RSM International
global excellence in audit, tax & consulting

Talking Points

Clean Technology in Europe

David Bartlett
Economic Advisor, RSM International

Amid rising concerns about global climate change and growing anxieties over regional energy security, the European Union has launched a range of initiatives to spur adoption of clean technologies:

- 20-20-20 Directive, which sets clean energy goals for 2020 (20 percent cut in energy consumption; increase of the renewable share of EU energy consumption to 20 percent; reduction of greenhouse gas emissions by 20 percent below 1990 levels)
- Strategic Energy Technologies (SET) plan, which seeks to position Europe as a leader in clean technologies through systematic coordination of national- and supra-national resources
- EU Roadmap for a Low Carbon Economy, whose aspirations for 2050 go well beyond the 20-20-20 targets (80-95 percent reduction of greenhouse gases from the 1990 level)

The slow and halting recovery from the global financial crisis has dampened private investment in clean technologies, while the fiscal consolidation underway in many EU countries has constrained public financial support of renewable energy projects.

But the challenging economic environment has not diminished the European Union's official commitment to clean technologies. Indeed, in 2010 the European Commission broached the possibility of raising the 2020 emissions reduction target from 20 to 30 percent if circumstances warrant. EU authorities are also proceeding with their plans to revamp the Emissions Trading Scheme (ETS) in 2013, when they will set a community-wide emissions cap to establish a stable and predictable carbon price.

The course of Europe's pursuit of a clean energy future ultimately depends on private sector investment in new and emerging technologies, whose development and commercialisation are essential to meet the EU's ambitious goals. This article examines the state of play in European clean technologies, focusing on the role of patents in clean technology innovation.

Innovation in Clean Technology

In September 2010, the United Nations Environment Programme (UNEP), the European Patent Office (EPO), and the International Centre for Trade and Sustainable Development (ICTSD) issued a report detailing the findings of a global study of clean technologies. The report, which draws on a large-N international survey and a database on global patenting, represents the most comprehensive study to date of innovations in clean technology.

Scholars of technological development have long used patents as a measure of the innovative capacity of national economies, regions and companies. Patents are an imperfect measure of innovation. Many patents are filed by university researchers who have no intention of taking their inventions to market. Other patented technologies languish in corporate R & D labs, thwarted by financial and operational hurdles to commercialisation. Other patents are taken out for purely defensive purposes to preempt rival inventors from capturing revenue streams. Moreover, patent-centric research fails to account for path breaking innovations emanating from small and medium enterprises and business startups that choose not to patent their technologies for financial, legal or strategic reasons.

But within those qualifications, patents are widely accepted as a proxy for technological innovation. Below the findings of the UNEP/EPO/ICTSC study of patenting activity in clean technology are highlighted:

1. Among the key clean energy technology (CET) categories, solar photovoltaic captured the largest share (57 percent) of issued patents between 1998 and 2007. Wind power ranked second with 14 percent of CET patents, followed by hydropower (12 percent), solar thermal (10 percent), biofuels (5 percent), carbon capture and storage (4 percent), and geothermal (2 percent).
2. Solar PV also registered the highest rate of patent growth during this period, followed by wind, carbon capture and storage, and biofuels.
3. There was a quickening of clean technology patents (led by wind power) following the 1997 Kyoto Protocol, which established targets for greenhouse gas reductions under the United Nations Framework Convention on Climate Change. CET patenting activity slowed in the early- and mid-2000s, when uncertainties over the position of the United States (which never ratified the Protocol) raised doubts about the robustness of the UN Framework. The UNEP/EPO/ICTSC study does not cover the post-2008 period to show the patent-related effects of the financial crisis and the follow up (and widely derided) Copenhagen Accord.
4. Developers of clean technologies show a high sensitivity to global market signals. For example, trend line data show a strong correlation between world petroleum prices (which have fluctuated widely since the oil shocks of the 1970s) and biofuels patenting (the commercial prospects of which are strongly influenced by price parity with conventional fossil fuels).

5. The study indicates uneven correlation rates between clean tech patents and CET-related research and development. The correlation is high with carbon capture, a hugely expensive and highly risky early stage technology for which patents are a necessary precursor to heavy R&D investments. But the patent/R&D correlation is weak for geothermal, a relatively mature technology for which patents are evidently not a pre-condition for R&D expenditures.

European Clean Technology Patents

The UNEP/EPO/ICTSC study confirms Europe's standing as primary source of innovative clean technologies. Japan is the overall leader in clean tech patents, followed by the United States and Germany.

As shown in the exhibit below, European countries figure prominently in each of the CET categories covered in the report:

1. Germany is the world leader in wind patents, and ranks third in solar patents. Within the solar category, Germany is the leader in solar thermal technology despite the country's cloudy climate. Other European countries occupy leading positions in intermittent renewables: Denmark, France, Italy, Netherlands, Spain, United Kingdom.

