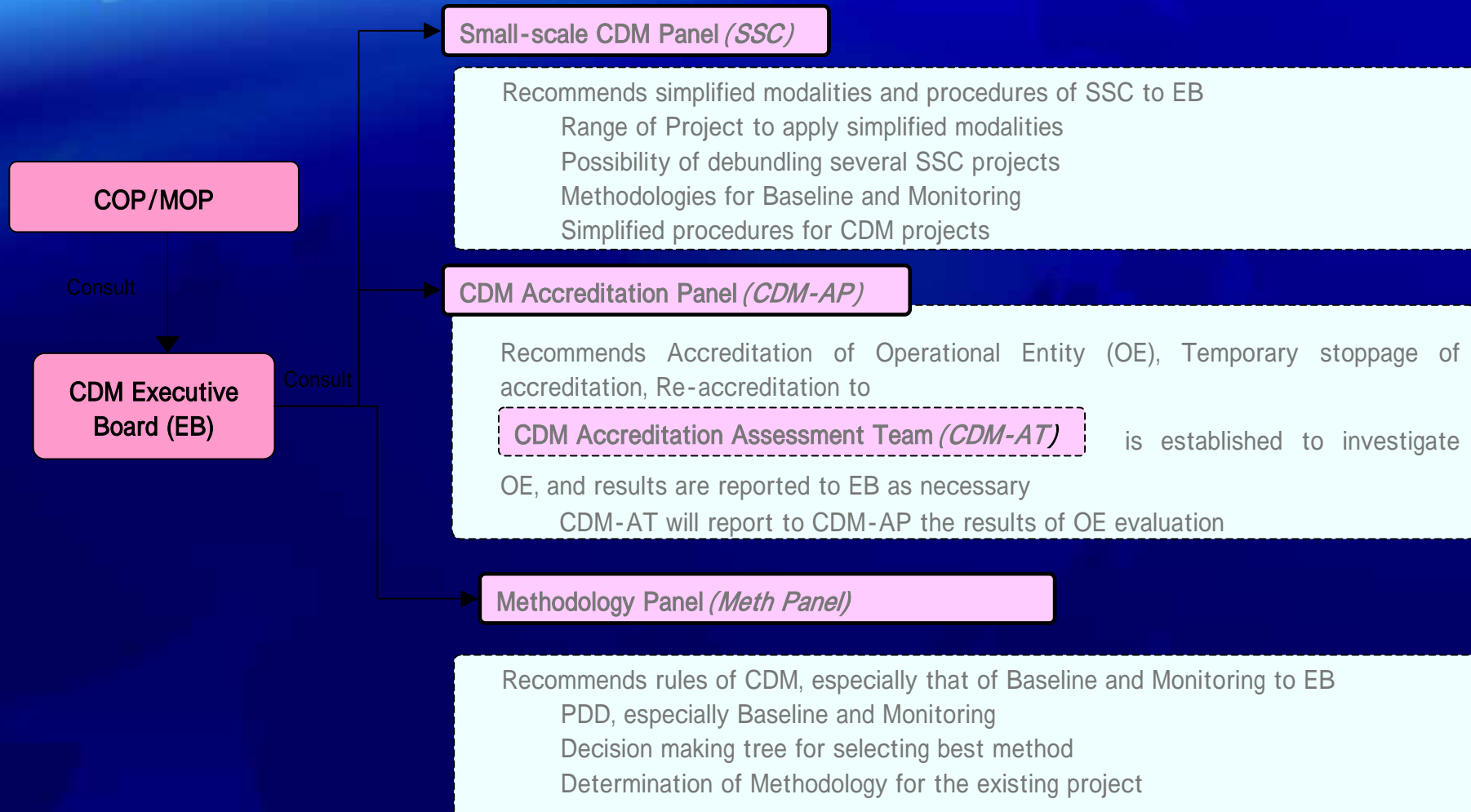
CDM Project Cycle



For projects started between year 2000 and Marrakech Accord, reduction after year 2000 will be credited if the project is registered by CDM EB before 2005.

Toward the implementation of CDM

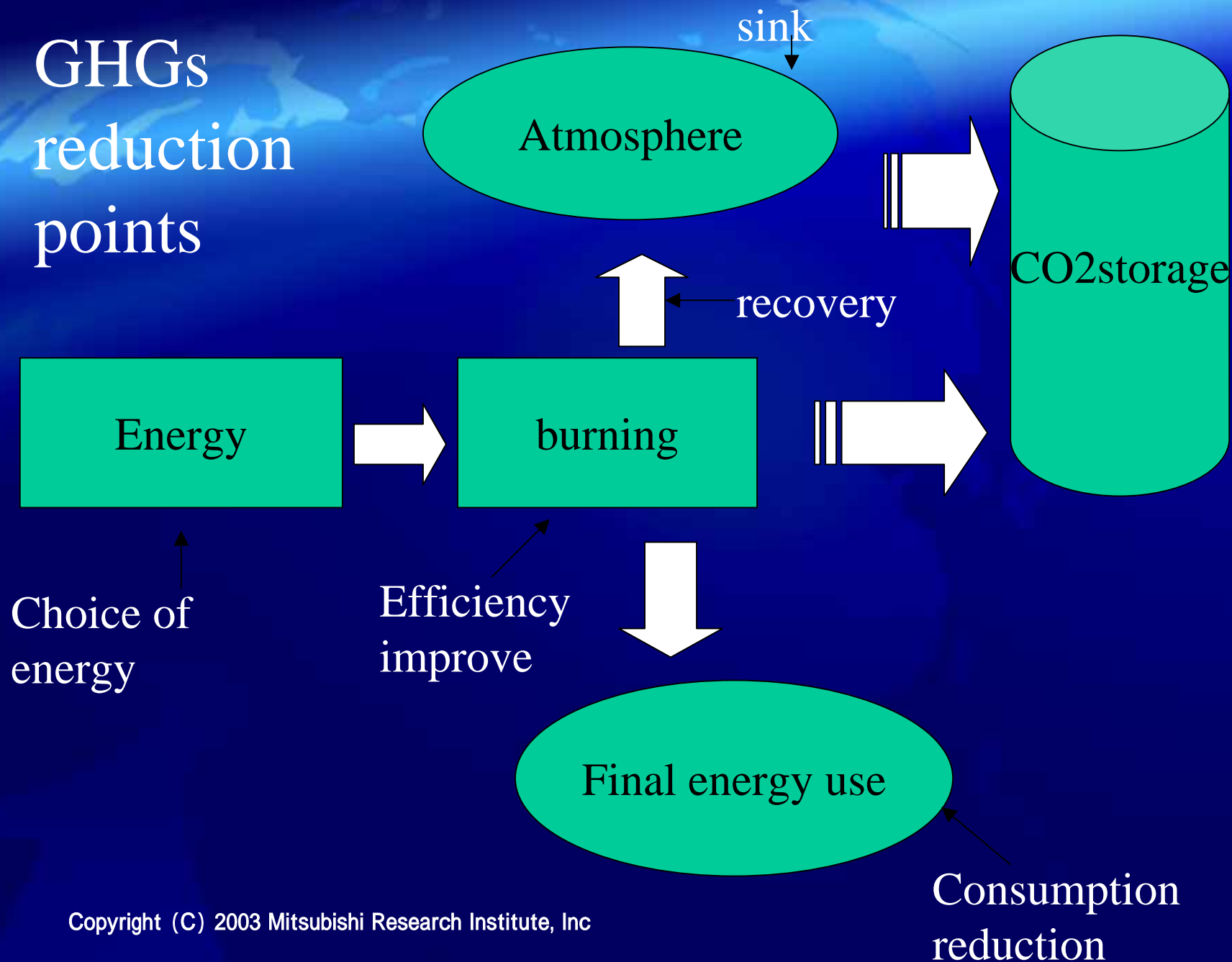
Following the Marrakech Accords in COP7, full-scale international negotiations have been ongoing toward the launch of CDM.



To be a host country of a CDM project activity

- Ratify the Kyoto Protocol
- Assess a project proposal from the SD priority, provide a letter of approval
- Develop procedures for public participation and environmental impact assessment
- Capacity building needs
 - :Institutional, legal capacity
 - :Development of project portfolios
 - :OEs familiar with the host country's circumstances

GHGs reduction points



GHGs reduction points

- Choose low emission fuel
- Increase energy efficiency at energy conversion
- Recover from flue gas
- Recover from atmosphere(sink)
- Increase energy efficiency at final use
- Methane use

Low emission energy source

- nuclear
- Hydrogen in future
- Natural gas(methane)
- Renewable energy(wind,solar,biomass)

High efficiency energy conversion

- cogeneration
- Fuel cell
- Micro gas turbine
- Gas turbine

CDM/JI project example(1)

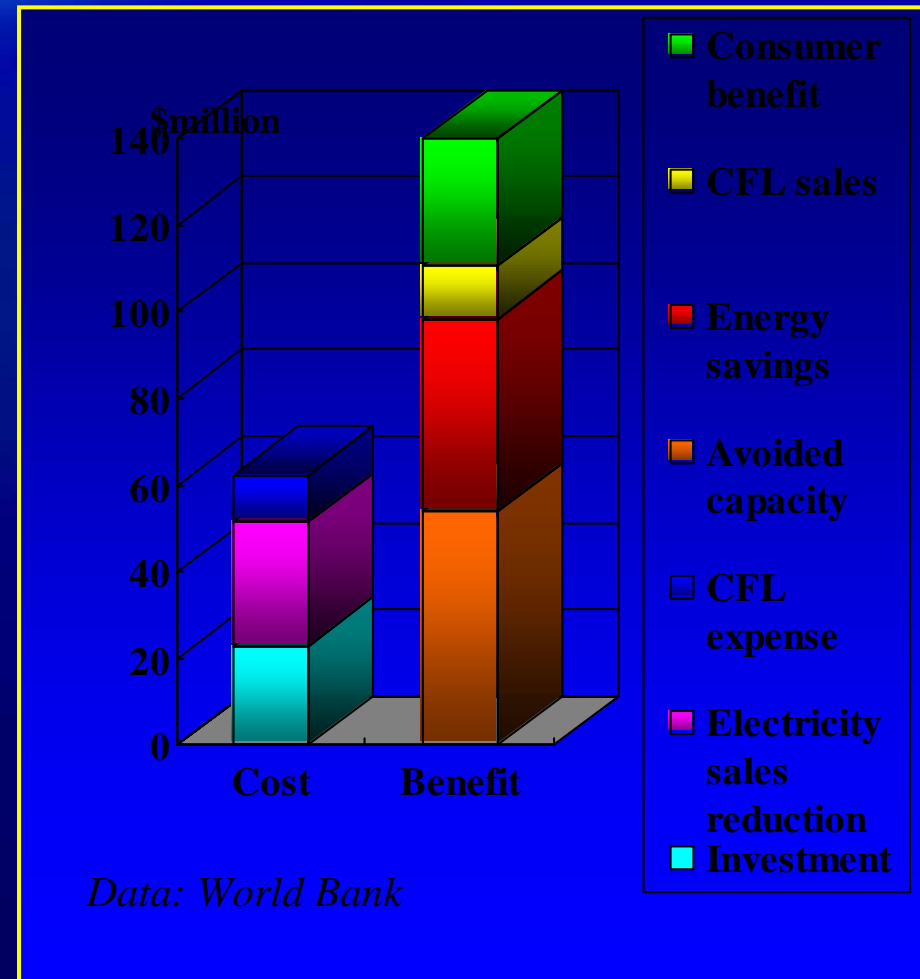
...multiple benefits

- Efficiency increase of a gas-fired power plant (1,000MW) from 30% to 40%
 - Saves 44,000,000m³/yr of natural gas
 - Saves 1,000,000t-CO₂/yr of carbon (which can be marketed: indicative price up to \$10/t-CO₂, thus 10 year reduction could finance about 10% of investment)
 - Reduces pollution through reduced energy consumption and additional environmental measures
 - Improved quality of electricity and/or heat

