

Effective Use of the Clean Development Mechanism

Commission on Sustainable Development
Learning Centre
United Nations Secretariat, New York
1st May 2006

Bruce P. Chadwick, Columbia University

bpc2@columbia.edu - www.bruce.chadwick.org

Eron Bloomgarden, EcoSecurities

eron@ecosecurities.com - www.ecosecurities.com

Order of Topics

- Objectives
- Background on the Kyoto Protocol and CDM
- Transaction Costs and the CDM
- CDM and Sustainable Development
- Carbon Market Dynamics
- EcoSecurities: “Tales from the trenches”
- Discussion and Wrap-up

Objectives

- Clarify the Clean Development Mechanism and its relationship to other greenhouse gas activities
 - Emissions trading, Joint Implementation
 - Voluntary Emissions Reductions
- Identify key transaction costs and their effects
- Recommend a procedure for integrating Sustainable Development into CDM planning
- Evaluate the performance of Carbon Markets, one year after Kyoto
- Discuss, identify new challenges and opportunities

Acknowledgements:

Much of this material has built on work by my students at Columbia University in 2004 and 2005

2004

Rodolfo Gallardo
Kristin Anderson
Sahar AlNasrallah
Eron Bloomgarden
Chun-Ying Chow
Yigal Gelb
Yogesh Ghore
Andrew Jhun
Aizhan Keremkulova
Toshi Koganeya
Manuel Mejia

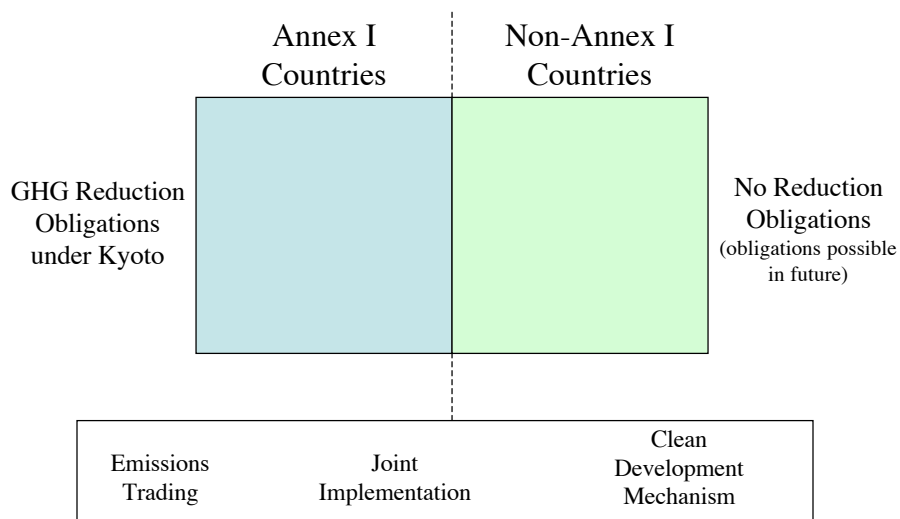
2005

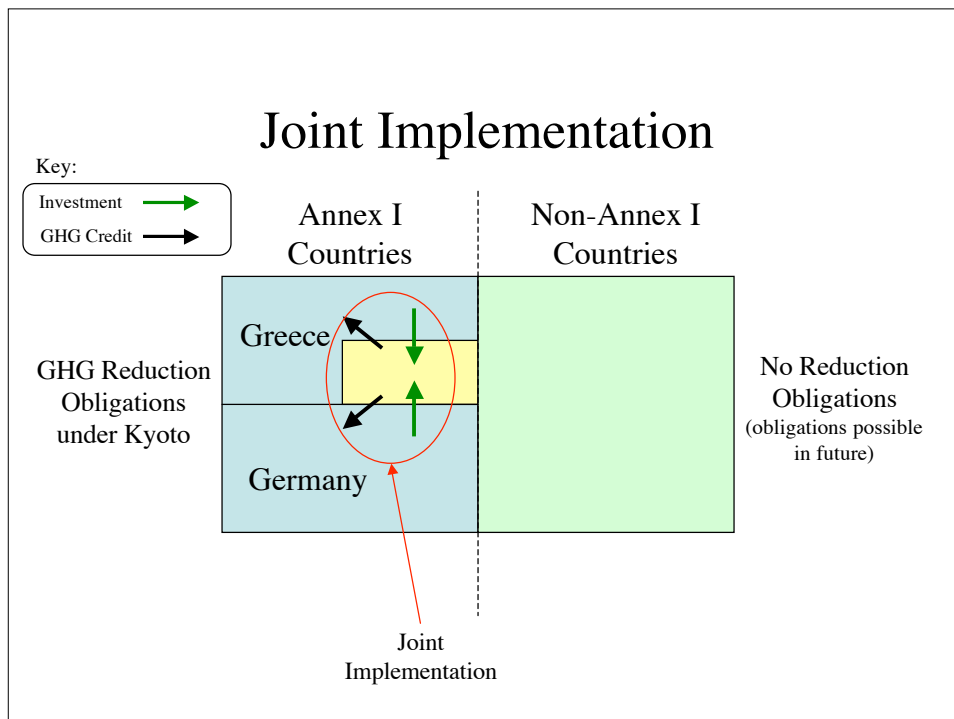
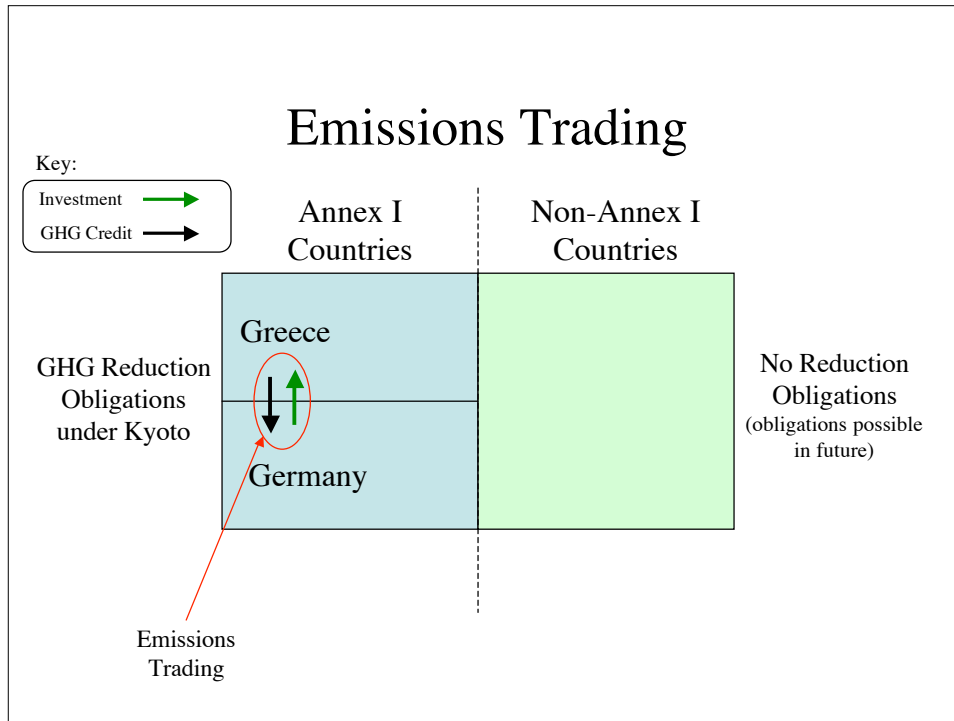
Alexander McCloskey
Tisha Joseph
Mark Aranha
Amanda Bergqvist
Andrew Dvoracek
Takuya Kudo
Eliot Levine
Amy Lile
Heather Matsumoto
Cindy Pearl
Jessica Rogers
Reis Lopez Rello

