Patents and Clean Energy

Bridging the gap between evidence and policy

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Conference on Innovation and Climate Change

Topics

- An innovative *partnership*: UNEP, EPO, ICTSD
- The patent landscape of clean energy technologies (CET)
- Cooperation in CET
- Main findings and conclusions

JOINT PROJECT, BUT I DON'T REPRESENT ON OCASSION THE 3 MAIN ORGANIZATIONS

The partnership

✓Three distinctive organizations with support from OECD's Environment Directorate and in cooperation with business associations

✓The rationale

- IPRs and ESTs an ongoing and controversial issue
- Existing asymmetries in ownership of IP assets and technology exchanges
- What was missing in the debate to address climate change imperatives?

✓The exercise

- Simultaneous work on a technology mapping combining a patent landscape and survey of licensing practices
- Data includes worldwide patent documents

Starting point: Technology mapping commissioned by ICTSD -renewable energy sources- validated by experts of the Intergovernmental Panel on Climate Change (IPCC). Carried out by Energy Research Centre of the Netherlands (ERCN):
it was used to define fields for the patent landscaping for the current project
Future work might involve Buildings and Transportation

✓Technology transfer is a key objective of the United Nations Framework Convention on Climate Change (UNFCCC

✓Article 4.5 requires developed countries to "take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to environmentally sound technologies and know-how to other Parties, particularly developing country parties to enable them to implement the provisions of the Convention."

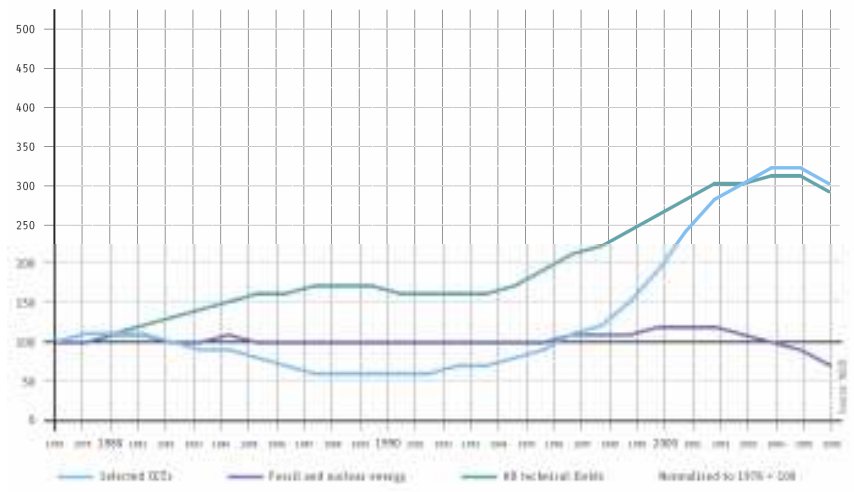
✓Article 4.7 establishes a link between the extent to which developing countries will implement their commitments under the UNFCCC and the effective implementation by developed countries of their commitments relating to financial resources and the transfer of technology.

Clean energy technologies and patents: issues at stake

- General use of patents
- ~~Incentive to innovate~~
- Access to technologies
- ~~Flow of technical information~~
- Licensing
- Technology transfer

The technology landscape: an overview

Growth rate of clean energy technology patenting

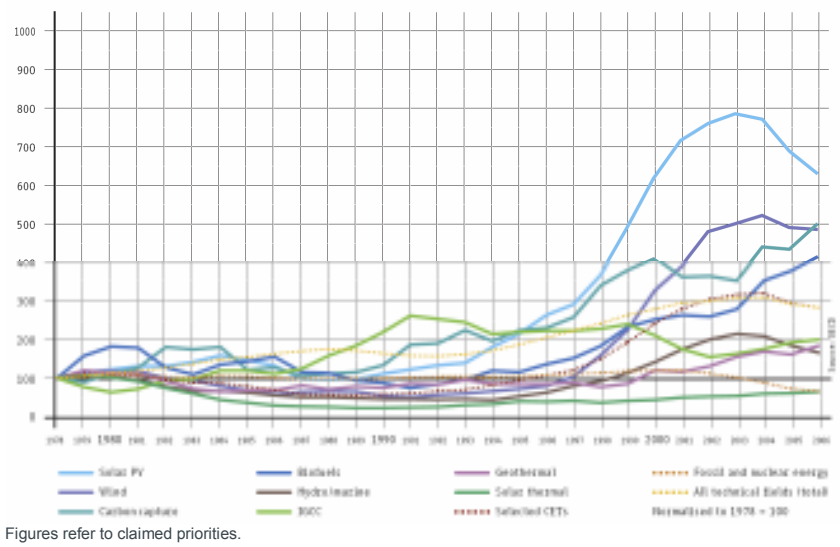


Figures refer to claimed priorities.