CDM/JI project example(2)

... commercially viable projects

- ILUMEX High Efficiency Lighting Project (Mexico)
 - Replace 1.8 million incandescent light bulbs with compact fluorescent light bulbs (CFL)
 - Net producer/consumer benefits are \$76 million
 - 940,000t: Lifetime avoided emission of CO₂

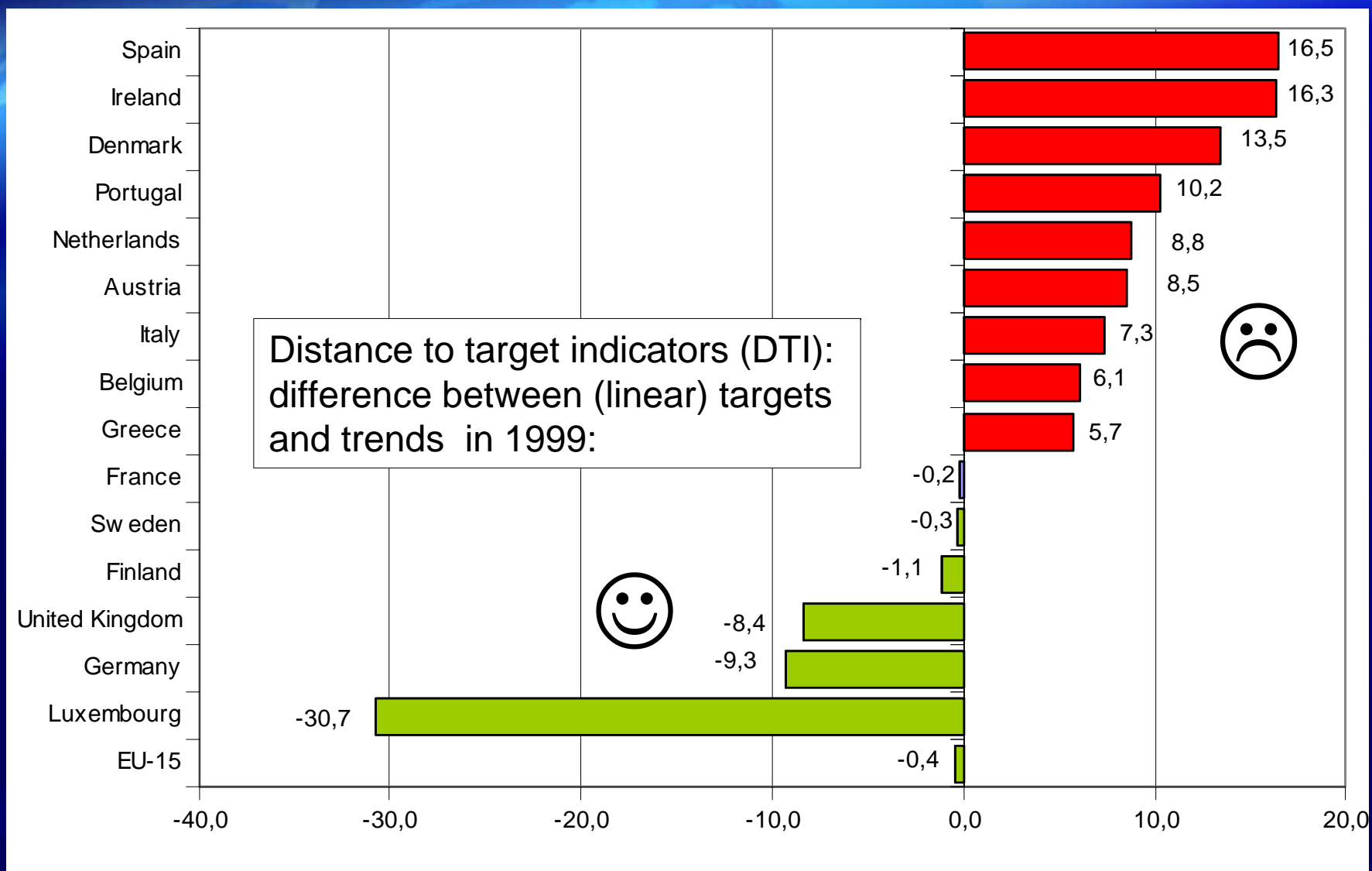


Main countries GHG emission situation

Developed countries emission

- Widely recognized that it is almost impossible to reach Kyoto target without the usage of Kyoto mechanism

EU Progress of Individual Member States

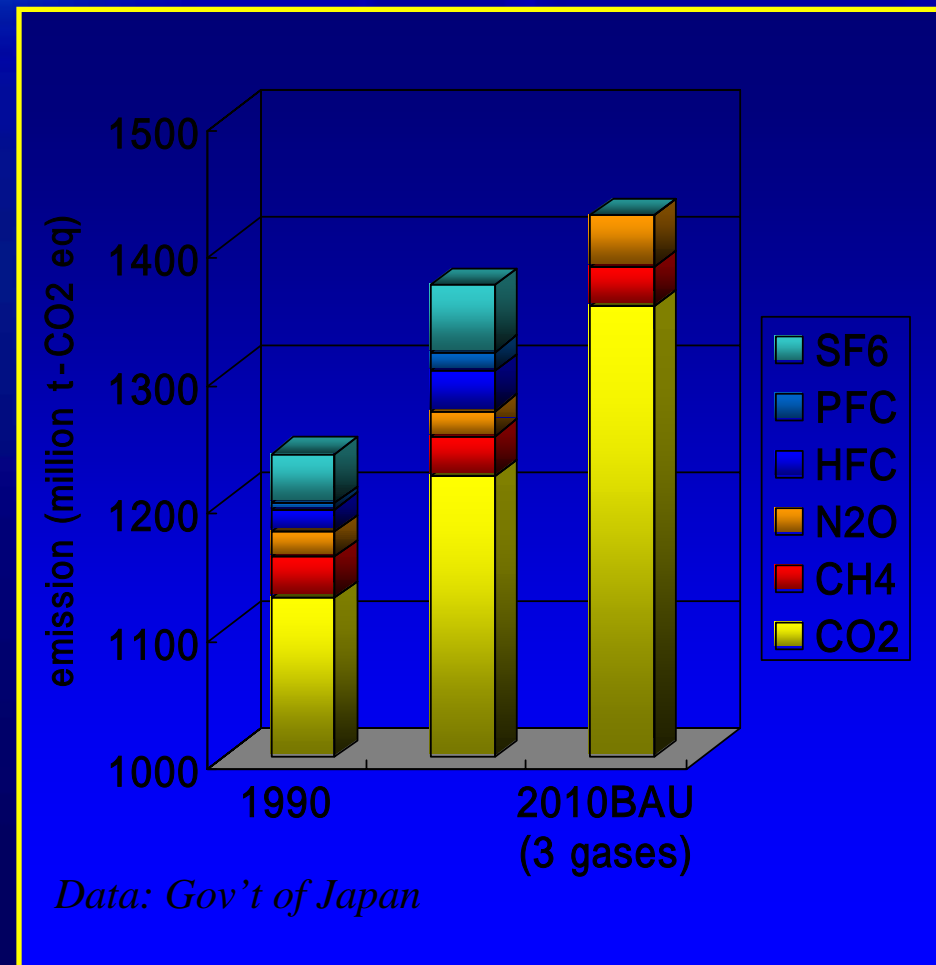


Bush Administration Climate Change Policy

- Reduce U.S. GHG intensity 18% by 2012
- Improve voluntary national emissions registry
- Provide baseline protection and give “transferable credits” for “real” reductions
- Further measures if 2012 goal will not be met

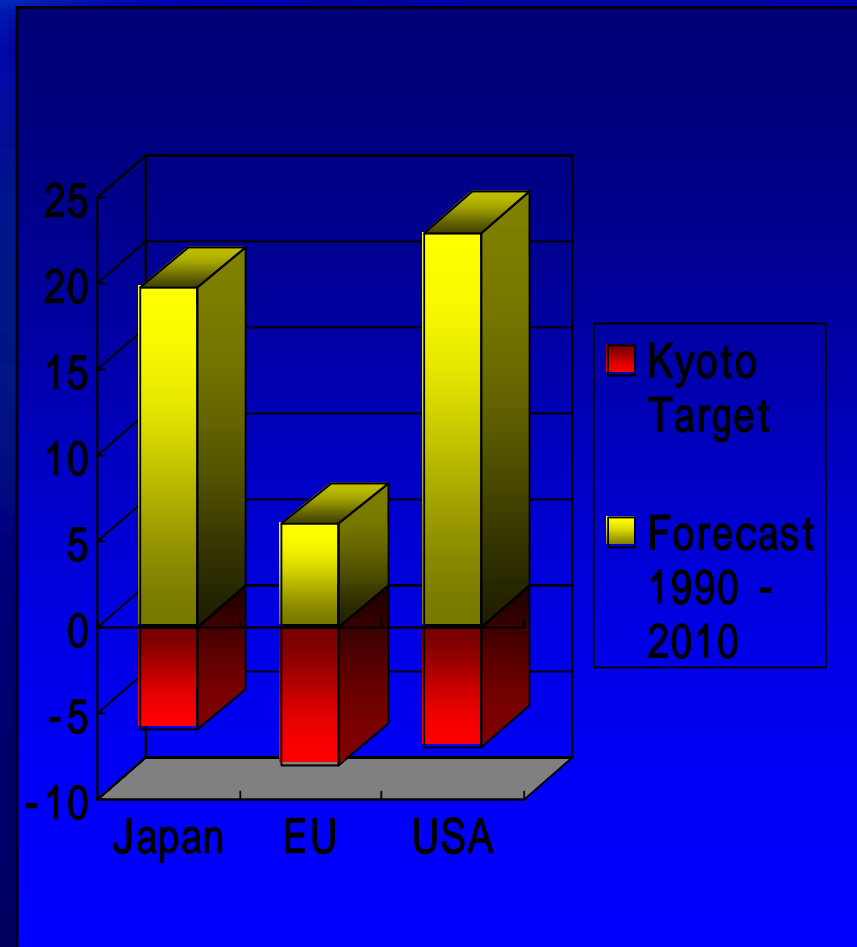
Japan: emissions are on the rise...

- Japan
 - Has to decrease emissions by 6%
 - So far it has increased by about 10%
 - Without measures, it will increase by another 10%
 - Decrease in 1997 and 1998 mainly due to recession



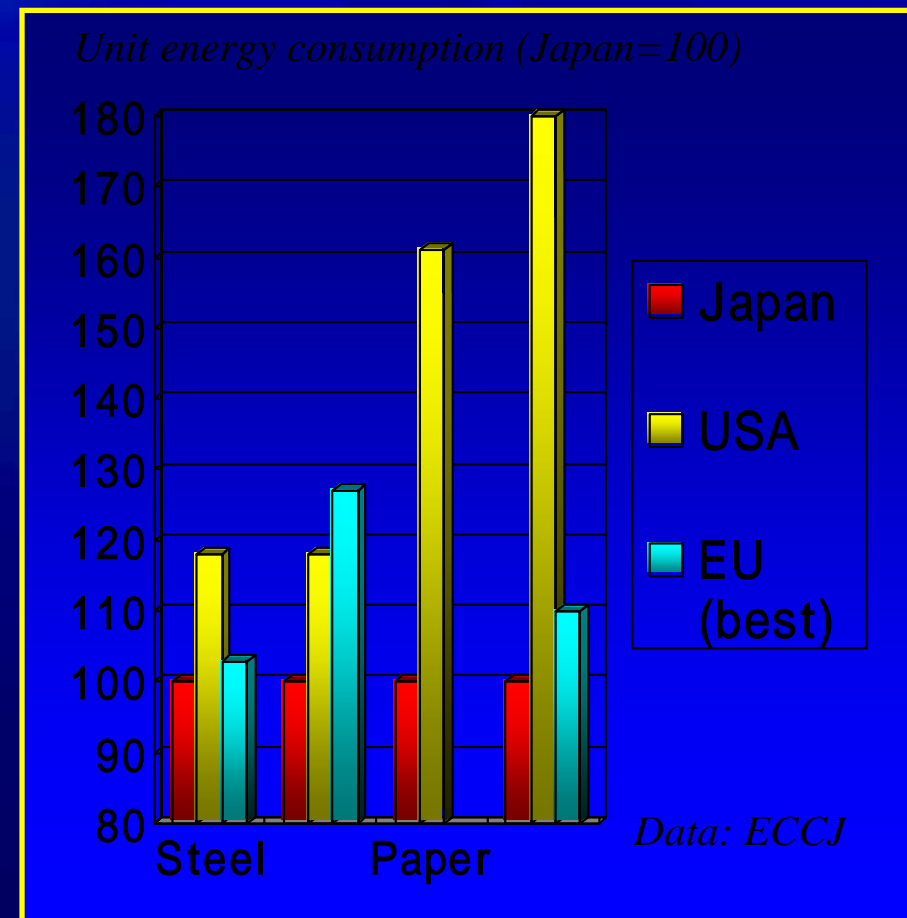
...but the targets are high...