History of Protocol and CDM

- 1992: Rio de Janeiro - Framework Convention on Climate Change
- 1997: Kyoto - Signing of Kyoto Protocol
 - Annex B countries commit to reductions over a baseline year.
 - Protocol includes 3 “flexibility mechanisms.”
- 2001: Marrakech: Kyoto details finalized
- 2004: Ratification of Protocol by Russia
- 2005: Protocol enters into force

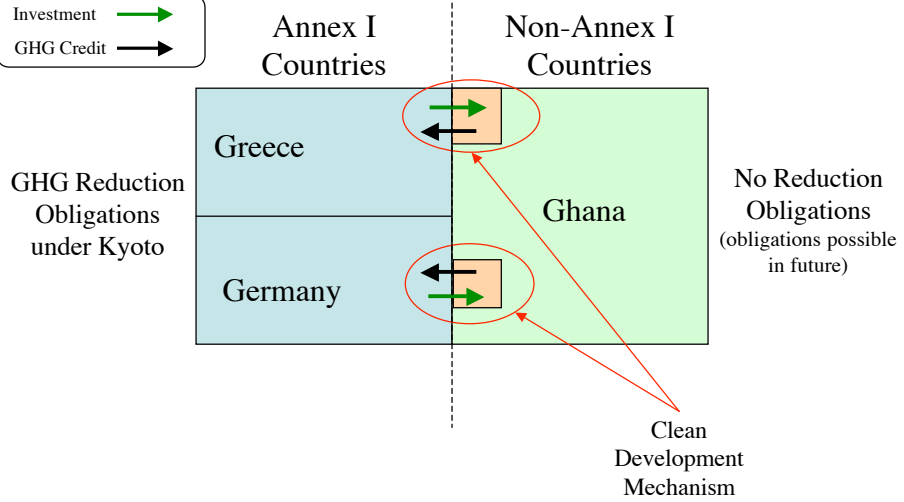
Flexibility Mechanisms





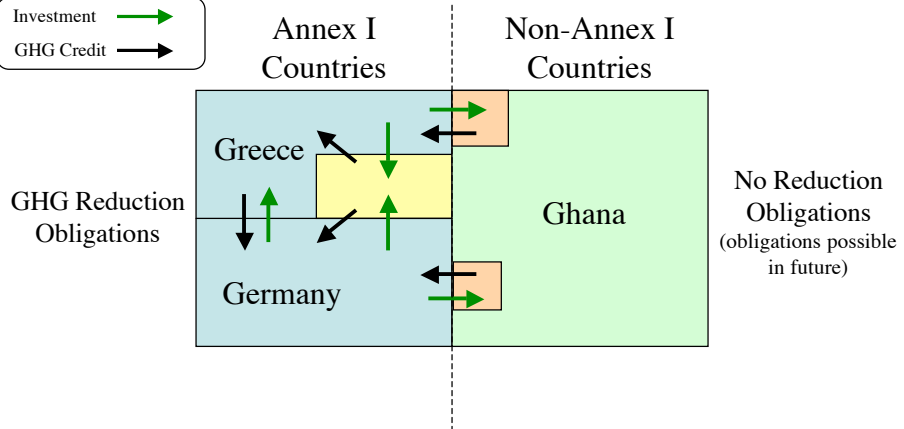
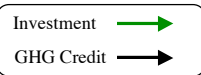
Clean Development Mechanism

Key:

