Climate Change Mitigation: Barriers, Opportunities and Technology Transfer

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Role of Technology Transfer in Climate Change Mitigation

- **Article 4.5 of the Convention**
  - Signatories shall take steps to promote, facilitate, and finance environmentally sound technologies (ESTs) and know-how to implement the provisions of the Convention
- **IPCC Special Report on Tech Transfer defines**
  - **Technology:** Know-how, experience and equipment for mitigation and adaptation
  - **Transfer**: Includes diffusion and cooperation within and across countries
    - Understand, utilize, and replicate the technology
- **Research and development are not covered in SRTT**

Which energy sectors are important?

Table 6.1 Carbon emissions from fossil fuel combustion in Mt C (Price *et al*., 1998)			
Sector	Carbon Emissions and (% Share) 1995	Average annual growth rate (%)	
		(1971-90)	(1990-95)
Industry	2370 (43%)	1.7	0.4
Buildings			
-- Residential	1172 (21%)	1.8	1.0
-- Commercial	584 (10%)	2.2	1.0
Transport	1227 (22%)	2.6	2.4
Agriculture	223 (4%)	3.8	0.8
All Sectors	5577 (100%)	2.0	1.0
-- Electricity Generation*	1762 (32%)	2.3	1.7

Mitigation potential -- 2020
(Cost Range: Negative to $100/t C)

Sector	Potential emission reductions in 2010 (MtC_{eq}/yr)	Potential emission reductions in 2020 (MtC_{eq}/yr)
Buildings	700 – 750	1000 - 1100
Transport	100 – 300	300 - 700
Industry		
-energy efficiency:	300-500	700-900
-material efficiency:	~200	~600
-non-CO_2 gases:	~100	~100
Agriculture	150 –300	350 - 750
Waste	~200	~200
Montreal Protocol replacement applications	~100	n.a.
Energy supply and conversion	50-150	350-700
Total[2]	1900-2600	3600-5050

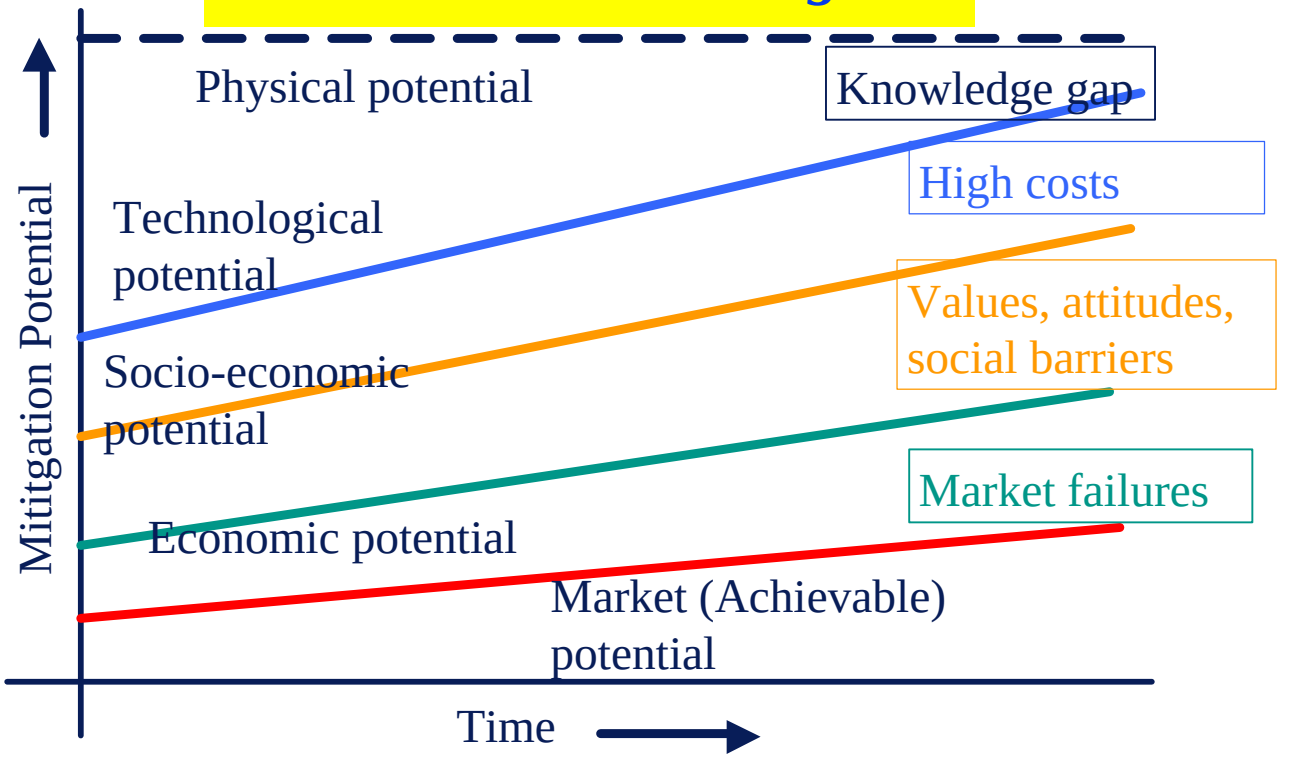
Realizing this Potential Requires Overcoming Many Barriers

