Technology Transfer for Addressing Climate Change in the Energy Sector
CLIMATE CHANGE
Global Warming
Greenhouse Emissions
Navigating the literature:

Key work in this area includes:

- University of Sussex: empirical analysis of barriers & opportunities in India, China and now Kenya as well as generic policy assessments for OECD, UNFCCC, Commonwealth Secretariat
- ICTSD (on IPRs)
- Tom Brewer (especially his paper in climate policy on changing nature of climate tech flows & redundancy of N-S perspective)
- Chatham House (especially related to trade & China)
- Heleen de Coninck & Erik Haites & their empirical work on CDM & tech transfer
- Ambuj Sagar’s work on climate innovation centres
- Martin Bell’s work on innovation capacities
- Lall’s work on technology, development & competitiveness
- Tim Forsyth’s work on tech transfer & poverty + work on partnership based approaches
- Frauke Urban’s work on pro-poor low carbon development
- Jon Lovett’s team at University of Twente & work on tech transfer & poverty/gender + work on partnership based approaches
To be published June 2012 – includes contributions from most authors on previous slide
Overview

1. Why is low carbon technology transfer unique?
2. Existing policy regime
3. Indigenous innovation capacities
4. Context specificities & a needs based approach
5. Intellectual property rights (IPRs)
6. Implications & opportunities for Africa
What is technology transfer?

- Traditionally the transfer of a technology from one place to another
- Occurs naturally in the private sector
Emissions trajectories in developing countries – without clean technology
Emissions trajectories in developing countries – with clean technology

\[ \text{CO}_2 \]

Time / economic development
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Why is climate technology transfer unique?

1. Urgency
2. Public good nature of technology
3. Technological maturity
Policy making under conditions of urgency
Public good nature of low carbon technology
Horizontal technology transfer
Horizontal technology transfer

Changing direction of flows e.g. north-south, south-south, south-north (Tom Brewer)
Vertical technology transfer

- Research & development (R&D)
- Demonstration and revision
- Supported commercial deployment
- Commercialisation
## Technological maturity

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Stage of technology development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-carbon power generation technologies</td>
<td>Pre-commercial</td>
</tr>
<tr>
<td></td>
<td>Coal gasification including IGCC</td>
</tr>
<tr>
<td>Network / infrastructure technologies</td>
<td>Supported commercial</td>
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<tr>
<td></td>
<td>Biomass including fuel supply chain issues</td>
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<tr>
<td>Low carbon end use technologies</td>
<td>Commercial but slow diffusion</td>
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<tr>
<td></td>
<td>Improving combustion efficiency</td>
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<tr>
<td></td>
<td>LED lighting</td>
</tr>
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<td></td>
<td>Hybrid vehicles</td>
</tr>
</tbody>
</table>
Countries and communities lack experience and capacity to work with, or innovate (socially or technically) around these technologies.
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International policy context

Enshrined in several Articles of the UNFCCC + commitment under Kyoto Protocol:

- Article 4.3 obliges developed country Parties to transfer finance to developing countries
- Article 4.5 states that technology transfer must be facilitated and financed to developing countries
- Article 4.7 states that the extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and the transfer of technology
International policy context

• Commitment under UNFCCC & Kyoto

• Various other multi-, bilateral and national initiatives

• Controversial – viewed as key failure especially for LDCs

• “Carrot” for developing nations
Promising moves forward?

- Technology Mechanism being negotiated under UNFCCC
- Includes idea of Climate Innovation Centre and Network
- Additional funding under Green Climate Fund
Why should developing countries care about mitigation?