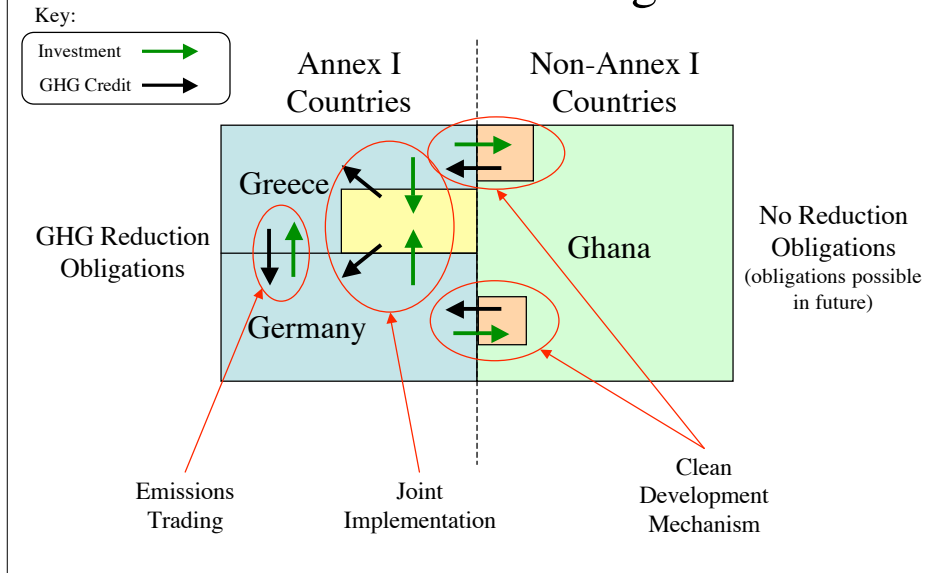


All Mechanisms Together

Key:



All Mechanisms Together



Different Accounting Units

<u>Unit</u>	<u>Allocation</u>	<u>Description</u>
AAU	Country	Assigned Amount Units: Each country allocated based on baseline and Kyoto commitment.
ERU	Project	Emission Reduction Units: Reduction over baseline projections for Joint Implementation projects.
RMU	Project	ReMoval Units: Kyoto-recognized unit for GHG reductions from sequestration (JI)
CER	Project	Certified Emission Reduction: GHG reductions from CDM-approved and verified processes.
EUA	Project	EUropean Allowance: GHG reduction acceptable for use in European Trading System, but not for Kyoto.
VER	Project	Verified Emission Reduction: GHG emissions acceptable for Chicago Climate Exchange contracts, but not Kyoto.

Challenge: combine national and project-based accounting units

Determining AAUs

Sample Country

Baseline Year	1000 tCO ₂ e
Committment	-8%
AAUs	920 tCO ₂ e / yr

Determining Compliance and Fines

Annual GHG Inventory Accounting

- Total National Emissions from all sources
- AAUs (national account)
 - + AAUs sold to other countries
 - + ERUs (from hosted JI projects)

National Compliance Gap (or Surplus)

- ERUs Retained (from hosted JI projects)
- CERs held
- Other Purchases (ERU, AAU, RMU, etc.)

Fineable Gap (or saleable surplus)

Fines are 40 euro/tonne in first period, 100 euro/tonne in second period (Only ETS has 2nd per.)

Objectives of the CDM

Article 12.5 of KP

CDM Projects must:

- *Be voluntarily approved by all participants*
 - i.e. benefit project developers, investors, and host country sust. development
- *Lead to real, measurable, and long-term benefits related to the mitigation of climate change*
 - i.e. be verifiable reductions
- *Lead to reductions in emissions that would not have occurred otherwise*
 - i.e. lead to **additional** reductions viz. "normal" development (*additionality*)

Methods of the CDM

CDM Projects must pass four hurdles:

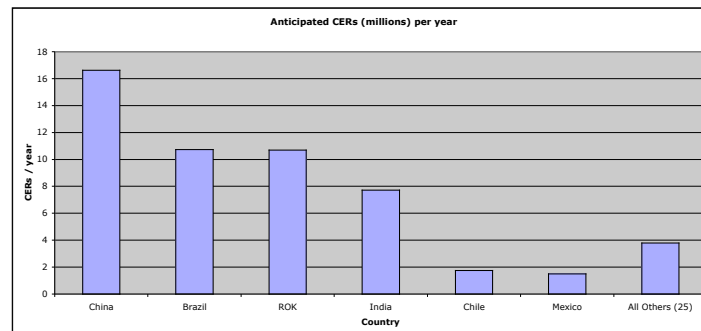
1. *The project must use an approved methodology to measure emissions reduction*
 - A designated operational entity (DOE) certifies the methodology
 - CDM Executive Board accredits DOEs and approves new methodologies
2. *The project must be approved by host country DNA as consistent with national sustainable development objectives*
3. *The project must be registered by the CDM Executive Board as an official CDM project*
4. *Project must have its reduced emissions validated by an accredited DOE*

CDM presently dominated by a few early adopters

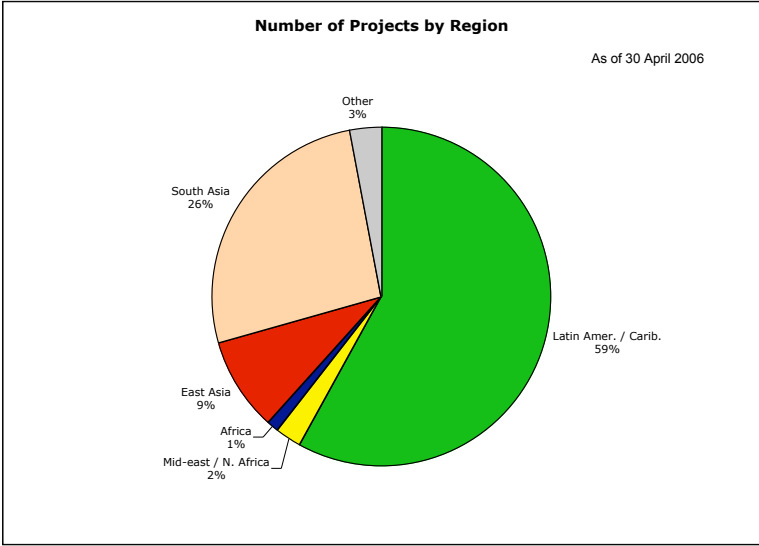
Country	Projects	Million CER/yr	% Total CERs	Value (M)*
China	7	16.62	31.47%	\$249.28
Brazil	41	10.73	20.32%	\$160.95
Rep. of Korea	3	10.70	20.26%	\$160.49
India	37	7.72	14.62%	\$115.83
Chile	10	1.75	3.31%	\$26.23
Mexico	15	1.50	2.84%	\$22.52
All Others (25)	54	3.78	7.16%	\$56.75
Total	167	52.80	100.00%	\$792.06