- ✓ [Indeed, patenting activity in 'clean energy' technologies has been much greater than in traditional fossil-fuel energy sectors.
- ✓ In view of the large number of technologies existing in the field, the study was limited to analysing patenting trends for selected technology domains, categorised according to the energy source. Selected CETs:
  - Solar Photovoltaic (PV),Solar Thermal, Wind, Geothermal, Hydro/marine, Biofuel, Carbon Capture and Storage (CCS), Integrated Gasification Combined Cycle (IGCC)
- ✓ The analysis for DE. JP and US shows that while R&D budgets dedicated to traditional energy sources have generally decreased, government R&D spent on renewables has remained more-or-less stable.

However, without further analysis it is difficult to draw conclusions about the role of government R&D relative to other determinants that may encourage inventive activity.]

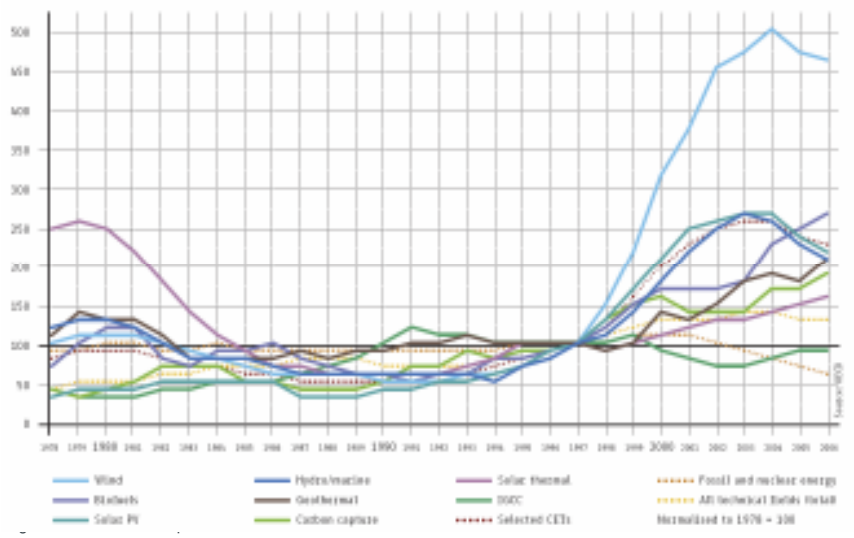
Relative growth rate for selected clean energy technologies



Figures refer to claimed priorities.

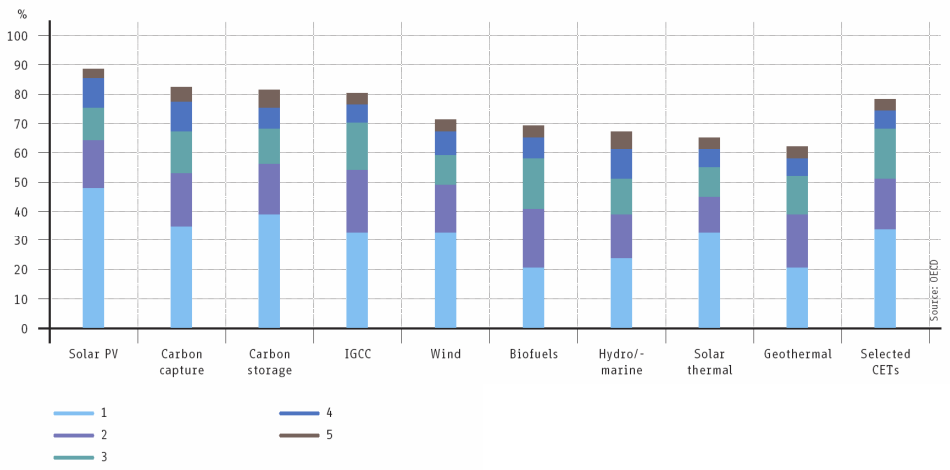
[Wind power, solar photovoltaic (but not thermal) and CO2 capture have been exhibiting particularly rapid growth in recent years.]

The Kyoto effect?
Disaggregated data



[Surge of in patenting activity in the selected CET occurred around 1997, when the Kyoto Protocol was signed.]