• Likely to suffer most from the impacts of climate change
• Linchpin of “common but differentiated responsibilities” under UNFCCC
• Technology underpins development
  • North-South gap in technology ownership
  • Reflected in relative levels of industrial development

In policy terms

• Viewed as hardware financing problem
• Policy mechanisms like CDM
• Opportunities for cheap emissions reductions in developed countries
  • Developing countries can exploit opportunities provided by climate finance
CDM registered projects and accumulated investment value, as at end of February 2010

Source: Bryne et al. based on figures from UNEP Risø (2010)
Number of registered CDM projects as of the end of February 2010, disaggregated by project type (2062 total registered projects)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Projects</th>
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</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>562</td>
</tr>
<tr>
<td>Methane avoidance</td>
<td>318</td>
</tr>
<tr>
<td>Wind</td>
<td>297</td>
</tr>
<tr>
<td>Biomass energy</td>
<td>277</td>
</tr>
<tr>
<td>Landfill gas</td>
<td>154</td>
</tr>
<tr>
<td>EE own generation</td>
<td>132</td>
</tr>
<tr>
<td>N2O</td>
<td>60</td>
</tr>
<tr>
<td>EE industry</td>
<td>56</td>
</tr>
<tr>
<td>Fossil fuel switch</td>
<td>45</td>
</tr>
<tr>
<td>Coal bed/mine methane</td>
<td>26</td>
</tr>
<tr>
<td>HFCs</td>
<td>21</td>
</tr>
<tr>
<td>EE supply side</td>
<td>19</td>
</tr>
<tr>
<td>Solar</td>
<td>19</td>
</tr>
<tr>
<td>Cement</td>
<td>19</td>
</tr>
<tr>
<td>Forests</td>
<td>13</td>
</tr>
<tr>
<td>Fugitive</td>
<td>12</td>
</tr>
<tr>
<td>Geothermal</td>
<td>8</td>
</tr>
<tr>
<td>EE households</td>
<td>7</td>
</tr>
<tr>
<td>PFCs and SF6</td>
<td>6</td>
</tr>
<tr>
<td>EE service</td>
<td>5</td>
</tr>
<tr>
<td>Transport</td>
<td>2</td>
</tr>
<tr>
<td>Energy distribution</td>
<td>2</td>
</tr>
<tr>
<td>Tidal</td>
<td>1</td>
</tr>
<tr>
<td>CO2 capture</td>
<td>1</td>
</tr>
</tbody>
</table>

- Over 75% registered CDM projects use just five types of technology
- Only one new renewable energy technology - wind - although mature relative to other new renewables

Source: Bryne et al. based on figures from UNEP Risø (2010)
Diversity is being constrained

- Limited contexts where technologies deployed
- Kinds of technologies being developed
- Private gains likely skewed in favour of industrialised-country firms
Hardware financing mechanisms reinforce static comparative advantages

- Unlikely to transform local contexts & make more locations:
  - Attractive for low carbon investment
  - Able to pursue self-determined low carbon development paths

- Non-BRIC (especially LDCs) risk being marginalised
- At worst may have no option but to establish carbon-intensive development pathways
Hardware financing mechanisms reinforce static comparative advantages

As mitigation imperative becomes increasingly urgent, technologies may be imposed, undermining hard-won development gains & good practice (e.g. participatory development practice, ownership and governance)

Lack of *indigenous innovation capacities* raises likelihood that externally imposed technologies will fail, further undermining mitigation & adaptation efforts
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Recognition of centrality of capacities

UNCTAD 2007:

1. Sustained economic growth and substantial poverty reduction in LDCs require development of productive capacities in way that population of working age becomes increasingly fully & productively employed.

2. Productive capacities develop through 3 closely interrelated Processes: capital accumulation, technological progress and structural change.

Unless LDCs adopt policies to stimulate technological catch-up with rest of world, will continue to fall behind & face deepening marginalization in global economy.
1. **Innovations ‘new to the world’**: Firm first to introduce innovation for all markets & industries, domestic and international.

2. **Innovations ‘new to the market’**: Firm first to introduce innovation in its particular market.

3. **Innovations ‘new to the firm’**: Firm introduces product, process or method new to that firm, or significantly improved by it, even if it has already been implemented by other firms.