- The developed countries face tough emission targets under the Kyoto Protocol
- “Hot Air” trading mainly from Russia will not be enough to cover the deficit



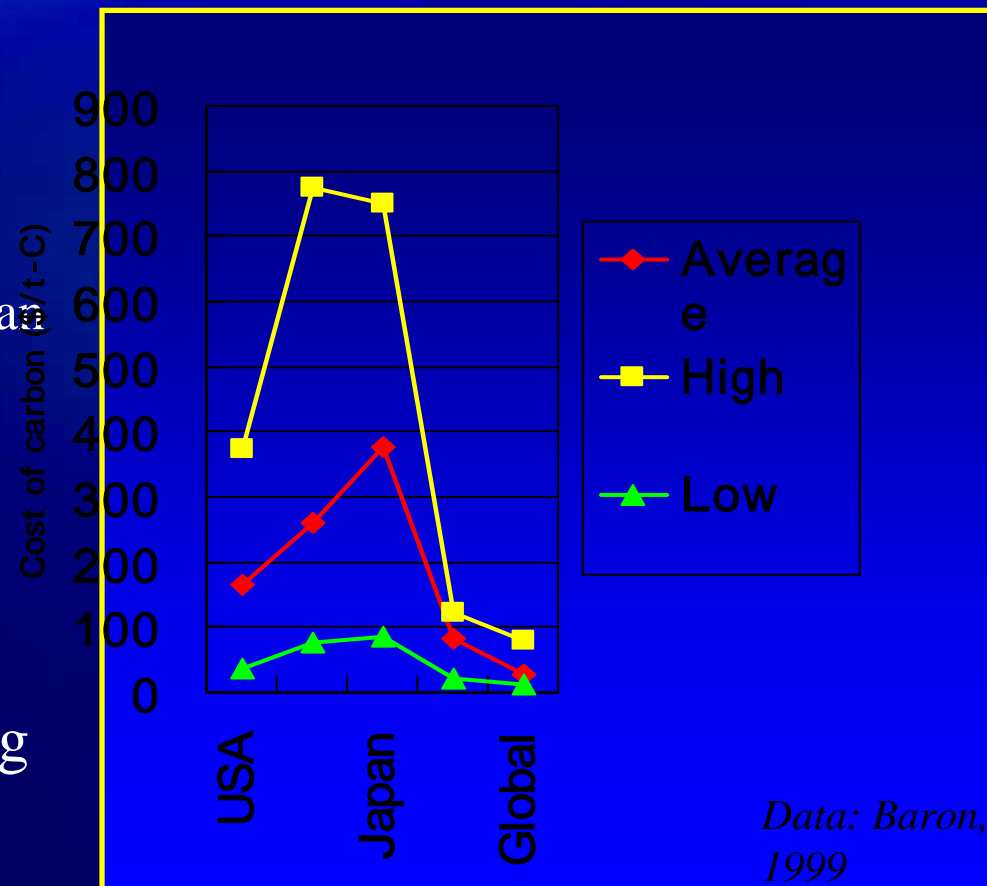
...and options are limited...

- The case of Japan
 - Energy efficiency already highest among OECD.
 - Mass transportation exists.
 - Little scope for additional reforestation.
- Limits domestic options, but provides a source for technology transfer



...as well as costly

- Survey of models yield the following:
 - Japan is probably the costliest place
 - Trading (ET, JI, CDM) can contribute
- Need to consider necessity/possibility of trading
- Japan will be one of the biggest 'buyer' in trading



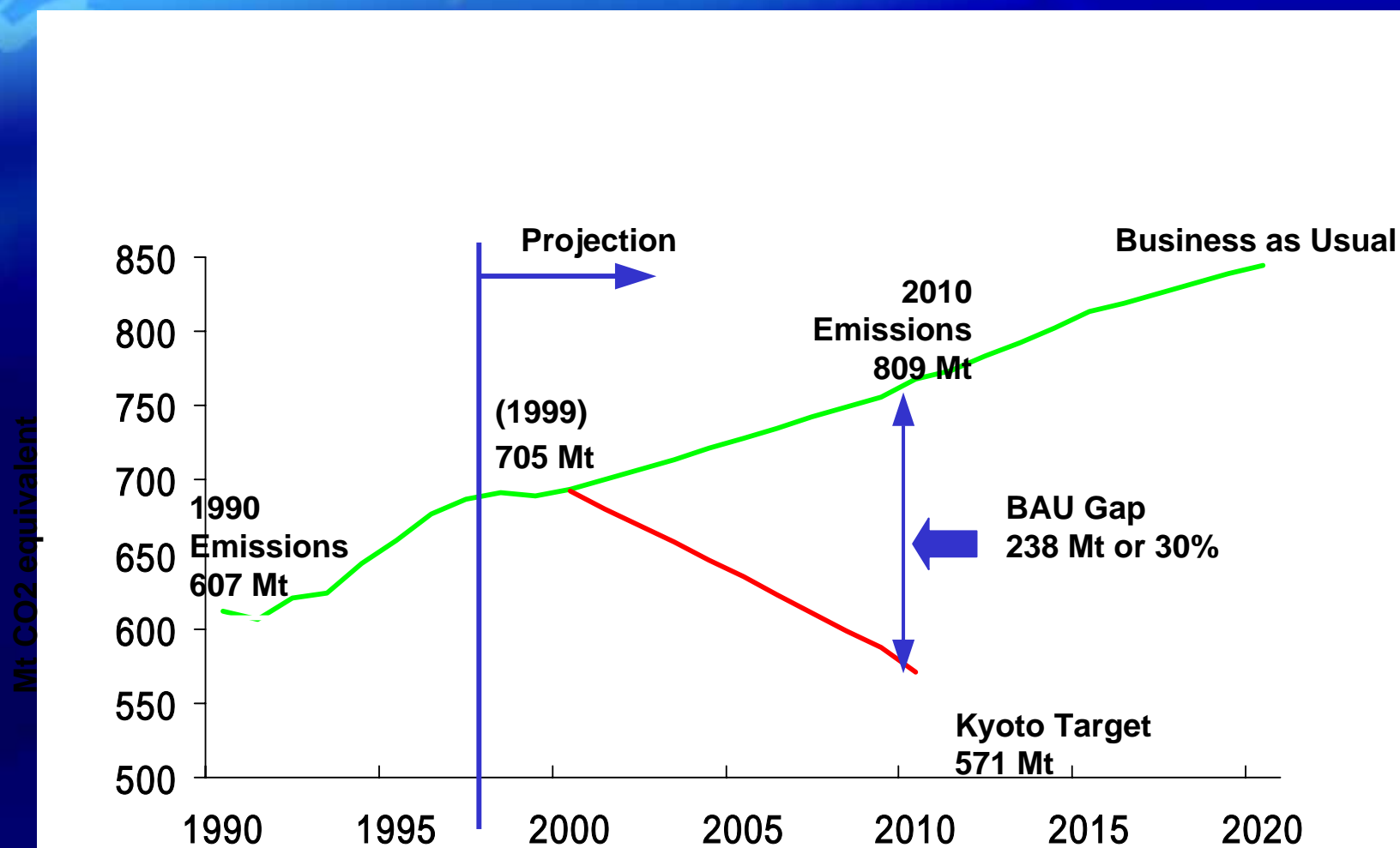
Japan's targets to achieve 6% reduction by Sectors

| Sector | Target |
|--|----------------|
| CO2 from energy sources | ± 0 . 0 % |
| CO2, methane (CH4) and Dinitrogen Monoxide (N2O) from non-energy sources | 0 . 5 % |
| Development of innovative technology and further extensive efforts by public | 2 . 0 % |
| Three gases including alternatives of fluorocarbon, HFCs, PFCs, SF6 | + 2 . 0 % |
| Sinks by forest management | 3 . 9 % |
| Total | 6 . 0 % |

1 . For the time being, we shall to reduce 6% with above mentioned targets (1 to 5). However, in case adequate progress is expected within the first commitment period, further emissions reduction shall be promoted.

2 . On the other hand, taking account of Kyoto mechanism being supplementary to domestic measures, we shall seek for the utilization of the mechanism to achieve Kyoto Protocol in cost effective manner.

Canada's Kyoto Challenge



Ratification of KP

- USA withdraw
- EU ratified
- Japan ratified
- Russia maybe ratify
- Canada ratified
- Australia out

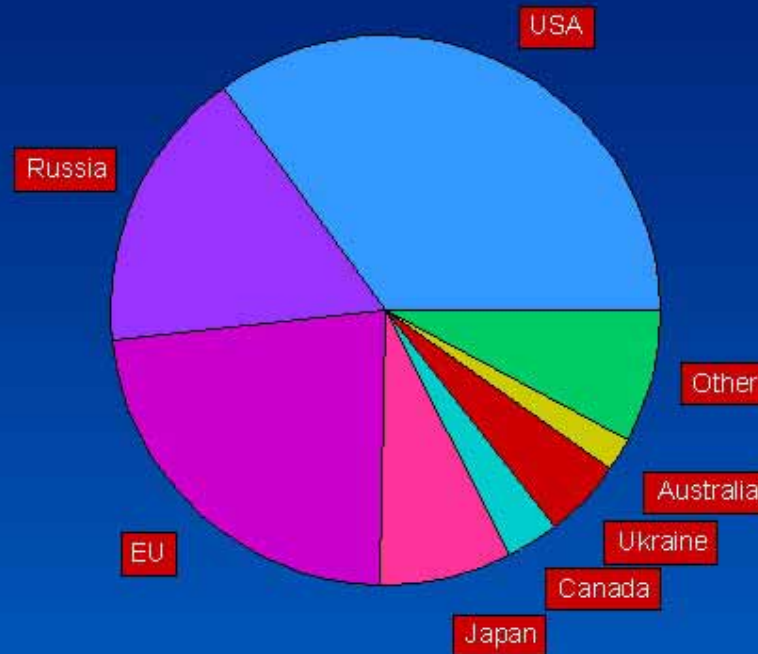
PROTOCOL STATUS

Likelihood of Protocol Entry Into Force

- Kyoto Protocol enters into force 90 days after at least 55 countries ratify accounting for at least 55% of 1990 Annex I CO₂ emissions
- Because US (36%) will not ratify, everything depends on Russian ratification
- Protocol will probably enter into force by the end of 2003 (but not necessarily in time for COP-9 to be COP/MOP-1)