Country specialisation by field



Proportion of claimed priorities of top five inventor countries; for each CET field relative to claimed priorities worldwide in this field (1988–2007)

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- ✓ **[This figure shows the proportion of claimed priority applications that the top 5 inventor countries comprise.**
- ✓ **Overall, nearly 80% of all examined patents come from the top five inventor countries, namely Japan, the US, Germany, Korea and France.]**

- ✓ [Approximately one-third are from Japan the biggest inventor country.
- ✓ The overall figures are heavily dominated by solar PV, the technological sector with the largest number of patents.
- ✓ For solar PV, 87% of counted patents are invented by 5 countries (JP, US, DE, KR and FR), with Japan inventing nearly half of all PV patents.
- ✓ Geothermal is the least concentrated technology field, with just over 60% of patents invented by the top 5 inventors, and 20% by the top inventor country (a similar percentage to biofuels).]

Going beyond statistics: cooperation, sharing of technologies

- The statistical analysis and the licensing survey provide insights on cooperation strategies, and attitudes towards sharing technologies
- Analysis gives picture of international patenting, identifying country of origin of the invention and countries where protection is sought
  - Case of carbon capture and wind energy

Patent data

While the vast majority of inventions are only patented in one country (often that of the inventor, particularly for large countries), some are patented in several countries (*i.e.* the "international patent family size" is greater than one).

Such "duplicate" applications can then be used to develop indicators of technology transfer.

Of course, patents only give the applicant protection from potential imitators. It does not reflect actual transfer of technologies.

If applying for protection did not cost anything, inventors might patent widely and indiscriminately.

Given the relative importance of developed economies in CCMT innovation, there are particular benefits from encouraging flows of climate change mitigation inventions originating in Annex 1 countries to non-Annex 1 countries.

With respect to solar PV and solar thermal technologies:

In addition to China, Korea and Taiwan, the biggest recipient countries include Israel, Brazil, Mexico, South Africa and Morocco.

China dominates as the most important recipient country, with Korea, Brazil and South Africa also important in all areas.

However, in some specific areas other countries emerge as important recipients – e.g. Morocco for wind power and Indonesia for carbon capture.

The relative importance of the source countries is also very different in the different fields.

While the US dominates PV, Europe is most important for wind power and biofuels.

While Japan is a dominant innovator in all fields, there is less evidence

Patenting trends between countries: carbon capture

Source: OECD

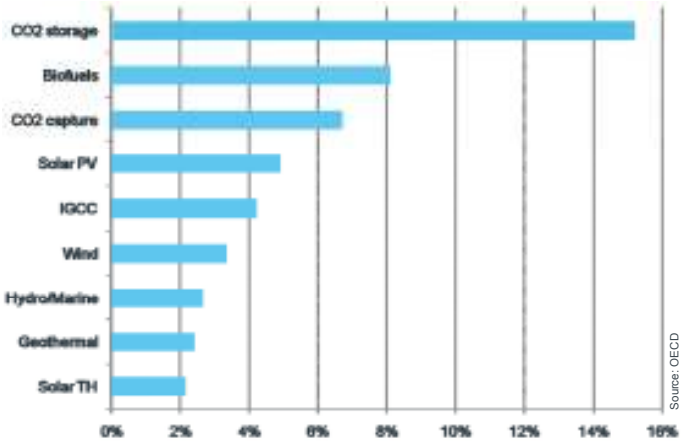
Patenting between source country (“inventor country”) and countries in which IP protection is sought.

Patenting trends between countries: wind energy

Source: OECD

Patenting between source country (“inventor country”) and countries in which IP protection is sought.

Co-inventions by sub-sector

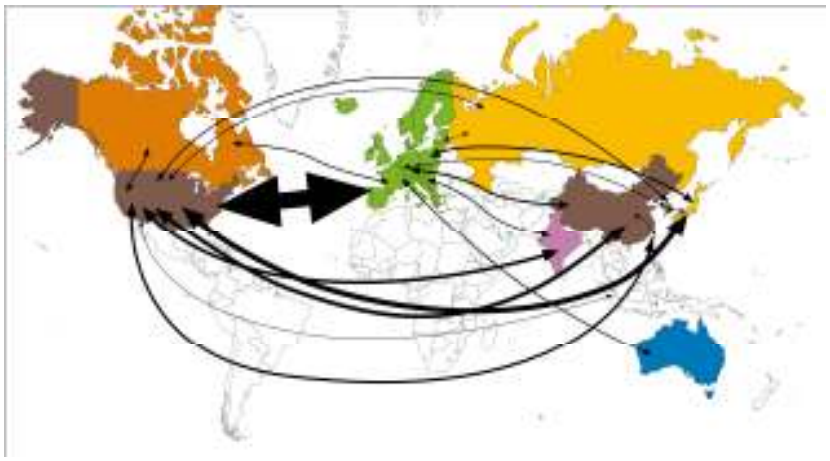


The chart shows the frequency of co-operation between inventors from different countries in the development of patented technologies.