As of 30 April 2006

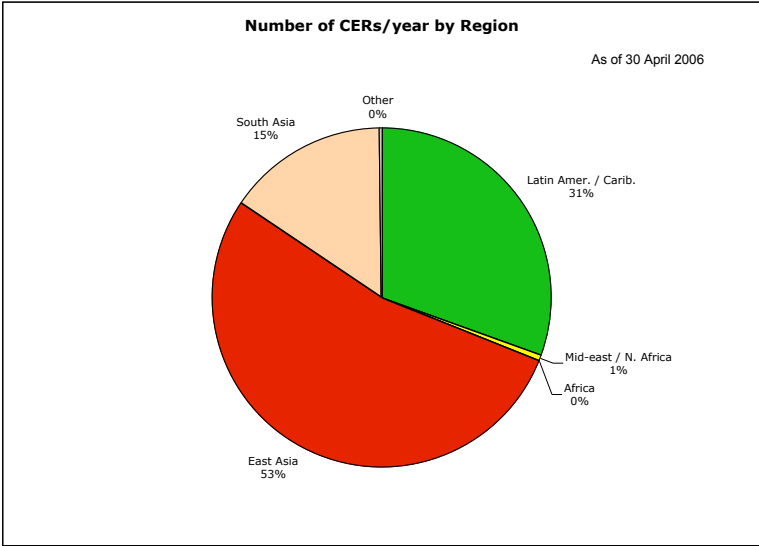
*Value assumes a spot price of \$15 / tCO₂e.



CDM Registered Projects



CDM Registered Projects



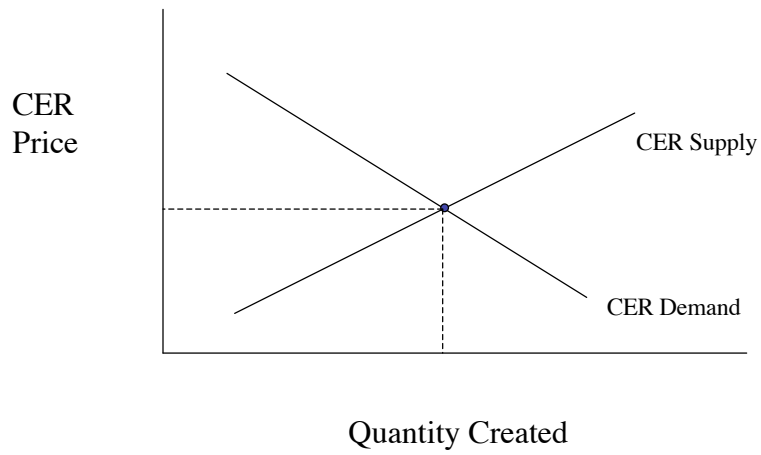
Transaction costs and the CDM

- Transaction costs are:
 - Costs in the price of a CER that are not attributable to...
 - The technical process of removing GHGs from the atmosphere.
 - Changes in the demand for CERs
- Other more academic definitions exist...
 - Price of obtaining a property right
 - Expenses other than the labor, capital, and materials used to carry out productive activities

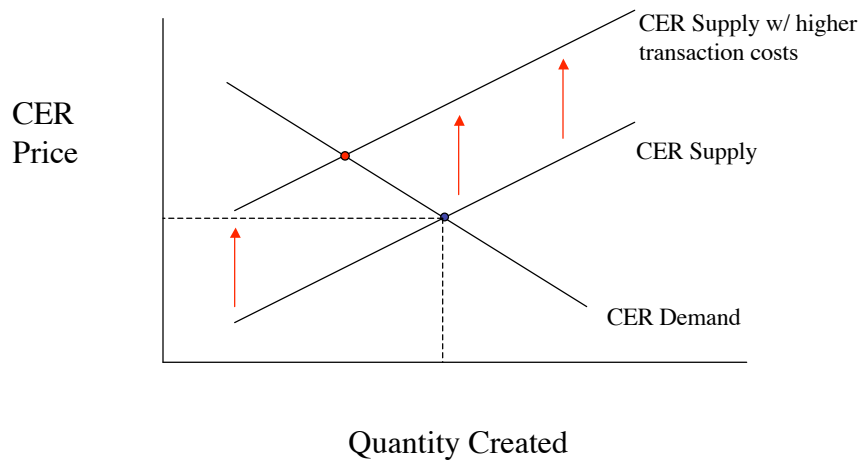
CDM and Transaction Costs

- Additionality criterion is a big challenge
 - “Carbon reductions that go beyond what would be expected in a ‘business as usual’ scenario”
 - If a project or technological addition makes economic sense (i.e. makes money) without the issuance of CERs, then project is not approvable.
 - Implications:
 - For technological retrofitting: CERs must pay for the retrofit.
 - For entire carbon projects (e.g. sinks), the value of CERs sold is the maximum obtainable profit.
 - The baseline emissions rate determines how much GHG will actually go into the atmosphere.
- Anything that lowers the profitability of producing CERs means that less GHG is removed from host country sources.