1990 ANNEX B CO2

55% Needed for Protocol Entry Into Force



RATIFICATION

Numbers Grow But CO₂ Requirement Not Met Yet

- As of 20 March, 106 countries had ratified, but only 43.9% of 1990 CO₂ emissions covered
- EU and Japan ratified prior to Rio+10 and others followed in the fall
- Canada ratified in December in spite of lack of Provincial agreement
- US & Australia remain outside

RUSSIAN RATIFICATION

Biggest Country in World Holds Most of Cards

- Ratification is essential for KP entry into force
- “Hot air” is essential for many OECD countries to meet targets
- Probably will ratify, but not quickly
- Probably will sell some hot air, but not all
- Resulting price in credits market will be high

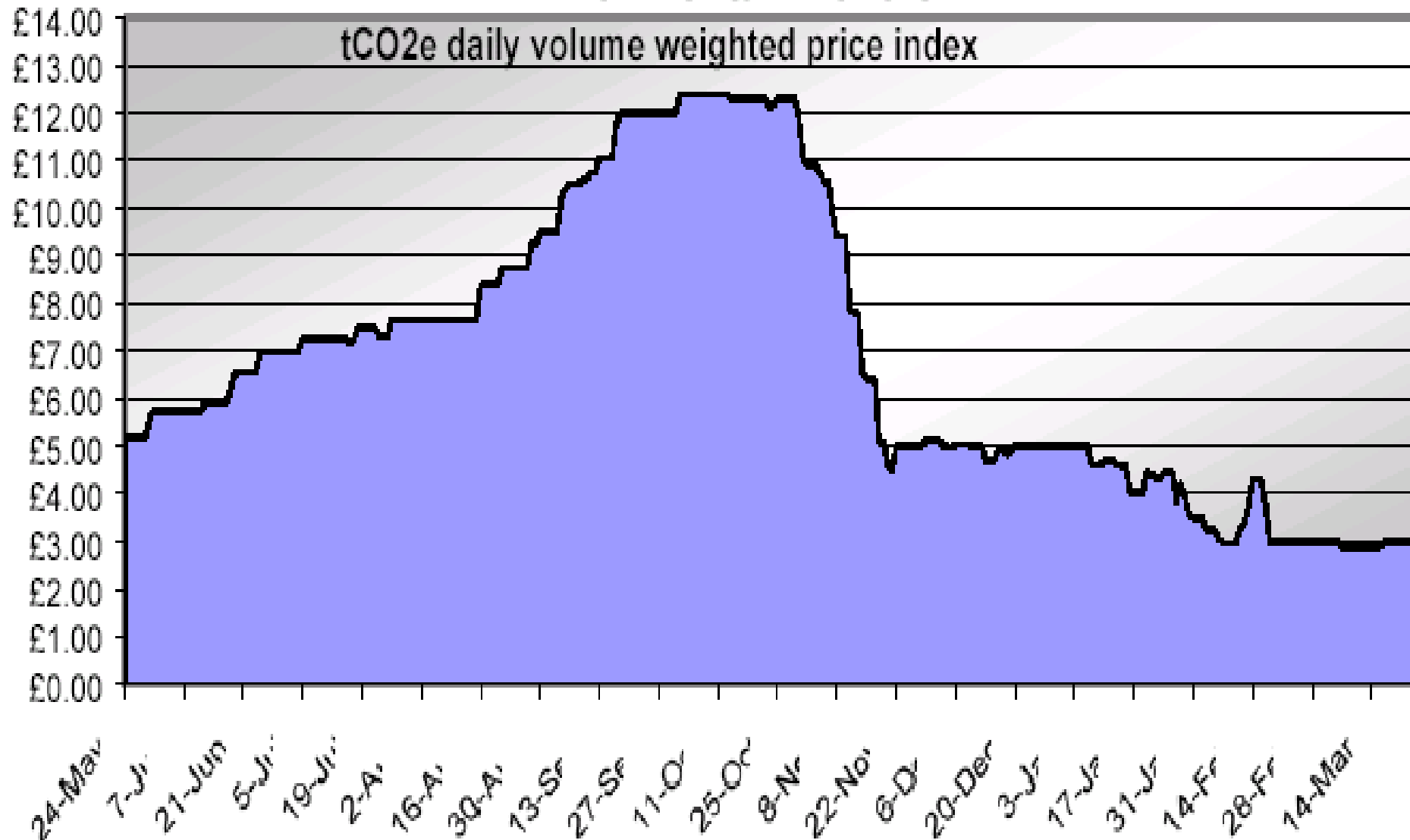
Carbon Trading

- Trading by private rule
- Trading by official rule
 - Denmark green electricity trading
 - UK GHG trading market
- EU wide trading will start from 2005
- Japan starts to design of GHG trading rule

Market Activity

- UK GHG trading program
 - DuPont - Mico executed first GHG transaction of government-sanctioned instrument
 - Auction held to provide companies with funds to reduce emissions below a baseline; \$305 million allocated, 4 mmt of reductions committed
 - Approximately 20 trades have occurred and 100,000 to 200,000 allowances traded
- Danish power sector cap & trade program
 - Initial cap on CO₂ of 23 million tons in 2000 is reduced 1 million tons per year through 2003
 - Approximately 10 trades have occurred and 300,000 to 500,000 allowances traded
- First swap of UK and Danish allowances brokered in 20e occurred

ICAP Environmental Brokers



Main Points

- Project-based credits could become a bridge between JI/CDM and market
- Need to create value in multiple jurisdictions
- Kyoto Unit will be hard currency
- Multinationals & speculators will provide demand for currency trading

Recent Development on CDM

- Total CER until 2012 is about 100Mt-CO₂
- CER issued in '05
 - 25% CERUPT,
 - 25% NCDF (Netherlands Clean Development Facility)
 - 15% PCF, Others
- Preferred Non-CO₂ and Renewable Energy Projects
- Price \$3-6.5/t-CO₂
- Host countries
 - Brazil 50%, Indonesia, Panama, India 8%

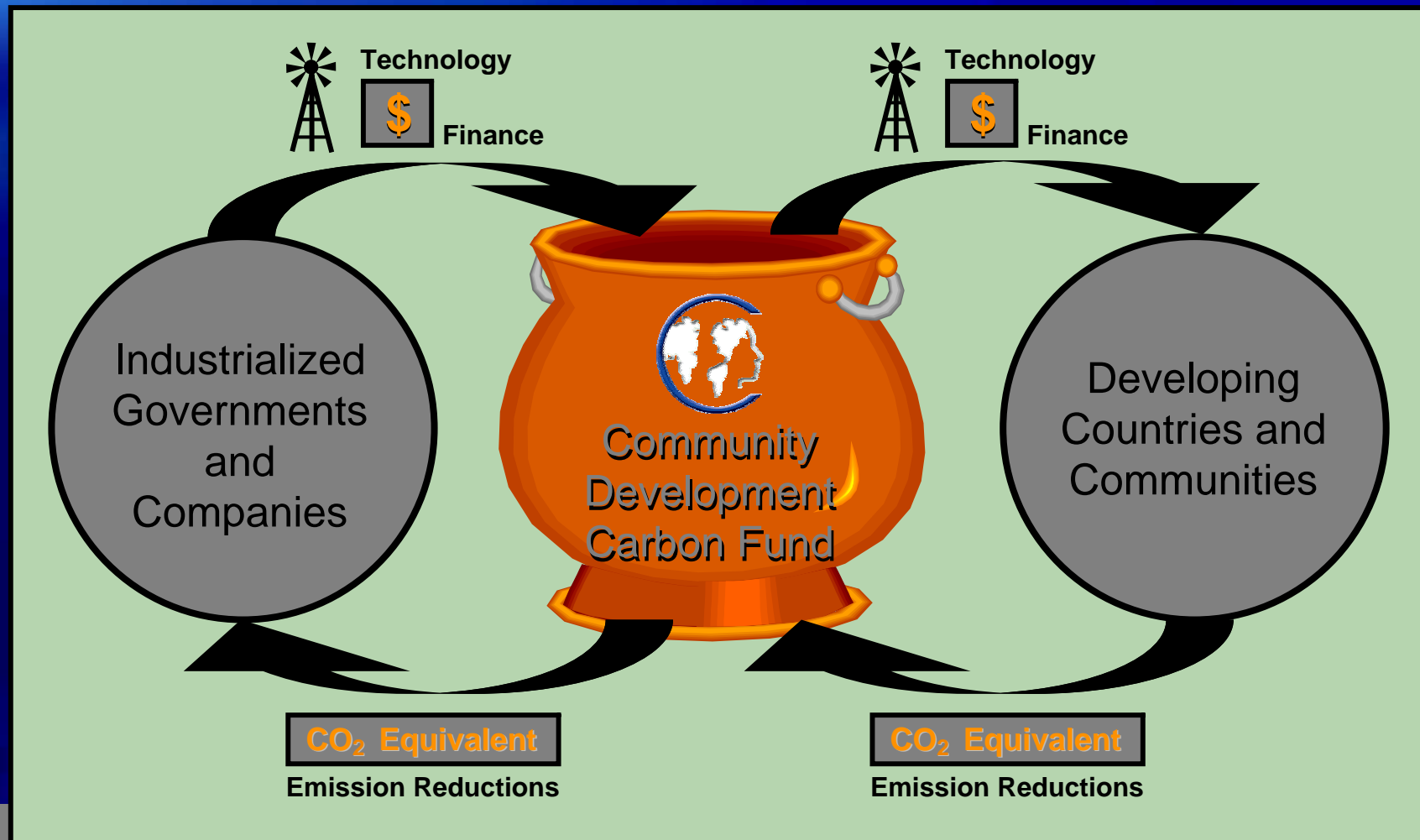
Recent Development on CDM(2)

- MoU on CDM
 - Central and South American Countries leads MoU
- Size
 - Project with CER above 1Mt-CO₂ / yr is unusual
 - Average: 100-500 kt-CO₂
- GHG reduction projects initiated by Non-Annex I countries are getting popular ;India,Brazil