- Lack of information; lack of access to capital, especially for smaller firms; absence of full-cost pricing; risk aversion in financial institutions, including Multilateral Development Banks; trade barriers, such as tariffs or export restrictions
- Individual behaviour, social values and preferences, cultural traits and norms, gender issues
- Barriers add to the cost of implementation, and reduce the realizable potential

Mitigation Opportunities for a Given Country May be Found in the Removal of Any Combination of Barriers

- Most countries could benefit from innovative financing, institutional reform and removing barriers to trade.
- Developed countries: Removing social and behavioral barriers.
- Economies in transition: Price rationalization
- Developing countries: Price rationalization, increased access to data and information, availability of advanced technologies, financial resources, and training and capacity building.

Quantification of Barriers Remains a Challenge



Opportunities for Barrier Removal

- Removal of barriers during capital stock turnover and periods of rapid social change can minimize disruption and mitigation costs

Systematic identification and quantification of such opportunities is lacking

Trends in Technology Transfer

- Official Development Assistance (ODA) experienced a downward trend from 1993 to 1997 in absolute and percentage terms. ODA (~ US$ 45-50 billion)
  - Important for some countries and sectors (agriculture, forestry, health, and coastal zone)
  - Improves enabling conditions that are necessary for private sector flows of funds and technology
- Foreign Direct Investment (FDI), commercial lending, and equity investment have all increased (~ US $ 300 billion)
  - Directed mostly towards East and South East Asia, Latin America, Middle East and North Africa. South Asia and Sub-Saharan Africa got less than 5% each in 1996

Technology flows, as opposed to monetary flows, are difficult to monitor, estimate, and forecast

Focus on Three Major Elements to Increase the Quantity and Improve the Quality of Technology Transfer

- Develop adequate human and organizational capacity
- Create an appropriate enabling environment
- Establish effective mechanisms

Human Capacity

- Adequate technical, business, management, and regulatory skills are essential for effective technology transfer
  - Government programs have traditionally focused on building technical skills

Programs need to focus on
information, financial, legal,
business consulting, and engineering services

Organizational capacity

- Participation of all stake holders -- private actors, public agencies, NGOs, and grassroots organizations -- is important for effective technology transfer
- Encourage industry and professional associations
- Continual capacity building is needed to keep up with evolution of mitigation technologies

Create an Enabling Environment

- All governments could:
  - Improve regulations, codes, standards, etc. to capture the full social and environmental costs
  - Reform legal systems to improve contracts enforcement by national courts and international arbitration
  - Protect intellectual property rights so as to foster innovation
  - Encourage financial reforms and open and competitive markets
  - Improve transparency of project approval and public procurement procedures
  - Reduce corruption in conformity with international conventions

Improving Mechanisms for Technology Transfer

- National Systems of Innovation (NSI)
  - Comprehensive approaches that integrate capacity building, improved access to information, better enabling environment to support the creation of an innovation culture
  - NSIs can be enhanced through partnerships with international consortia
- Official Development Assistance
  - Mobilize and multiply additional financial resources
- Global Environmental Facility (GEF)
  - Duplication of successful technology transfer models
- Multilateral Development Banks

Summary

- Key actions for EST transfer are ***sector-specific***
- ***Networking*** among stakeholders is essential for effective technology transfer
- Most effective technology transfers focus on products and techniques with ***multiple benefits***
- Monitoring quantity and quality of technology flows will require ***performance benchmarks, indicators and clearing houses, and models for projecting tech transfer needs***
- IPCC review shows a ***major gap in research***
  - Few studies explicitly identify ***barriers*** and ways to overcome them, and estimate the costs of their removal
  - Systematic quantification of ***opportunities***