The figure shows how frequently inventors from different countries cooperate in the development of patented technologies and the extent of internationalisation of research which is taking place in ESTs.

[Focussing on solar thermal, wind and biofuels, the maps below show the important co-invention relationships graphically.
In all areas, the United States and Europe have a high degree of cooperation.
Other interesting bilateral relationships include Belarus and Russia (solar thermal), South Africa-Europe (biofuels and wind), India-US (wind).
In addition, it is interesting to note that there is little cooperation with China in terms of wind power, despite its importance in the field.]

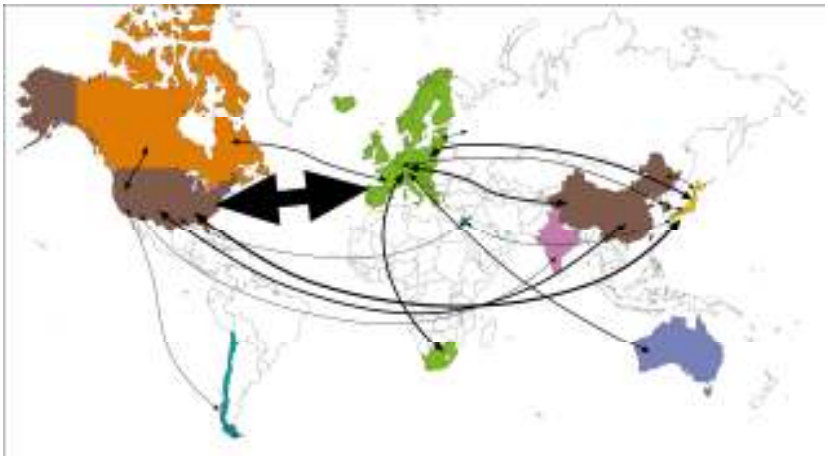
Co-inventions: solar PV



Source: OECD

The map shows the frequency of co-operation between inventors from different countries in the development of patented technologies.

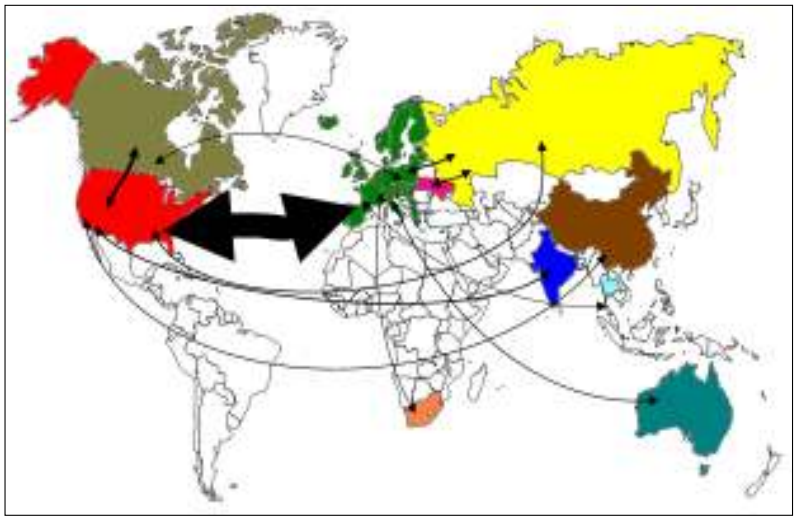
Co-inventions: biofuels



Source: OECD

The map shows the frequency of co-operation between inventors from different countries in the development of patented technologies.

Co-invention: Wind



The licensing survey

A: General questions seek to identify:
Proportion of ESTs-related patents in the overall patent portfolio of the responding organization
Importance of ESTs *Out-Licensing* and *In-Licensing* activities
Has there been a shift in the organization's business strategy towards licensing of ESTs in the past three years?
Activities that are based on additional collaborative IP mechanisms (patent pools, cross-licensing, joint ventures, strategic alliances, etc)
Relative importance different IP-related activities to the overall business strategy of the responding organization