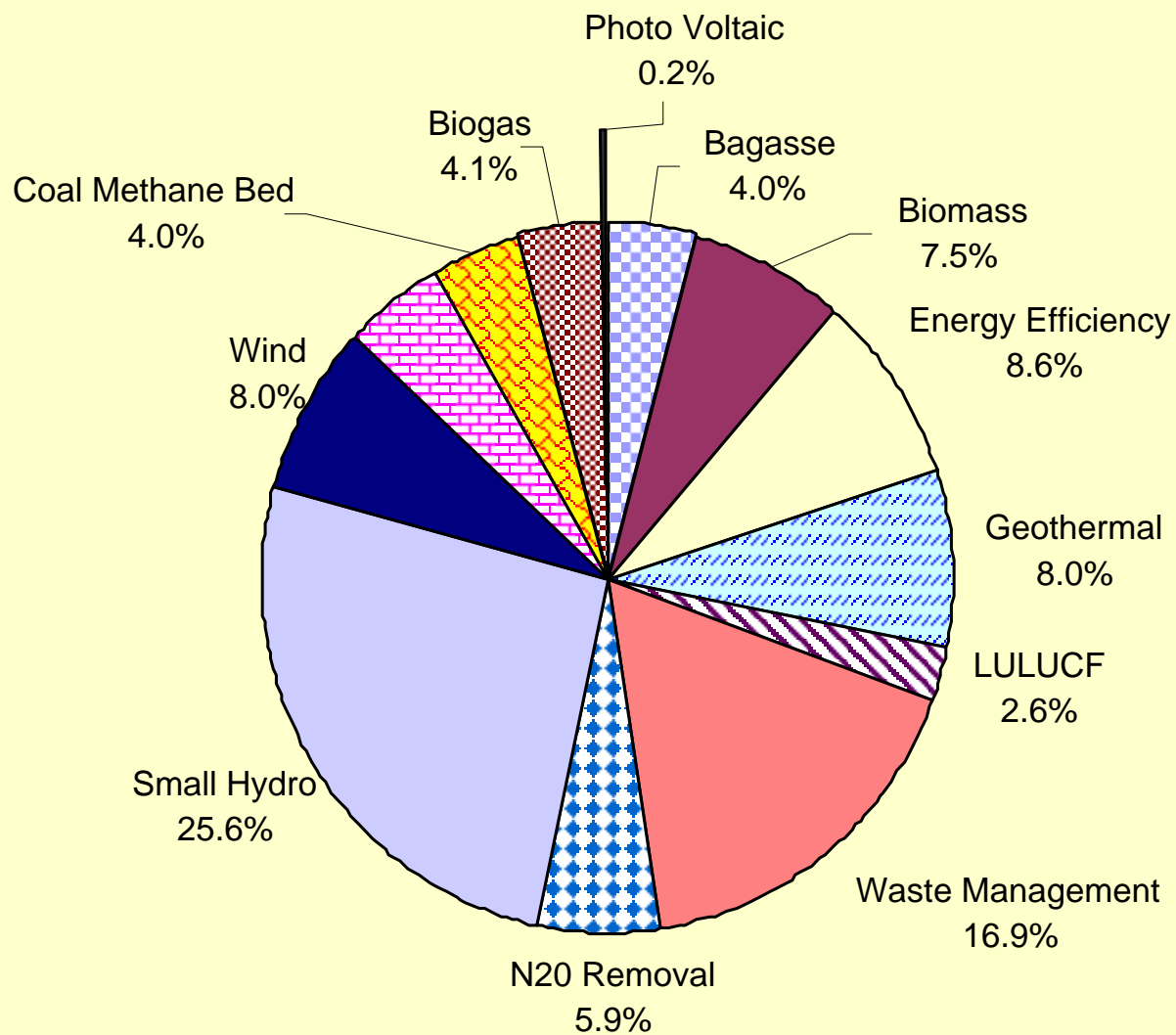
World Bank PCF Experience

- World Bank started JI/CDM fund from 1999
- The bank gets so much experience through this fund
- Worth to learn their experience to get the reality of carbon reduction project

How the Funds Work



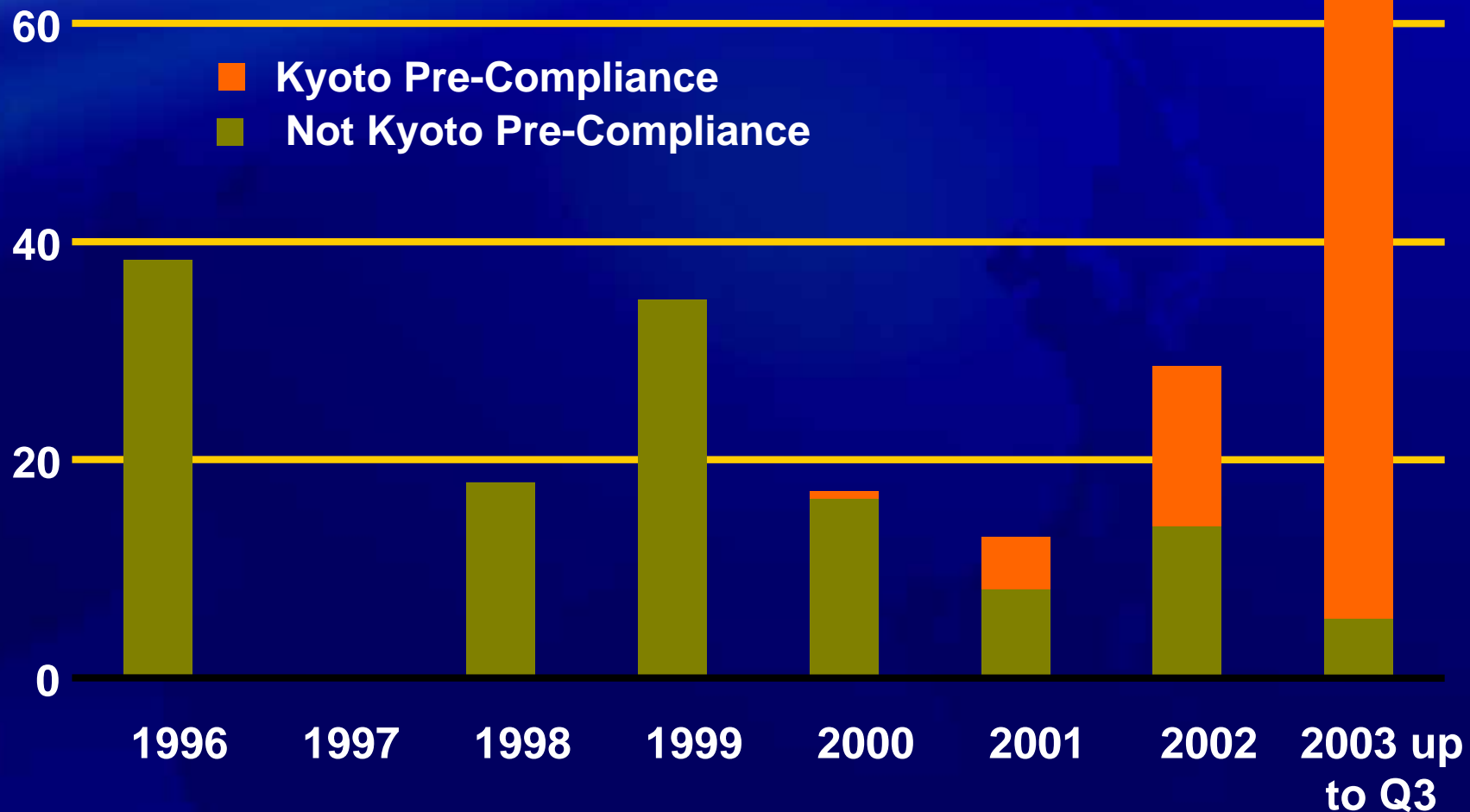
**Technological Distribution of Active Pipeline Projects for Carbon Financing (PCF, NCDF, and CDCF)
Total of Approx. US\$323 Million**