4. **Non-Innovations**: Include purchase of identical models of equipment, or minor extensions and updates to existing equipment or software.
Different levels of innovation

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Different levels of innovation

- Radical innovation
- Incremental innovation
- Adaptive innovation
Different levels of innovation

• Radical innovation
• Incremental innovation
• Adaptive innovation
Hardware vs. knowledge

- Technology is **not** about hardware
- Technology is about **knowledge**
- Includes codified (e.g. patents, trade secrets) and tacit (skills and experience e.g. engineering, design, systems management) knowledge
- Importance of tacit knowledge greatly under emphasised
Hardware vs. knowledge

• International firms’ advantage is due to their knowledge not the hardware they own

• International firms often have greater innovation capacities
  ➢ i.e. capacities to adapt, develop, deploy and operate low carbon technologies effectively within specific developing country contexts

(similar idea to “absorptive capacity” & “technological capacity”)

Building innovation capabilities

Supplier firms’ engineering, managerial and other technological capabilities

Technology transferred

Capital goods, services & designs
Skills for operation & maintenance: Know how
Knowledge & expertise: Know why

Technology importers

New production capacity
Accumulation of innovation capabilities

Adapted from Bell (1990)
Maximising leverage
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Context specificity: Situated needs, multiple spaces

- Context-specific needs situated across different spaces

- Very real implications for efficacy of policy & potential for low carbon energy technology uptake as part of sustained low carbon development pathways
Context specificity: Situated needs, multiple spaces

Cultural space...
- Uptake of externally manufactured fuel-efficient cookstoves
- Gender related aspects of energy related practices

Ecological space....
- Wind vs. solar vs. geothermal vs. CCS

Socio-economic space...
- Household vs. industrial needs
- Rural poor vs. urban industry
- BRICs vs. LDCs vs. SIDS
- Existing technological capabilities

Technological space...
- Hardware / software balance e.g. CCS vs. distributed solar

Temporal...
- Current vs. future generations
- Poor now, emerging later
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The IPR debate: View 1

Strong IPR regimes = basis for tech tfr

Stronger IPR regimes *a la* TRIPS
The IPR debate: View 2

Strong IPR regimes = barrier to tech tfr

Fund for buying up IPRs
IPR and low carbon technologies: Evidence to date

• Empirical analysis is limited

• Six studies considered:
  - 2 covering wind, solar PV and biofuels in depth
  - 1 (Defra/DECC funded UK-India Study) which considered other technologies (biofuels, hybrid cars, IGCC, LED, Solar PV, Wind)
  - 3 covering more generic issues re. IPRs and trade

• Focus mostly on India and China & PV/wind therein
**IPR and low carbon technologies: Evidence to date**

- Developing countries generally had access to, or were active at some point along the RDD&D spectrum in relation to all technologies examined.
- Generally didn’t have access to the cutting edge.
- IPRs didn’t seem to prevent access but did in some cases seem to slow the rate at which manufacturing capabilities could be developed, especially at the cutting edge.
- Overall uncertain picture re. role of IPRs in TT.
Different interpretations of evidence depending on political discourse

**Diffusion perspective:**

- IPRs no barrier to technology access, especially at the user end
- No IPR-specific policy action required
Different interpretations of evidence depending on political discourse

**Development perspective:**

- Companies do not produce at the cutting edge
- IPRs might prevent access
- Action necessary to increase access to IPRs
- Interventions like TRIPS cause for concern
Resolving the diffusion/development dichotomy

- IPRs sometimes necessary but not sufficient for technology transfer

- Innovation capacities will underpin sustained development via both:
  - **Diffusion** of existing low carbon technologies
  - Sustainable economic **development** based on the adoption, adaption and development of low carbon technologies that fit bespoke conditions in developing countries
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Implications & opportunities for Africa

• Engagement with negotiations
  • Climate Innovation Centres
  • Reformed CDM

• Opportunities for harnessing investment
  • Climate funds
  • Donors
  • Private sector
Key messages

• National development strategies & PRSPs aligned with low carbon development aims & priorities
  • Align strategic objectives with donors’, investors’ & climate funds’ priorities

• Articulate context-specific low carbon energy needs
  • Include engagement with UNFCCC TNA approach and emerging climate innovation centres imitatives

• National policy based enabling environment
  • Regulations governing market access
  • Financial assistance and incentives
  • Addressing subsidies for conventional energy

• Building innovation capacities (fundamental to future development)
  • Focus on partnerships & learning through technology transfer
  • Also bespoke training initiatives e.g. international exchanges & knowledge sharing
  • Build on opportunities for regional cooperation