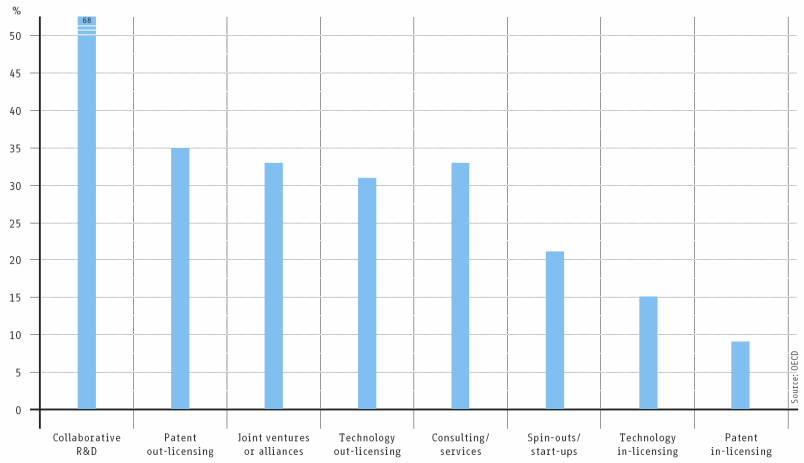
Part B: Developing countries:
The extent to which the responding organization is engaged in licensing activities in developing countries
Which developing countries?
Which factors affect the decision to enter into licensing agreements (and other collaborative IP-base activities) in developing countries:
- *Protection of intellectual property rights;*
- *Scientific capabilities,*
- *infrastructure and human capital;*
- *market conditions;*
- *investment climate.*

Willingness (ability) to provide more flexible licensing terms (including monetary ones) in developing countries

Part C:
Type of organization (private company, academic instiution, governmental body, national laboratory, consortium, etc..)
Where is it based (HQ)
Size of organization (multinational, large but focusing on domestic markets, SME, non-for profit, etc)
The ESTs fields it deals with (Wind, Biomass / Biofuels, Solar, Ocean/ Wave, Waste, etc)
Intensity of R&D activities

RANKING OF IP RELATED ACTIVITIES OF SURVEYED ORGANIZATIONS
Collaborative R&D in the vanguard

'Please rank your organisation's intellectual property activities relating to CET patents and technology (including know-how) in the following areas.'



Analysis is based on the frequency of respondents giving a high ranking (answers 3 and 4) to each activity.

RANKING OF IP RELATED ACTIVITIES OF SURVEYED ORGANIZATIONS

PartA Q4a - To what extent is your organization active in collaborative mechanisms for intellectual property rights, such as patent pools, cross-licensing, etc?

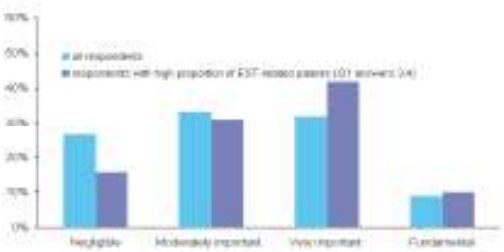
Never	24%
Rarely	39%
Occasionally	26%
Frequently	11%

PartA Q4b - To what extent does your organization engage in cooperative research and development agreements or joint venture agreements with other companies or organizations to develop or improve ESTs?

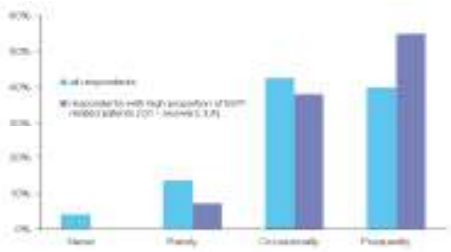
Never	4%
Rarely	13%
Occasionally	43%
Frequently	40%

Companies active in CETs more prone to collaboration and out-licensing

Importance of CET out-licensing activities



Engagement in co-operative research or joint ventures to develop/improve CETs



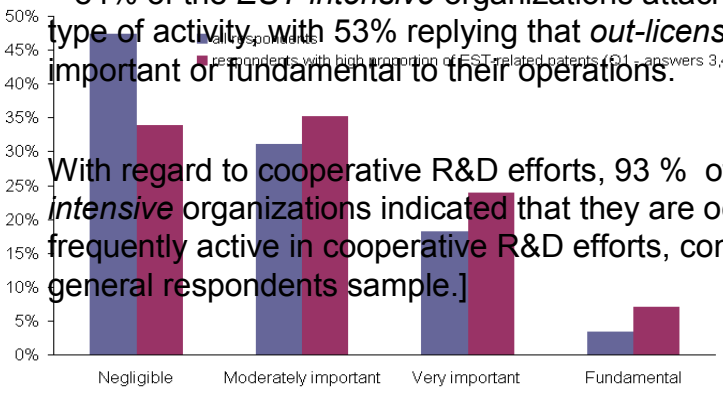
To what extent does your organization engage in cooperative research and development agreements or joint venture agreements with other companies or organizations to develop or improve EST's?