Main Driver: Compliance

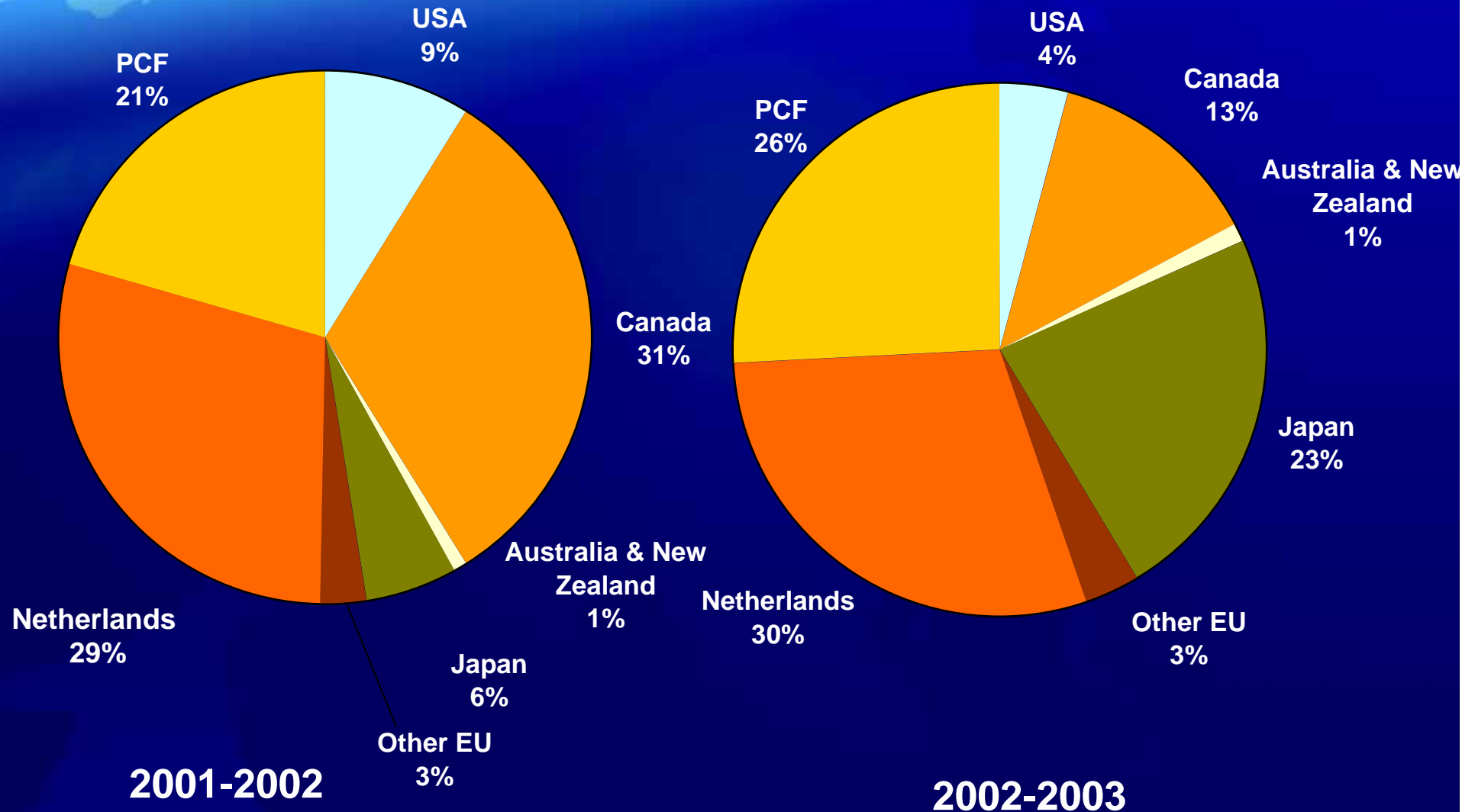
MRI

Volume traded in project-based transactions,
million tCO₂e



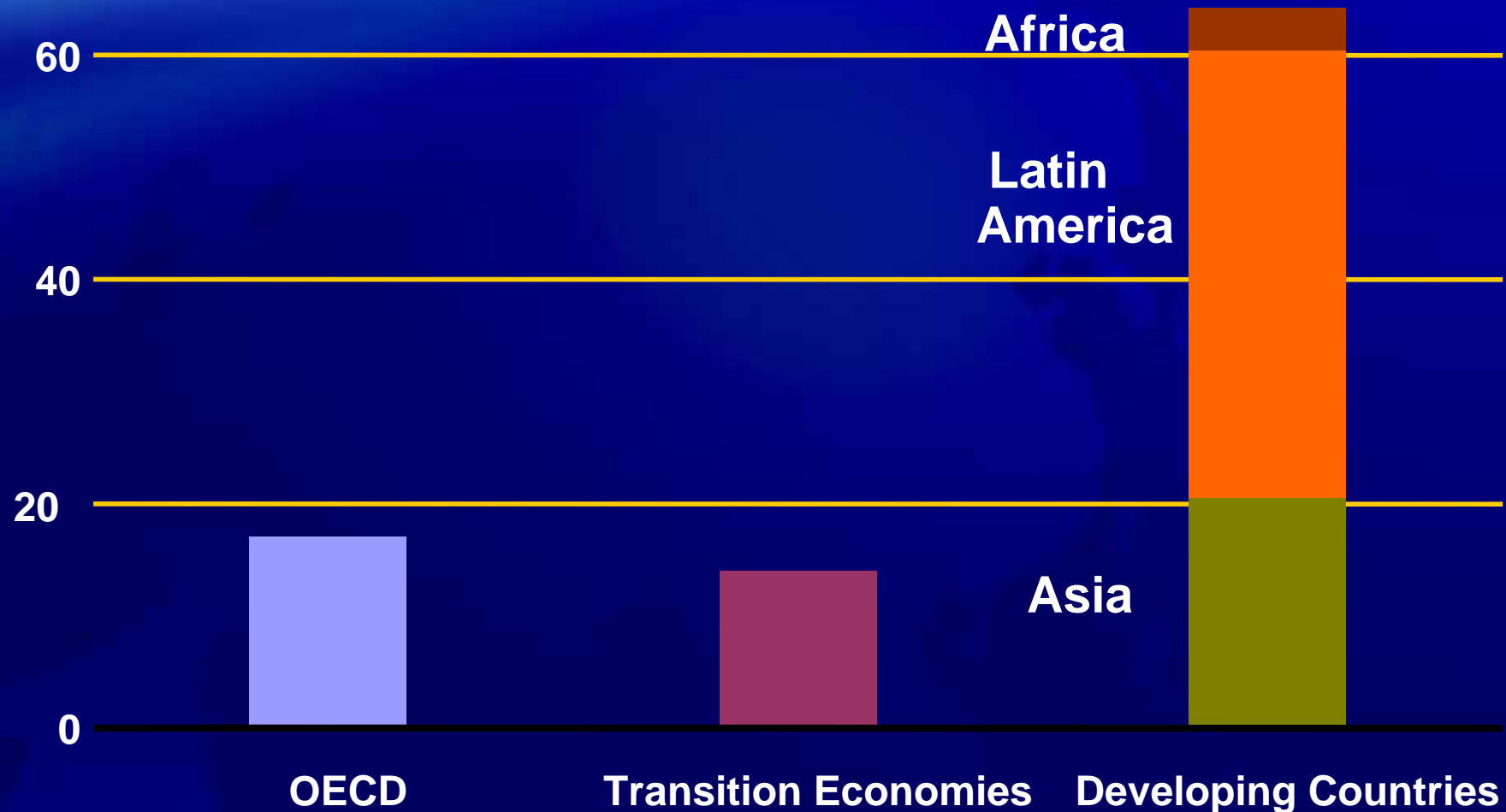
Who is buying?

In percent of volume purchased



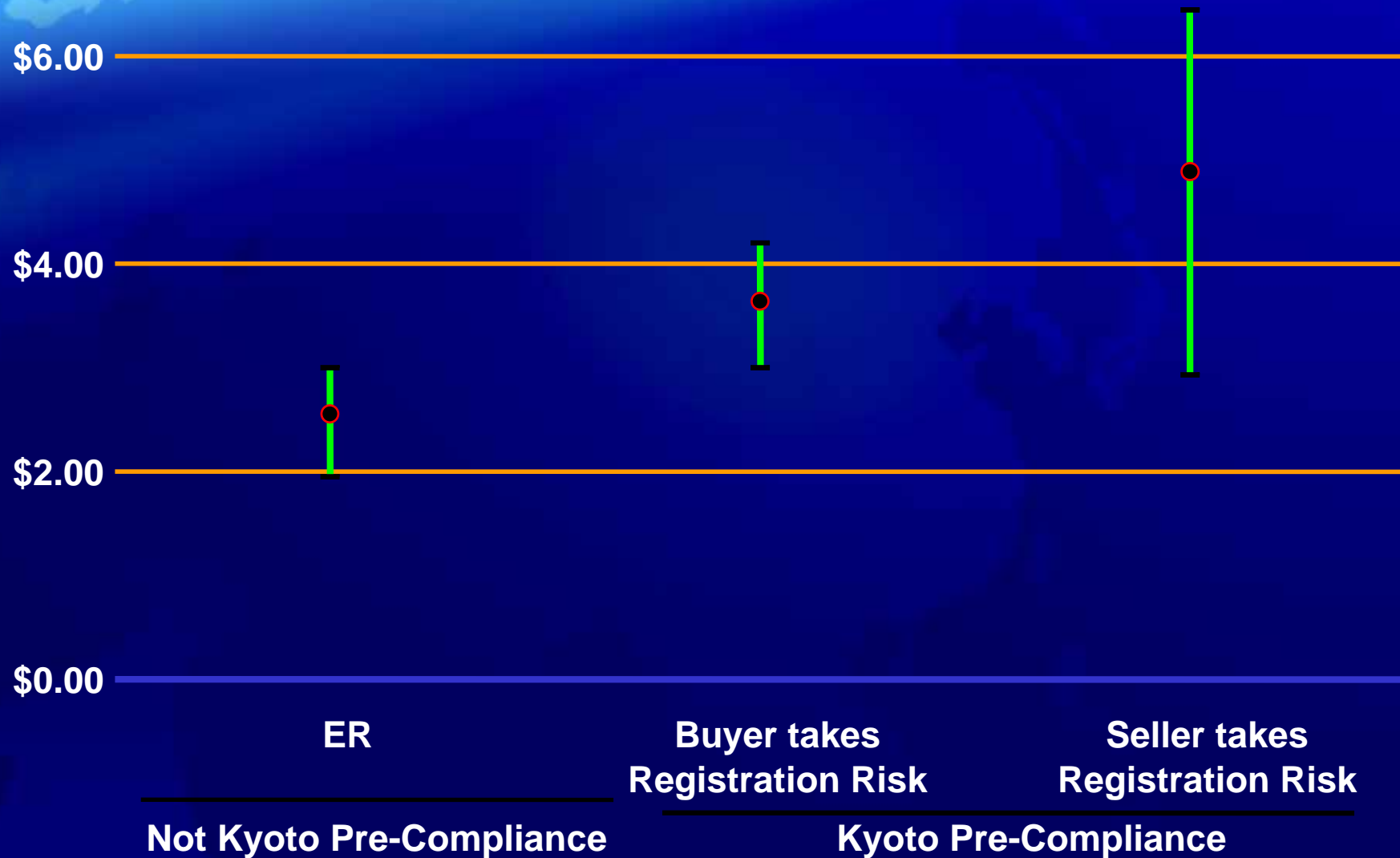
Who is Selling?

In million tCO₂e sold from 2002 to Q3 2003



Prices in 2003

(in U.S.\$ per metric tone of CO₂e)



What to Expect of the Market in 2004

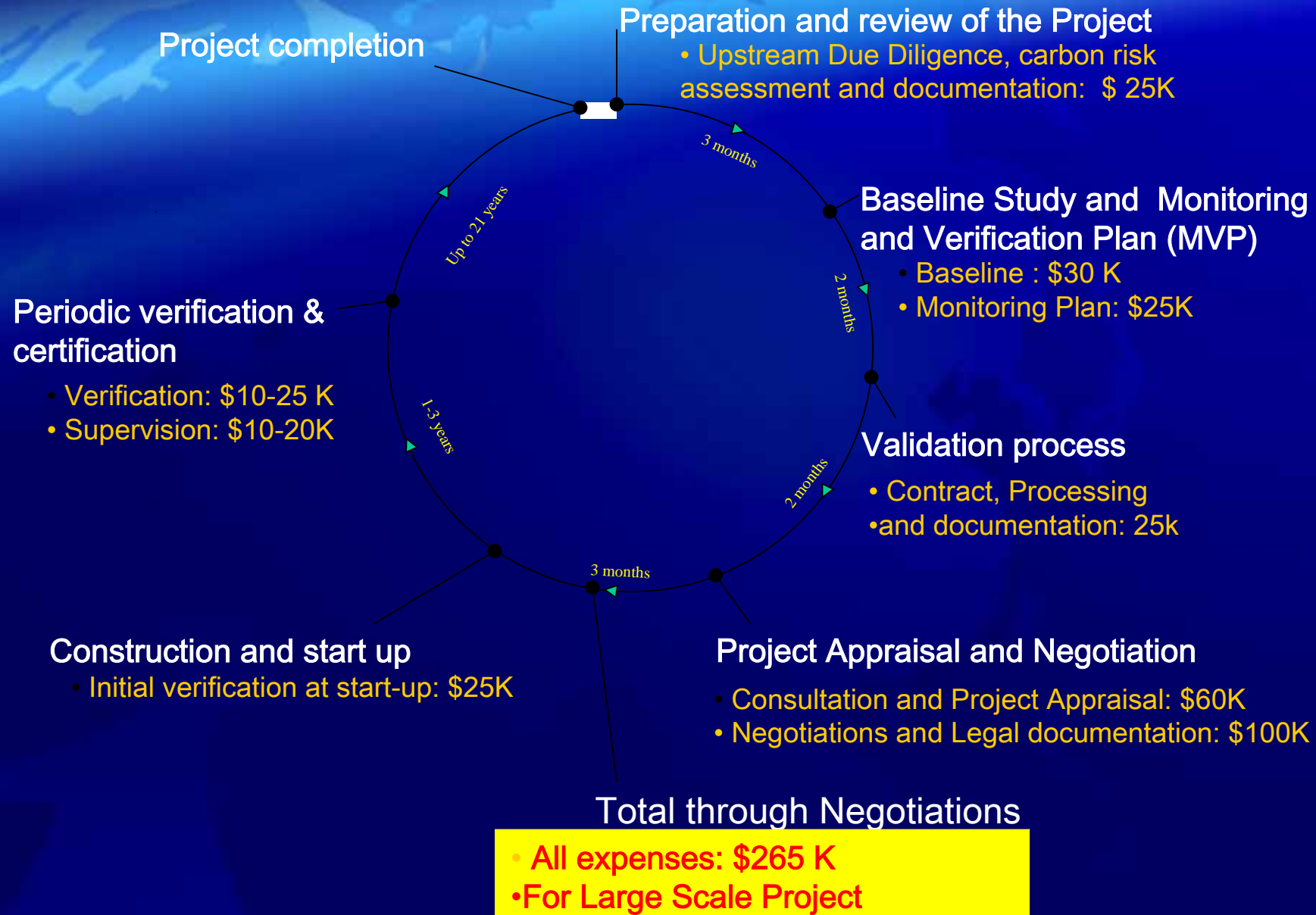
- **Contracted value is likely to double (~ 150 million TCO₂e)**
- **EU ETS will**
 - create enormous potential carbon liabilities for European firms
 - drive the carbon market in 2004
- **Current institutional buyers (like PCF and the Dutch) will lose dominant position**
 - European corporate buyers will finally enter the market
 - Japanese activity in the market will further strengthen
 - Spain and Italy will enter the market
- **Large sellers (China, India, Brazil, Indonesia and Mexico) will start shaping the market**
- **Long term viability of the market will be questioned if Russia does make moves to ratify the Kyoto Protocol in 2004**