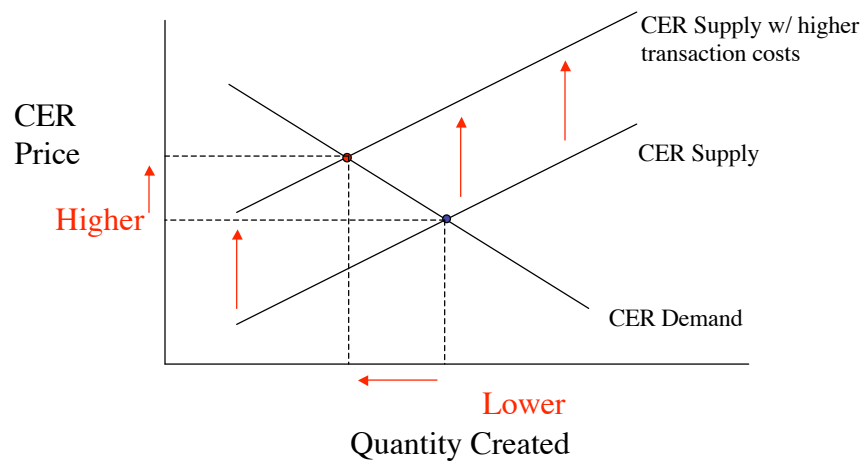
Transaction Cost Economics



Transaction Cost Economics



Transaction Cost Economics

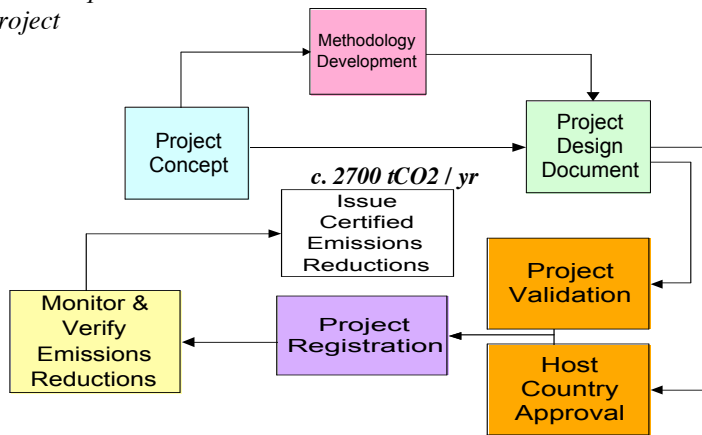


Effects of Supply/Demand Shifts

Event	GHG Sellers	GHG Buyers	Climate
<i>CER supply costs increase</i> (e.g. transaction costs up)	Good	Bad	Bad
<i>CER supply costs decrease</i> (e.g. new technologies)	Bad	Good	Good
<i>CER demand increases</i> (e.g. other reductions difficult)	Good	Bad	Good
<i>CER demand decreases</i> (e.g. other reductions easy)	Bad	Good	Bad

CDM Project Cycle

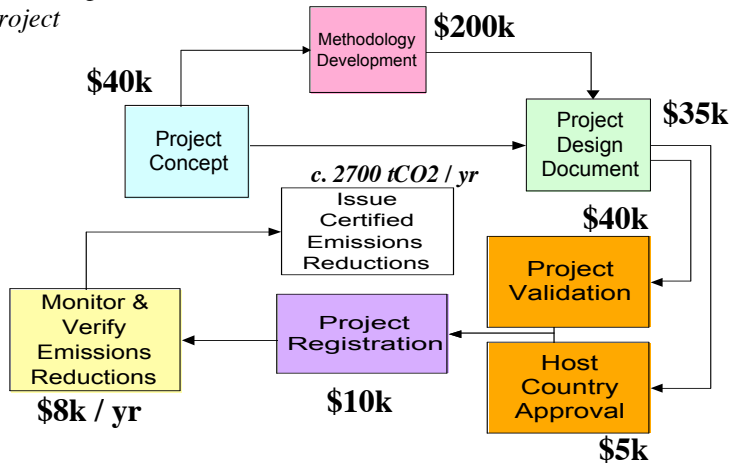
Ghana Liq. Pet. Gas Project



Slide prepared by Alex McCloskey

CDM Project Cycle

Ghana Liq. Pet. Gas Project

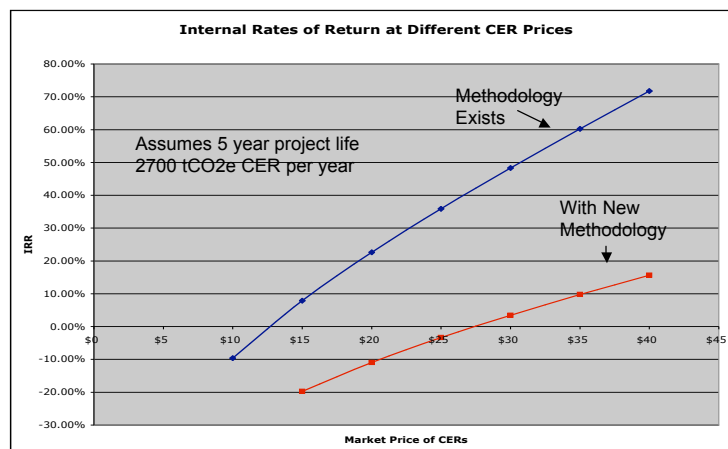


Slide prepared by Alex McCloskey

Ghana LPG Case Study

- Up-Front Costs: \$330,000 (\$130,000 w/o methodology)
 - Project Documents: \$75,000
 - Approvals: \$55,000
 - New Methodology Development: \$200,000
- Variable Costs
 - Monitoring and Validation: \$8,000 / yr
- Outputs
 - Approx 2700 tCO₂e CERs / yr

Internal Rates of Return by Anticipated CER Sale Price



Principal Categories of Transaction Costs

Item	Fixed Cost	Variable Cost
<i>Project Design</i>	X	
<i>Methodology Development</i>	X	
<i>Project Approvals</i>	X	
<i>Monitoring / Verification</i>		X
<i>Delivery Risk</i>		X
<i>Brokerage Fees</i>		X

Transaction Cost Summary

- Up-front fixed costs tend to be biggest hurdle
 - New methodology development can be substantially expensive, only viable for large scale or long-lived projects
 - Project documentation and approvals can also be costly
 - Both of these should decrease over time
- Variable costs can be substantial too
 - Monitoring and Verification (\$0.25 to \$3.00 per tonne)
 - Broker fee portions should decrease as liquidity improves
- Most effective strategies to control transaction costs
 - Capture economies of scale, standardize documentation procedures, good communication between authorities and project developers, reduction of uncertainties and delivery risk, public support for start-up costs, especially development of new methodologies, methodology licensing schemes.