[EST-intensive organizations address greater importance to *out-licensing* activities (compared with the overall population of the survey)

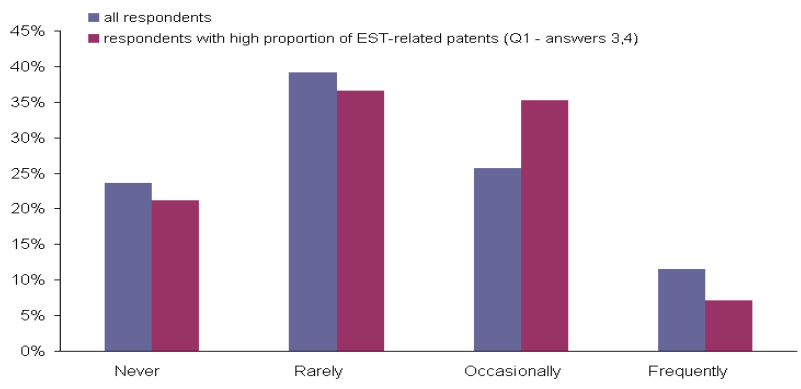
Importance of EST's *In-Licensing* activities

– 84% of the *EST-intensive* organizations attach importance to this type of activity, with 53% replying that *out-licensing* is either very important or fundamental to their operations.

With regard to cooperative R&D efforts, 93 % of the responding *EST-intensive* organizations indicated that they are occasionally or frequently active in cooperative R&D efforts, compared to 83 % of the general respondents sample.]

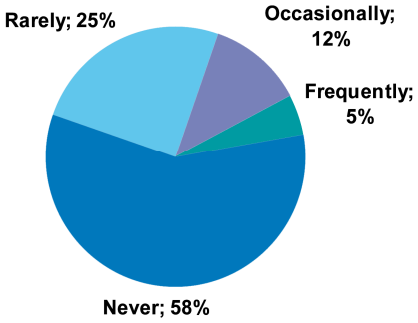


To what extent is your organization active in collaborative mechanisms for intellectual property rights, such as patent pools, cross-licensing, etc?



Licensing in developing countries

'To what extent has your organisation entered licensing agreements that involve licensees (which are not majority-controlled subsidiaries) based in developing countries in the last three years?'



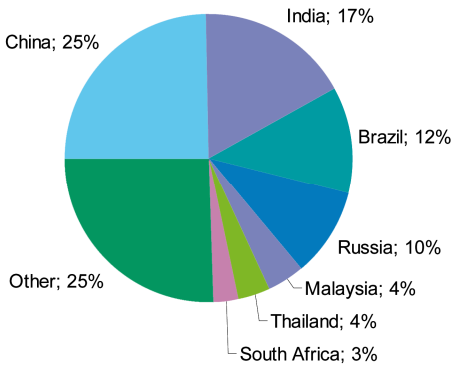
[There is overall little CET out-licensing activity towards developing countries among the survey participants, but the general level of such activity is no lower than in other industries.

Findings from other industries indicate that there are a number of hurdles to overcome in out-licensing due to factors such as the transaction costs involved, identifying a suitable partner and the right licensing conditions.

The willingness to out-license is often much higher than the actual level of licensing and this trend seems to be even greater for CETs.]

Recipients of collaboration agreements: emerging economies

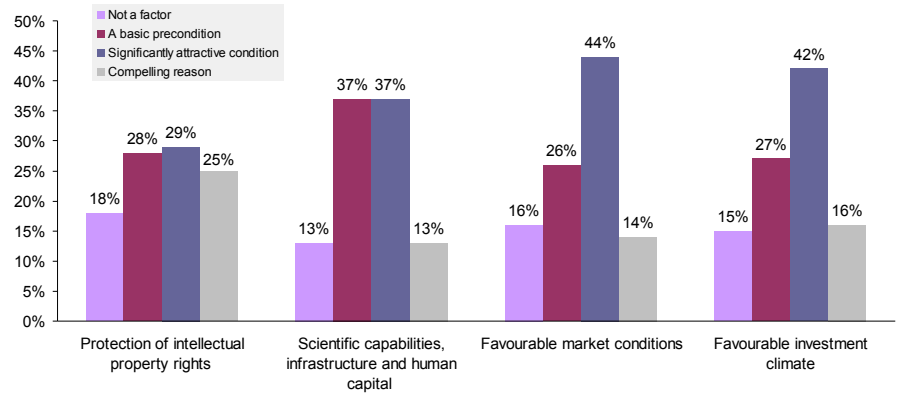
'With which countries has your organisation been most involved in licensing or other commercialisation activities of intellectual property in the field of CETs?'