Key Price Determinants

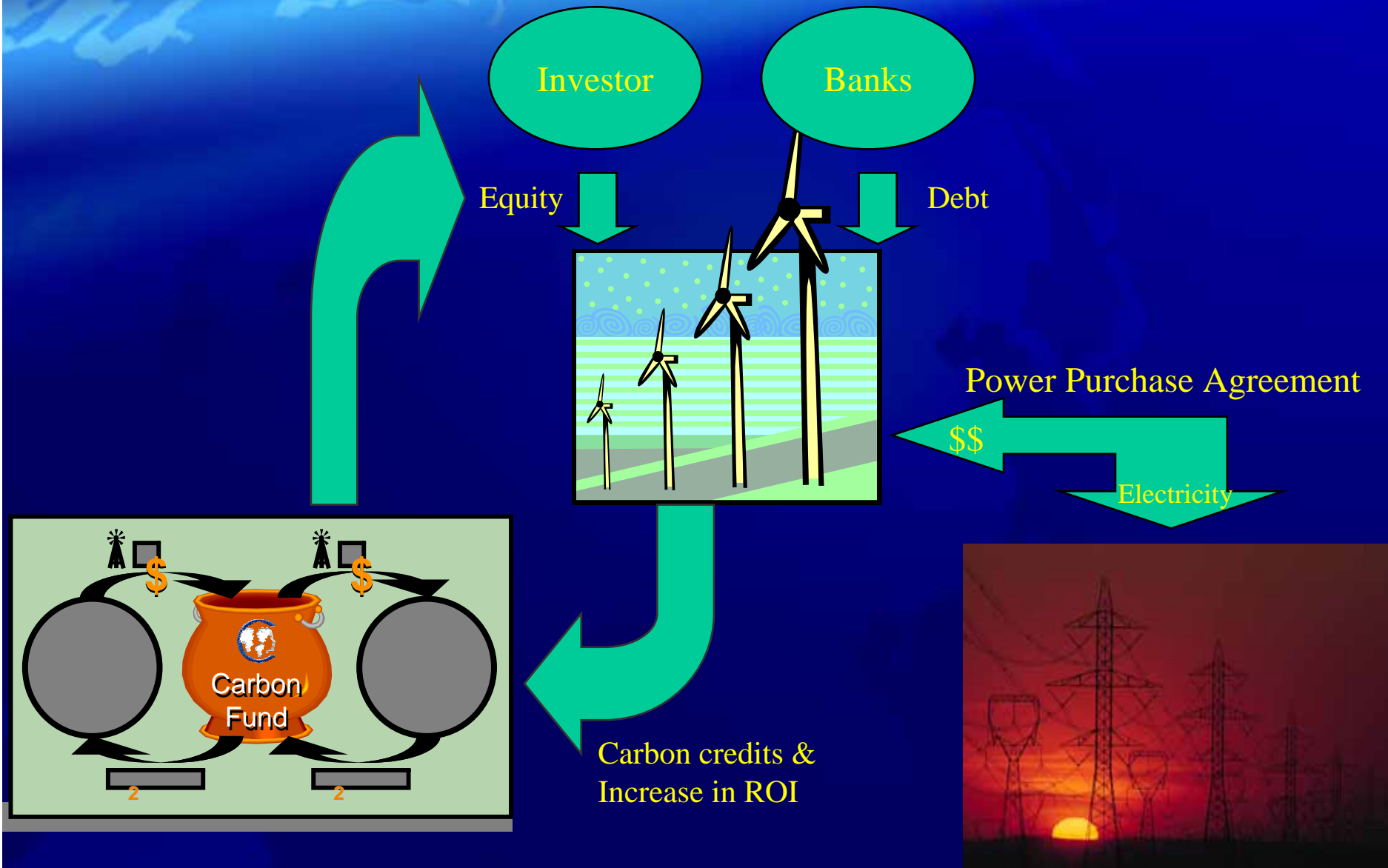
- Guarantee of delivery of registered ERs
- Creditworthiness of project sponsor
- Viability of underlying project, and liabilities of seller in case it under-performs
- ER vintage: pre or post 2012
- Cost of validation and potential certification
- Host country support
- Additional environment and social benefits

Carbon Asset Creation and Maintenance

Manufacturing Process and Costs based on Bank experience



Nature of Carbon Financing Contract



Impact of Carbon Finance on FIRR (\$3/tCO₂e)

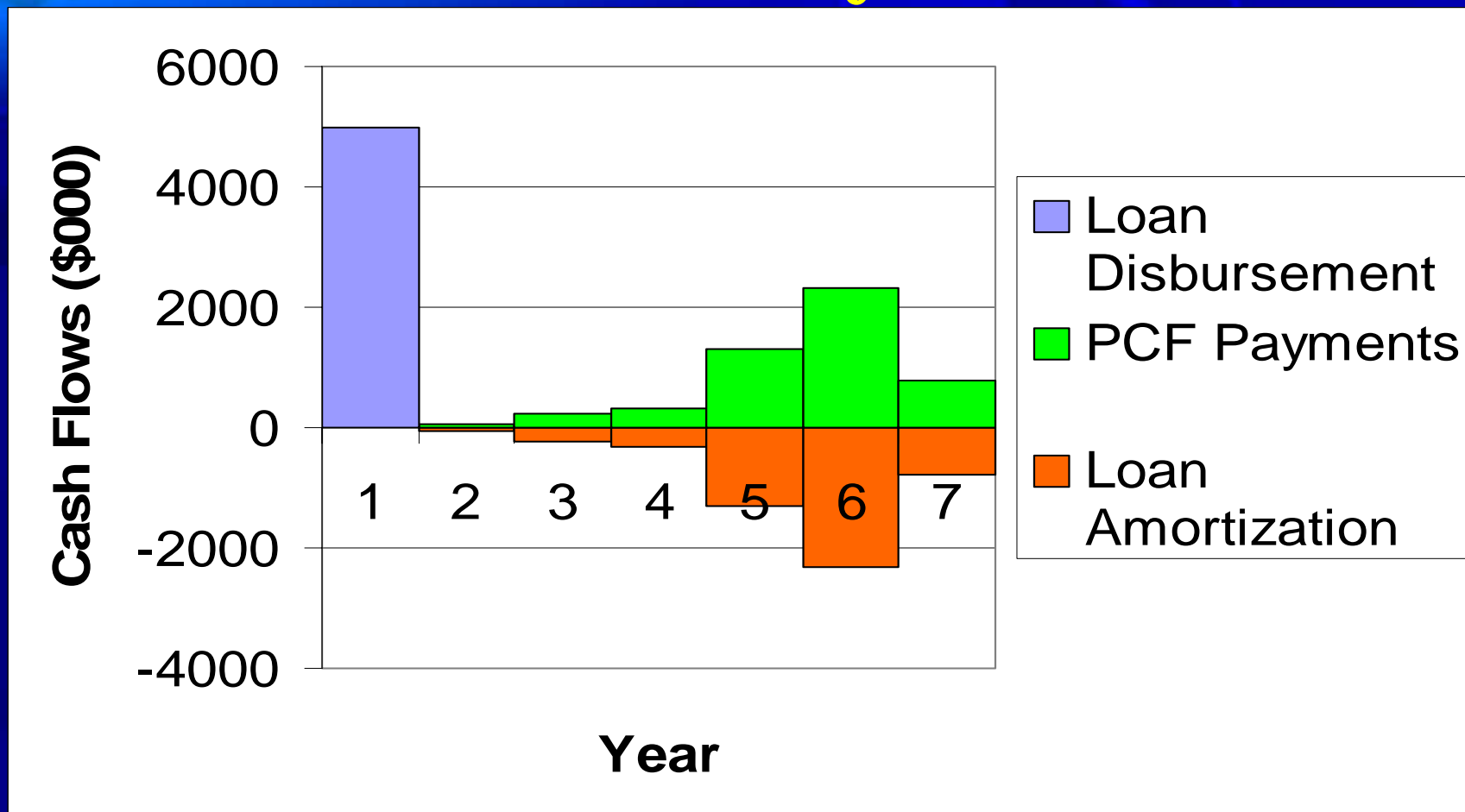
| Technology | Δ IRR |
|------------------------------|--------------|
| Hydro | 0.8-2.6% |
| Wind | 1.0-1.3% |
| Bagasse | 0.4-3.6% |
| Energy Eff.-District Heating | ~ 2.0% |
| Gas Flare Reduction | 2.0-4.0% |
| Biomass | 2.0%-7.0% |
| Municipal Solid Waste | 5.0%-10.0% |

Impact of Carbon Finance:

Quality and Quantity (at \$3/t CO₂e)

- **Methane-capture projects**: carbon finance can turn marginal projects into bankable ones
 - **“Traditional” renewables**: boost return by 0.5-2.6%
 - Makes some marginal deals bankable
 - Increases profitability and reduces investor risk
 - **Improves project’s access to capital markets** through:
 - **Secure contracted flow of foreign resources** from reliable counterparty
 - **Improved Quality of cash flows as well as volume**
 - **Payment of CF in hard currency (\$/€/Yen) to lender mitigates country risk**
- ⇒ Sponsor can borrow against contract (like PPA)

Structuring Loan Amortization to Match ER Payments



Most Important Findings of Bank

Carbon Finance Business to Date

- 1. Regulatory uncertainty remains post-Marrakesh**
- 2. CDM/JI Carbon Asset Creation remains complex and difficult with lead times of 3-7 years from project identification through delivery of first ERs.**
- 3. These and other factors severely limit direct private investment CDM/JI**
- 4. The first commercial carbon purchase transaction is key CDM/JI capacity building – governments and private sector (OECD and Local private sectors)**
- 5. Carbon finance and TA for capacity building must go hand in hand to support carbon market development**

Activities at Private level

Actions by Japanese company to tackle global warming

- No significant action compared to the US, Canadian, UK private sector, such as
 - Internal trading
 - Active participation in the international negotiation process
 - Private-sector based mutual trading for getting trading experience
- Some companies join international industry NGO activities, such as
 - WBCSD, E7

Example of Action by the Japanese company

- Investing in the World Bank PCF
 - Anticipating return as GHG credits
 - Utility companies, trading companies
- Investing in the EBRD ESCO fund
 - Anticipating new business opportunities
 - utility company
- Afforestation activities using biotechnology
 - Anticipating potential carbon credit
 - Paper and pulp, automaker
- Forming an alliance with an US trader
 - Establishing future trading markets
 - Trading company

Action by Japanese company(continued)

- Technology research and development
 - CO2 recovery from flue gas
 - Byproduct HCFC recovery
 - Energy saving
 - Hybrid engine, efficient air conditioner etc
 - New technology
 - Fuel cell, micro gas turbine, carbon recovery from flu gas
- Opportunities for wind power are sought through introduction of ‘green certification’
- Technology is advanced, but cost reduction is needed to enhance market competitiveness

Recent Japanese situation

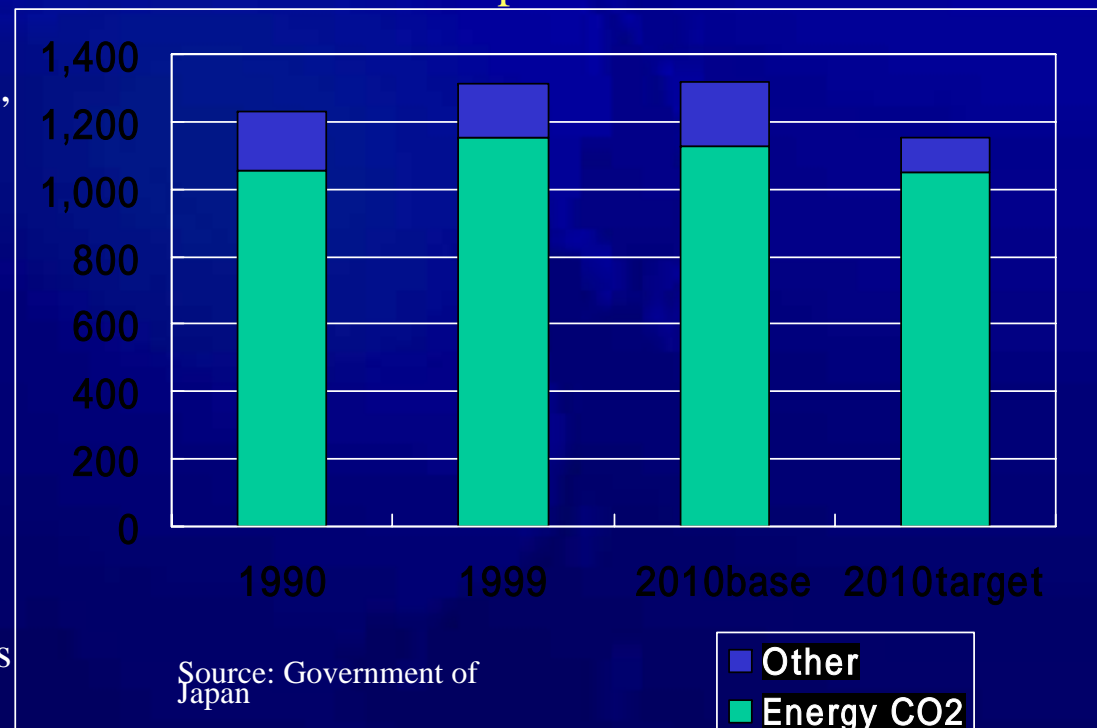
The Blueprint

- No additional measures until 2005
- If likely to miss target, then additional measures from 2005
 - Carbon / energy tax? Emissions trading?
- Scenario of compliance
 - Bring back to 1990 level through energy-related measures
 - 0.5% reduction through methane / N₂O
 - 2.0% *increase* through use of HFC, PFC, SF₆
 - 3.9% reduction through sinks
 - 2.0% reduction through “revolutionary tech. / further efforts”
 - Remaining 1.6% ...Kyoto Mechanisms?