2. Europe's successes in solar and wind power clearly reflect the technological capabilities of European-based energy companies (Accionia, Coenergy, EDF, Q-Cells, Torresol, etc.) and equipment manufacturers (e.g., Bosch and Siemens) active in the renewable energy market.

3. Some observers also attribute Europe's promise in these intermittent renewables to feed-in tariffs (FIT), which are presumed to incentivize clean technology investments by enabling renewable energy providers to negotiate long-term pricing contracts. The absence of a European-style FIT system is seen as a barrier to clean tech development in the United States, which issues large numbers of patents for technologies originating in American universities that end up being commercialised in the more forgiving markets of Europe and Asia.

4. However, the UNEP/EPO/ICTSC study yields inconclusive results on the relationship between feed-in tariffs and clean tech patents.

Innovation in Clean Technology

Leaders in Clean Tech Patents, 1988-2007

Country Ranking	Solar	Wind	Biofuels	Geothermal	Hydropower	Advanced Hydrocarbon
#1	Japan	Germany	U.S.	U.S.	U.S.	U.S.
#2	U.S.	U.S.	Germany	Germany	Germany	Japan
#3	Germany	Japan	Japan	Japan	Japan	Germany
#4	South Korea	Denmark	France	Israel	U.K.	France
#5	France	Spain	U.K.	Austria	France	U.K.
#5	U.K.	U.K.	Italy	Canada	Italy	Norway
#7	Taiwan	France	Austria	France	Canada	Canada
#8	Netherlands	Netherlands	Canada	Netherlands	Norway	Netherlands
#9	Italy	Canada	Netherlands	U.K.	Switzerland	Italy
#10	Switzerland	Italy	Switzerland	Italy	Australia	India
Top Emerging Market Patent Issuers	**China India Russia**	**China Russia Ukraine**	**China India Brazil**	**China Hungary CZ Republic**	**China Brazil Russia**	**India China Russia**

SOURCE: UNEP/EPO/ICTSD, *Patents and Clean Energy: Bridging the Gap Between Evidence and Policy,* September 2010

Germany experienced a marked increase in patenting activity in solar photovoltaics following the introduction of that country's much-lauded FIT system. But wind-related patents grew only modestly in Germany under the FIT regime. Spain, which introduced an aggressive FIT system covering solar PV as well as solar thermal and wind, experienced an over-investment in renewable energy that exerts a drag on that country's recovery from the economic downturn. By contrast, the feed-in regime of Denmark appears to have boosted that country's thriving wind energy industry. These results suggest that the impact of feed-in-tariffs on clean tech innovation depends not on the presence or absence of FIT regulations, but rather the design and administration of such regulations.

5. Europe occupies a leading position in biofuels, reflecting its historical dominance of mature biomass industries like anaerobic digestion and combined heat and power as well as European advances in pre-commercial technologies like cellulosic ethanol. Europe is a key player in geothermal (a location-specific industry with comparatively low technological content) and hydropower (another mature industry that has not experienced the technological breakthroughs of other clean energy industries). Europe is a world leader in advanced hydrocarbon, including next generation carbon capture and storage (CCS) technologies that offer a bridge from conventional to renewable energy.

Conclusion: Drivers of Technological Innovation

The preceding analysis shows that patents play an indispensable role in clean technology innovation by reducing the proprietary risks of clean tech investments and providing a legally defensible barrier to emulation of emerging technologies that confer a competitive advantage to their inventors.

But while patents are a key part of the clean technology landscape in Europe and other regions, the migration of innovative technologies from the laboratory to the market hinges on a broader range of factors:

- Favourable regulatory environment; global market prices of conventional energy sources
- Readiness of buyers to adopt potentially disruptive technologies
- The persistence and imagination of clean tech innovators

About David Bartlett

David Bartlett, Economic Consultant, has over ten years' experience of consulting, researching and teaching on international corporate strategy. He specialises in international growth, global manufacturing, foreign sourcing and distribution and corporate risk management.

David is Adjunct Professor of Strategic Management and Organization at the Carlson School of Management, University of Minnesota. He has also held faculty appointments at Vanderbilt University (USA), Yerevan State University (Armenia), and the University of World Economy and Diplomacy (Uzbekistan).

David has received a Fulbright Senior Scholarship, Salzsburg Seminar Fellowship and other scholarly awards. He holds a PhD and BA from the University of California and an MA from the University of Chicago.

E: david.bartlett@rsmi.com

About RSM International

RSM International is a worldwide member organisation of independent accounting and consulting firms. RSM International is represented in 83 countries and brings together the talents of over 32,500 individuals worldwide. The organisation's total fee income of US$3.8bn places it amongst the top ten international accounting organisations worldwide. Member firms are driven by a common vision of providing high quality professional services, both in their domestic markets and in serving the international professional service needs of their client base.

www.rsmi.com