[Main recipients of licensing of IPR in the field of sustainable energy technologies are fast growing developing economies of Brazil, China, India and Russia]

Factors influencing cooperation with developing countries

'When your organization is making a decision whether or not to enter into a licensing or cooperative development agreement with a party in a developing country, to what extent would the following factors positively affect your assessment?'

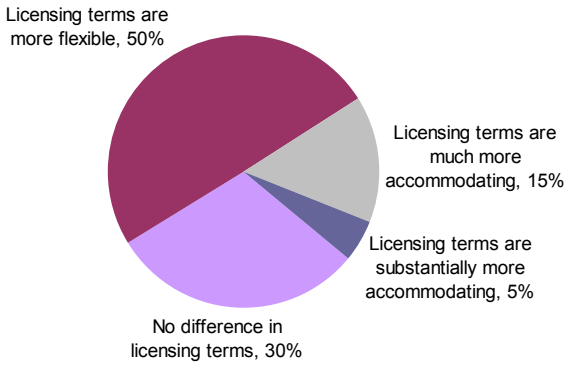


[Overall the survey finds that, together with other factors, the protection of intellectual property rights is an important factor affecting the decision to enter into licensing agreements in developing countries (82% find IP protection to be important factor, though to different degrees). That being said, the survey suggests that IPRs should be treated as one of many factors affecting the motivation to licensing. Favorable market conditions, favorable investment climate , scientific capabilities, infrastructure and human capital and IPRs all seem to have a similar weight in the decision to enter into licensing agreements (some of these factors have were found to be even more important then the protection of IPRs).

Interestingly, when drilling down into the results the survey find provides some further detailed insights. For example, in one end of the spectrum, and compared to the other factors (market conditions, investment climate, etc) slightly more respondents have considered IPRs not to be a relevant factor in their motivation and decision to license (18% in the case of IPRs compared to an average of 16% in the other areas). On the other end of the spectrum, and again compared to the other factors, more respondents have found IPRs to be pivotal to their motivation and decision to license (25% in the case of IPRs compared to an average of 15% in the other areas).]

Willingness to consider differential treatment

'When entering into an out-license agreement with parties that are based in developing countries, to what extent do the monetary terms of your license reflect your willingness to introduce greater lenience due to differences in the purchasing power of the parties?'



["Here the survey finds that 70% of the responding organizations would be willing (or already are) to make the terms of their licenses more flexible vis-à-vis entities that are based in developing countries."]

Main findings and conclusions

A. Technology mapping
B. Licensing survey
C. Conclusions

A. Technology mapping

- Patenting rates in the selected clean energy technologies (CETs) have increased
  - at roughly 20 per cent per annum since 1997
  - In that period, patenting in CETs has outpaced the traditional energy sources of fossil fuels and nuclear energy.
  - The fields experiencing the most intensive growth include solar PV, wind, and carbon capture

- The surge of patenting activity in CETs coincided with the adoption of the Kyoto Protocol in 1997
  - Providing a strong signal that political decisions setting adequate frameworks are important for stimulating the development of CETs

[Confirming WIPO PCT data: total number of PCT applications filed in 4 energy/related fields increased from close to 600 applications in 2000 to close to 3500 in 2009]

A. Technology mapping (2)

- Patenting in the selected CET fields is currently dominated by OECD countries
  - However, a number of emerging economies are showing specialisation in individual sectors, (Brazil, Mexico, China, India) providing further competition in the field and potentially changing the future of the CET patent landscape

- The leading 6 with actors innovating and patenting CETs: Japan, the United States, Germany, the Republic of Korea, France and the United Kingdom
  - Notably, the top 6 countries account for almost 80 per cent of all patent applications in the CETs reviewed, each showing leadership in different sectors
  - Concentration of patenting activity in these countries reflects patenting trends in other technology sectors

A. Technology mapping (3)

- A number of countries emerge as significant actors in selected fields when CET patent data is benchmarked against total patenting activity (all technology sectors) in a given country
  - Such an analysis reveals that India features within the top five countries for solar PV and carbon capture, while Brazil and Mexico share the top two positions in hydro/marine. Ukraine occupies the top position in biofuels
- The two emerging economies of China and India register relatively low patenting rates, not ranking in the top ten patenting countries in the selected CETs
  - China places tenth in solar PV, giving a similar picture in the biofuel sector.

In terms of patent filing trends between countries (structure of patent families), most activity is currently taking place in the patent offices of the top six patenting countries.