Sustainable Development Indicators

Sustainable Development and CDM

- CDM objective is to
 - Assist Annex I countries in meeting emissions targets at lowest cost
 - Emissions reductions must be verified by a Designated Operational Entity (DOE)
 - Using a methodology approved by the CDM Executive Board (EB)
 - Assist non-Annex I countries in meeting Sustainable Development objectives
 - Definition of Sustainable Development is left for each country to define for itself as part of its sovereign authority
 - A Designated National Authority (DNA) is created to approve CDM projects
 - EB will not issue credits unless a project is approved by DNAs of all countries involved.

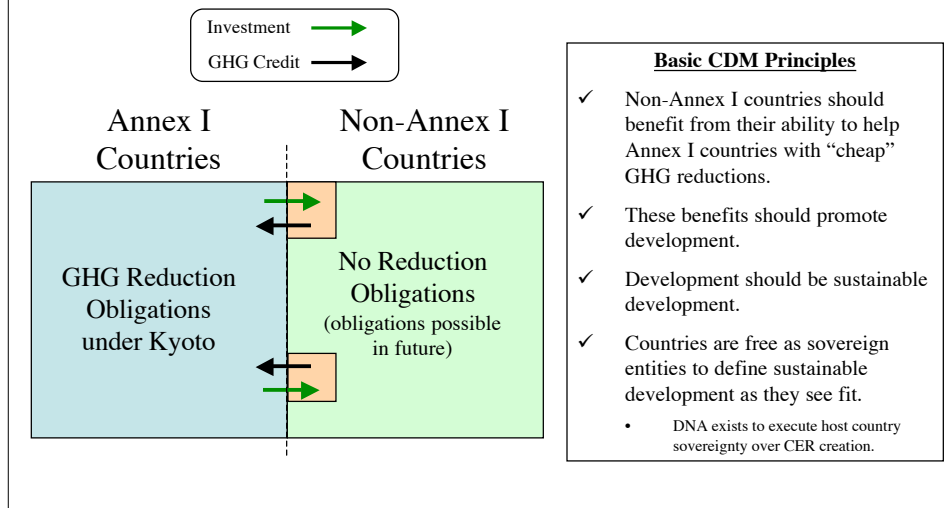
Defining Sustainable Development

- There is consensus on the general features of sustainable development, thanks to Rio UNCED
 - World Commission on Environment and Development.
 - “Three Pillar” Approach.
- Controversy over specific details
 - Afforestation? Hydropower? Nuclear?
 - What is the correct balance among pillars?
- Context affects the definition
 - Academic v. Negotiated v. Managerial
 - Differing contexts can create confusion or sense of “indefinition.”

Context of Sustainable Development

- Academic Definitions (Universities, Researchers)
 - *Goal*: be conceptually consistent, accurate, meaningful, and defensible, preferably measurable as well.
- Negotiated Definitions (Legislatures, Diplomats)
 - *Goal*: create consensus by defining acceptable and unacceptable actions.
 - Often defines the boundaries of “sustainable” and “non-sustainable.”
- Managerial Definitions (Project Managers)
 - *Goal*: create measurable, attainable targets to measure performance.

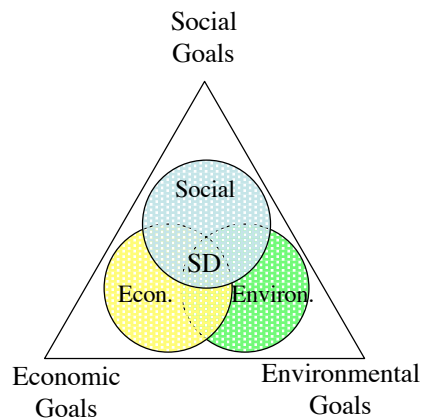
Why Sustainable Development in the CDM process?



Key Questions for DNA

- How to define Sustainable Development?
 - Necessary for project approvals
 - Should be well communicated to project developers to reduce project preparation uncertainties.
 - What conditions should be stipulated for project approval?
- How necessary to track project deliverables on sustainable development after approval is given?
 - Is it possible for DNAs to withdraw approval if sustainable development objectives not reached?

Three Pillars Approach: Most common framework



Advantages

- ✓ General consensus on appropriateness.
- ✓ Can build targets and timetables into pillar components.
- ✓ Expandability to include additional pillars.
- ✓ Looks nice in diagrams.

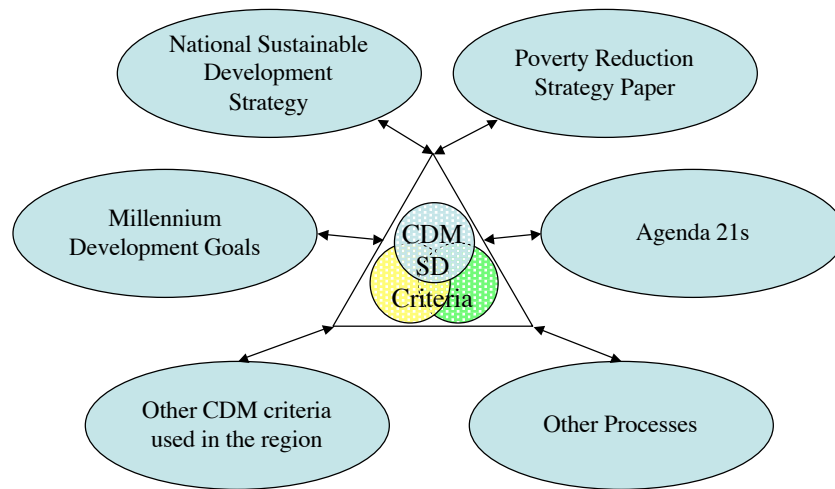
Disadvantages

- ✓ Difficulty in knowing whether pillars are appropriately balanced.
- ✓ Can be manipulated to under-emphasize environmental or social considerations.