Reality: Emissions are not likely to decline according to plan

- Nuclear power development
 - Plan says 13 new plants by 2010, but industry will build only 5
 - Lack in electricity demand growth, and opposition in facility siting stifles investment
- Introduction of efficient goods do not always mean reduction of energy / emissions
 - Efficient cars, but increased mobile air-conditioning / safety features lead to emission increase
- Reliance on uncertain measures
 - Targets on telecommuting, office air-conditioning
 - Much is left to individual lifestyles

2010 “Base case” expects no increase from 1999



Review of Blueprint is under way

- Review of sectoral achievement is under way.
 - Significant increase in energy-related CO₂ between 1990 and 2001 (transport: 22.8%, residential:19.4%, commercial:30.9%)
 - Only industry sector manages to reduce emissions (-1.3%), but the government expects industry to reduce by 7%
 - Introduction of efficient goods (cars, appliances) do not always lead to emission reductions

The Next Step

- If it is concluded that Step 1 (up to 2004) did not result in significant emission reduction, then further measures may be conceived
 - Environmental (carbon) taxation
 - Emissions trading
 - Kyoto Mechanism activities

JI / CDM activities

- Interministerial committee on KM
 - METI, MOE, MOFA, MAFF, MLIT
 - Formulated JI/CDM application procedure in Oct., 2002
 - Approved five projects to date
 - HFC decomposition in Ulsan, Korea (approved by CDM-EB)
 - V&M Fuel Switch (not approved by CDM-EB)
 - Cogeneration in Kazakhstan (JI or CDM?)
 - Rubber biomass in Thailand (not submitted to EB)
 - Off-grid microhydro in Bhutan (a 100% hydro country... not submitted to EB)
 - Government opposition to “unilateral” CDM due to preference to link CDM with transfer of Japanese technology

JI/CDM Activities

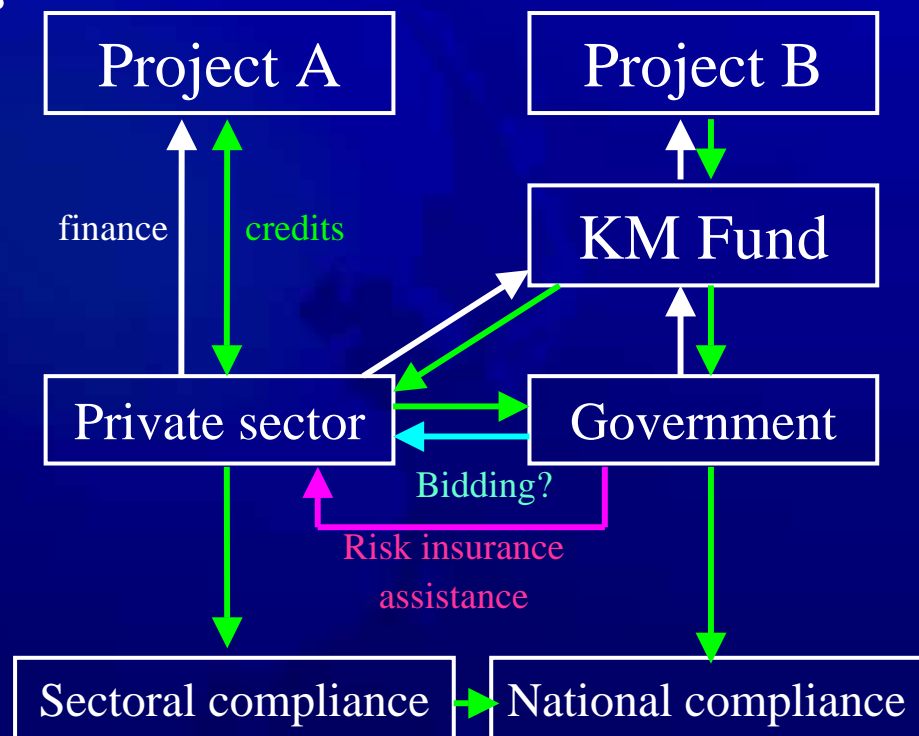
- Japan Carbon Fund (JCF)
 - Joint project by JBIC and DBJ
 - JBIC has the overseas network, whereas DBJ has the legal basis (to invest for Japan's development)
 - Total fund at JPY10billion (80 million Euro), with each JBIC and DBJ financing 10%. The remainder from private entities
 - Originally scheduled to start from June, 2004, but possibly later

JI/CDM Activities

- Government-sponsored feasibility activities
 - Energy-related projects (METI), other projects (MOE)
 - First major success: Rang Dong Associate Gas Utilization Project (Viet Nam) – methodology approved by CDM-EB
- Government-sponsored project activities
 - Government finances $\frac{1}{4}$ of initial finance
- Risk Mitigation
 - Nippon Export & Investment Insurance (NEXI) to consider insuring against CDM/JI-related host country risks (e.g. withdrawal from Kyoto Protocol)

Japan and the Kyoto Mechanisms

- Possibly the largest buyer of emissions reduction credits (perhaps on the order of 100Mt-CO₂/yr).
- Role of government is probably significant
 - Active role in project development
 - Passive role as a purchaser, possibly with a bidding process
 - Risk mitigation
 - What if government is in danger of noncompliance? Will it buy or will it “confiscate”
- A possibility: Emissions trading for the industry coupled with government incentives for JI / CDM (after 2005)



Possible scheme for utilization of Kyoto Mechanisms

MRI's Activities

- MRI is a Japanese private think tank established in 1970, it has wide variety activity area such as macro economy, social development, information technology
- MRI has 14 years' experience on research related to climate issues, since 1988 Toronto conference
- MRI has the largest research staff among the Japanese think tanks
- MRI has worked closely with both the Japanese government and industry on this issue
- MRI is involved in the internal discussions within Keidanren
- Since MRI has wide network in Japanese business, we can introduce proper contact points to foreign friends

MRI Carbon Offset Initiative

- *Objectives*
 - Find and evaluate commercially viable projects that result in emission reduction.
 - Explore opportunities to expand businesses related to credit trading.
 - Eventually set up a pilot system to assess, trade and verify credits from such projects through “learning-by-doing” process.

Outline of COI

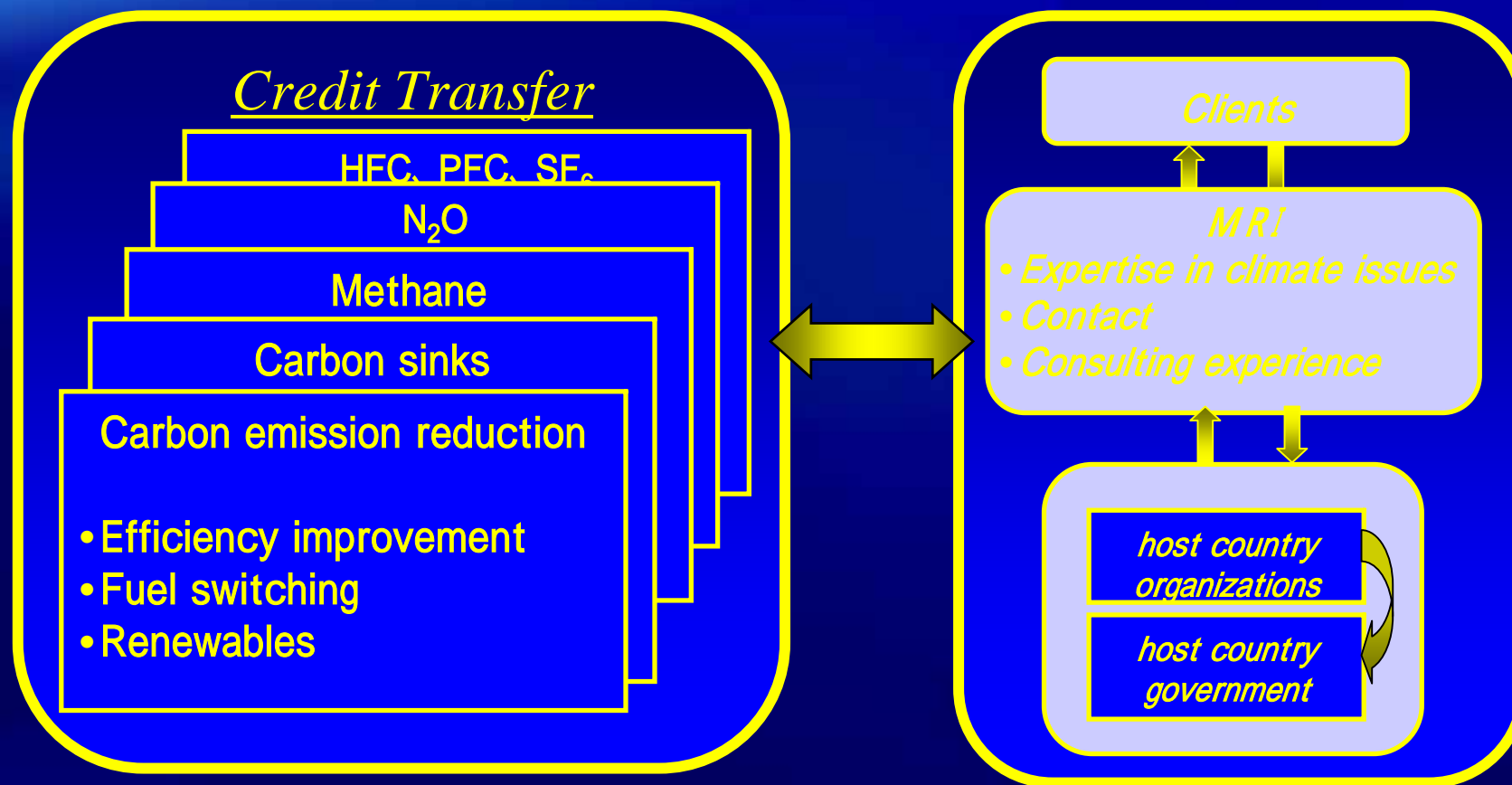
Project identification

Information and analysis

Analysis of business opportunities

- ☞ *Decision making support*
- ☞ *In-depth feasibility study*
- ☞ *Implementation support*
- ☞ *Business development consulting*

Project Identification:scheme



Project identification: status

Selection criteria

- Host countries:
 - Political stability
 - Reduction potential
 - Understanding towards Kyoto Mechanisms
 - Development of cooperating organizations
- Area of investigation
 - Host country needs
 - Investor needs
 - GHG reduction potential



- Countries
 - Brazil
 - Hungary
 - Thailand
 - Malaysia
 - Other Asean
- Sectors
 - energy/power
 - cement
 - air-conditioning
 - waste

Pushing the initiative forward

- Cooperation with the governments, which paves way for CDM/JI-specific projects
- Cooperation with private and public funding institutions
- Establishing a contract-based network in the host-countries

Host country viewpoints

- Greenhouse gas reduction is not the only priority for host country parties; overall objective is sustainable development
- CDM projects are different from conventional direct investment projects.
 - Respect of host country needs (technology, employment..)
 - Contribution to the host country economy
 - Local community support
 - Contribution to local environmental issues