However, China is the next most important filing destination for actors in the top six countries.

B. Licensing survey

- There is little overall CET out-licensing activity towards developing countries among the survey participants
  - The general level of such activity is no lower than in other industries
- There is a need to improve market conditions and encourage licensing in the context of efforts to enhance technology transfer to developing countries
- Where licensing agreements have been entered into, the main beneficiaries are actors in China, India, Brazil and Russia
- IP protection in the country of the licensee is an important consideration when determining whether to enter into a licensing agreement but not the only significant factor

✓ [Findings from other industries indicate that there are a number of hurdles to overcome in out-licensing due to factors such as the transaction costs, identifying suitable partners and licensing conditions.]

B. Licensing survey (2)

- Respondents attach slightly more weight to factors such as scientific infrastructure, human capital, favourable market conditions and investment climate
  - Licensing-intensive respondents attach somewhat greater importance to IP protection than to these other factors
- The majority of organisations favour collaborative R&D activities, patent out-licensing and joint ventures over mechanisms such as patent pooling and cross-licensing
- High proportion of respondents (70 %) are prepared to offer more flexible terms when licensing to developing countries with limited financial capacity
  - Academic institutions and public bodies are slightly more willing than private enterprises to provide accommodating licensing terms to developing-country recipients
  - Small and medium-sized enterprises seem slightly more willing to offer more flexible terms

C. Conclusions

- Difficult to isolate IP issues from macroeconomic factors (market size, local capabilities) and in general *framework conditions* to enhance innovation and facilitate transfer and diffusion of ESTs
- Joint UNEP-EPO-ICTSD study has moved the debate forward by providing evidence on what is known on available CET, patents trends and cooperation opportunities
- It has made a step forward in terms of transparency on information
  - EPO has introduced a new classification scheme for CET The EPO making this strategic resource available to the public (esp@cenet and PATSTAT database)

[Summarising advantages of EPO's new classification system

•More than 200 new categories related to clean energy technologies, enabling public and continuous flow of information

•Worldwide coverage of all available patent data

•All relevant technologies gathered together in one place

•Detailed break-down to component level

•Regularly updated with the newest patent publications

•Open and transparent procedure (several checks with external experts at interfaces), highest expertise in the field (patent searches carried out by EPO examiners)

•Extension to all mitigation (and also key adaptation) relevant sectors possible (if there is a political need)]

C. Conclusions (2)

- Most technology exchanges including cooperation activities is within the North or involving limited partners in the South
- Project focused on cooperation activities, mainly licensing.
  - Avenue not clearly open to the great majority of developing countries
- IPRs constitute an incentive to promote innovation and facilitate international transfer of technology by offering protection against a loss of control of information
  - But, IPRs have also an impact on access, availability, costs, rate of technology diffusion and competition
- Need to examine new initiatives -market and non-market- to facilitate access and dissemination of climate change technology.
  - A number of old-new ideas are under examination
  - Conference offers such an opportunity…

FINALLY…

Old and new initiatives: a summing up

1.Patent differentiation

2.Voluntary patent pools

3.Licensing strategies

4.Compulsory licensing

5.Patent exclusions, limitations

6.Public research grants

7.Partnerships

8.A technology mechanism

Climate change ICTSD selected publications

•Developing Countries: An Analysis of Solar Photovoltaic, Biofuels and Wind Technologies, John Barton, ICTSD Trade and Sustainable Energy Series, Issue Paper No. 2. (2007)

•Access to Climate Change Technology by Developing Countries. A Practical Strategy, Cynthia Cannady, Issue Paper 25 (2009)

•Fostering the Development and Diffusion of Technologies for Climate Change: Lessons from the CGIAR Model, Carlos M. Correa, Policy Brief Number 6, December 2009

•Technologies for Climate Change and Intellectual Property: Issues for Small Developing Countries, Moustapha Kamal Gueye, Information Note 12, October 2009

•Innovation and Technology Transfer to Address Climate Change: Lessons from the Global Debate on Intellectual Property and Public Health, Frederick Abbott, Issue Paper 24 (2009)

•Intellectual Property and Access to Clean Energy Technologies in Patent and Clean Energy: Bridging the Gap between Evidence and Policy, UNEP-EPO-ICTSD Report, 2010

•Intellectual Property Rights and International Technology Transfer to Address Climate Change: Risks, Opportunities and Policy Options, Keith Maskus and RuthOkediji, Issue Paper No. 32 (2010)

•The Climate Technology Mechanism: Issues and Challenges, ICTSD Information Note 18, (2011)

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