DNAs Should Consider...

- Once a DNA approves a project, it is difficult to withdraw approval later on.
 - Process uncertain in UNFCCC and CDM rules.
 - Likely to occur only under extreme conditions.
 - Creates incentive for project developers to over-promise in order to speed approvals.
 - Creates incentive for DNA to create a “negative list”
 - I.e. a list of items that will lead to project rejection, other projects accepted.
- CERs may seem cost-free to the host country DNA, but are not.
 - No commitments, CERs may appear to “go to waste”
 - CERs created in one project may not immediately prevent the approval of another project
 - Over time, projects may change baseline calculations
 - A country may want to “reserve” a portion of CERs from approved projects
 - Later Kyoto commitments
 - Potential price increases on open market

Sources of National Sustainable Development Guidelines



Recommended SD Criteria Strategy

1. Identify National Priorities for Each Pillar
 - Derive from other Sustainable Development Sources
 - May need to adapt to project-based system like CDM
 - May also include technological or regional priorities
2. For Each Priority, Find Baseline Values and Set Targets
 - Emphasize measurability and objectively verifiable targets
 - Where feasible, choose targets that are quantifiable and which are aggregable.
3. Evaluate Criteria for an Appropriate Balance Among Pillars
 - Are there substantially more criteria for one pillar than others?
 - Third party validation yields best results.
4. Review Criteria on a Regular Cycle
 - Allows mid-course corrections and inclusion of scientific advances into targets.

Example: Creation of Priorities and Indicators for Each Pillar

Table 7.2: Examples of Indicator selections for different objectives

Environment Pillar <u>Reduce deforestation rates</u> <i>Indicators:</i> Number of hectares of forests stabilized or protected; rates of forest loss <u>Increase use of Environmental Practices</u> <i>Indicators:</i> List of improved environmental practices adopted and number adopting them
Social Pillar <u>Improve literacy and education</u> <i>Indicators:</i> Percentage children completing primary and secondary education <u>Reduce absolute poverty</u> <i>Indicators:</i> Number and proportion of population below absolute poverty line
Economic Pillar <u>Net increase in foreign exchange</u> <i>Indicators:</i> Direct and indirect foreign exchange generated by projects <u>Newer technologies transferred to country</u> <i>Indicators:</i> Number of technologies transferred and use; list of technologies desired

Taken from B. Chadwick, "Sustainable Development Criteria and the Clean Development Mechanism," upcoming DESA working paper.

Special Considerations on Environmental Criteria and CDM

- Criteria for Environmental Pillar should ***not*** include "reduction of GHG emissions."
 - These benefits go to the investor, not the host. CDM EB approves this.
 - May include this criterion if CERs are retained by host country.
- Other climate change criteria are suitable and relevant to use...
 - "Reduced vulnerability to climate change."
 - "Climate change-related technology transfer"
 - Positioning for adaptation to warmer world.
- Also, remember ecosystem fortification or restoration as desirable environmental criteria
 - Particularly useful for sequestration-type projects.
 - Tendency to focus on "development with lesser impact" instead of ecological restoration.

Use Portfolio Approach to Track CDM Projects and Evaluate New Ones

Table 7.3: Sample indicator tracking table for use by a DNA

Indicator: (e.g. jobs created)	Total for projects in CDM Portfolio	Total per portfolio CER generated	Total per expected CERs in portfolio
Baseline value (and year)			
Target value (and year)			
Current project totals			
Current gap			
Anticipated total of approved projects			
Anticipated gap			

Project Portfolio Goals (points to Baseline and Target rows)
Current Values (points to Current project totals and Current gap rows)
Expected Results From Approved Projects (points to Anticipated total and Anticipated gap rows)
Per CER generated to date (points to Total per portfolio CER generated column)
Per CER expected over project lifetimes (points to Total per expected CERs in portfolio column)

Taken from B. Chadwick, "Sustainable Development Criteria and the Clean Development Mechanism," upcoming DESA working paper.

Evaluate projects based on per-CER contributions to SD goals

Table 7.4: Sample project evaluation table

Proposed CDM Project Title – (Start Year, End Year)						
Description						
Summary:						
Total anticipated CERs: ---			Total Estimated Investment: ---			
CERs issued to date: ---			Investment from State Sources: ---		Investment from national private sources: -	
CERs retained by country: ---						
CERs						
Expected Sustainable Development Impacts:						
Sustainable Development Indicators	Column A: Estimated Project Lifetime Impact at Proposal Time		Column B: Present Anticipated Impact on Indicator over Project Life		Column C: Project Impacts on Indicator to Date	
	Total	per CER	Total	per CER	Total	per CER
Indicator A						
Indicator B						
Indicator C						
Etc...						

Financial Information (points to Investment rows)
Anticipated Impacts (points to Column A and B)
Realized Impacts (points to Column C)

Taken from B. Chadwick, "Sustainable Development Criteria and the Clean Development Mechanism," upcoming DESA working paper.

Project Approval Method Based on Portfolio Strategy Approach

Table 7.5: Typology of CDM Project Evaluations

Project Category	Defining Characteristic	Decision
<i>Super-sustainable projects</i>	Positive improvements on all sustainable development indicators simultaneously.	Accept
<i>Sustainable projects</i>	Positive improvements on some sustainable development indicators, no negative impacts on any indicators.	Accept, unless per-CER impacts are substantially below average.
<i>Semi-sustainable projects</i>	Positive impacts on several sustainable development indicators, negative impacts on a few indicators.	Apply cost-benefit analysis, multi-criteria analysis, or identify other projects to compensate for negative impacts
<i>Non-sustainable projects</i>	Positive impacts on a few indicators, negative impacts on many indicators	Apply cost-benefit analysis; accept only if positive impacts are exceptional and negative impacts small, or if substantial compensating projects are contained elsewhere in the portfolio.

Taken from B. Chadwick, "Sustainable Development Criteria and the Clean Development Mechanism," upcoming DESA working paper.

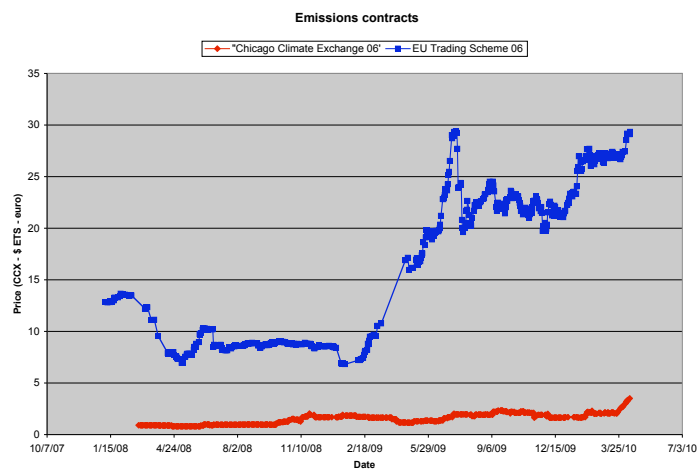
Benefits of Portfolio Approach

- Active reminder that CERs are *not* costless
 - CERs are best considered as a "mineable resource."
 - Project CERs can affect the "business as usual" scenario for future emissions reduction projects".
 - Cost of CER production will tend to rise over time, unless substantial technological breakthroughs occur.
- Portfolio approach helps balance pillar targets
 - As one target gets met, the value of meeting other targets increases and can be measured by per/CER contributions to the portfolio.
 - Remember that GHG reductions should not be a host country SD criterion, unless CERs are retained for later use.
- Portfolio approach can supply key data to feed into national sustainable development policy.

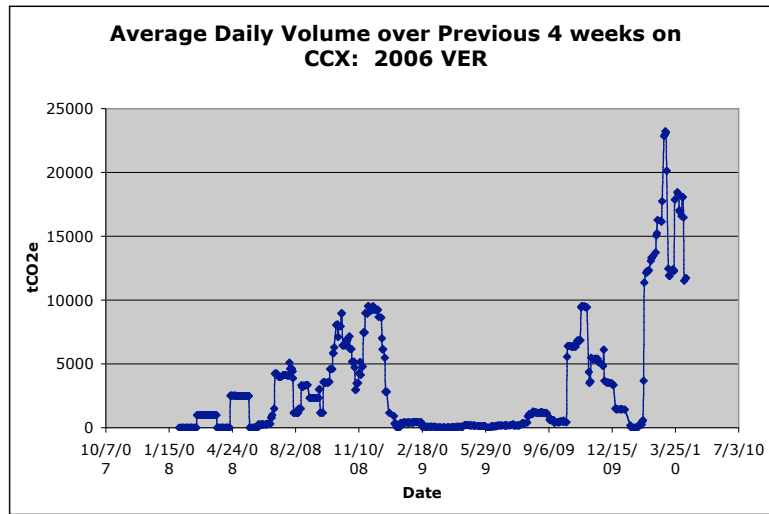
Carbon Market Dynamics

- Currently a \$1 Trillion market
 - New Instruments Emerging to work with market
- Various credit types
 - AAU, ERU, RMU, CER, VER
 - “Gold Standard” differentiation
 - Supersustainability: extension of “sustainable coffee” model to CER production
- European ETS prices approx 4x higher than US CCX
 - Effect of mandatory vs. voluntary emissions caps
- CERs are useable in virtually every market
 - But higher delivery risk affects pricing

Evolution of tCO₂e prices



Evidence of Markets Becoming More Liquid



Emerging Trends

- Alliance of investor and environmentalist interests
 - NGOs purchasing CERs, ERUs, VERs to increase demand.
 - Businesses creating “Carbon Neutral Products” by bundling CERs and other emissions credits with product purchases.
- Investor incentives
 - Carbon portfolios can reduce investor exposure to other risk classes, creating potential demand from institutional investors.
 - Balanced carbon investment portfolios are possible to channel investment to CDM projects at lower risk ratios than CO₂ alone.
 - Increasing sophistication of Socially Responsible Investment community.

“Tales from the Trenches”

Future Uncertainties

- Will GHG markets converge or fragment
 - Convertibility of EUAs-CERs-VERs?
 - Increasing US municipal and state action
 - Re-engagement of USA with Kyoto Protocol?
- Will European support for a second Kyoto commitment period wane if GHG reductions prove expensive?
 - EU ETS has second commitment period, independent of Kyoto
- Will developing countries begin to take on emission reduction requirements?
 - How will baselines be established for accession to Annex I (Annex B of KP)

Reasons for Optimism

- CDM is surprisingly well functioning, given the complexities involved.
 - CDM has existence independent of remainder of Kyoto Protocol.
- Emissions trading is creating appropriate incentives for technology transfer, experimentation, and evaluation.
- Emissions trading is creating a sizable number of investors with a financial interest in keeping Kyoto or GHG-exchange systems functioning.

Review of Objectives

- Clarify the Clean Development Mechanism and its relationship to other greenhouse gas activities
 - Emissions trading, Joint Implementation
 - Voluntary Emissions Reductions
- Identify key transaction costs and their effects
- Recommend a procedure for integrating Sustainable Development into CDM planning
- Evaluate the performance of Carbon Markets, one year after Kyoto
- Discuss, identify new challenges and opportunities

Discussion

- Audience experiences with transaction costs, S.D. criteria, etc.
- Audience identification of emerging issues in CDM and emissions markets

Audience Identified Emerging Issues

Thank you!

Contact Information

Bruce P. Chadwick, Columbia University
bpc2@columbia.edu - www.bruce.chadwick.org

Eron Bloomgarden, EcoSecurities
eron@ecosecurities.com - www.ecosecurities.com