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Clean Economy, Living Planet

Building strong **clean energy technology** industries

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0 Executive Summary

This report is the first ever comparison of countries on the basis of sales of their clean technology products. It includes the 27 EU member states and all G7 and BRIC countries and the major renewable energy and energy efficiency segments. All segments of sales are added to yield an aggregate country ranking by sales. A country's position in the ranking reflects its ability to produce and sell products and services that reduce CO_2 emissions. High ranking countries also generate high economic value and employment for a skilled workforce. Denmark, Brazil and Germany lead the ranking. China is the sixth largest. On the basis of an analysis of these sector leaders and interviews with international experts a number of success factors are identified as a "lessons learned".

The market for clean technology (CET) is booming, and was in 2007 larger than the pharmaceutical industry. It will be the 3rd industrial sector in the world in 2020 (EUR 1600 billion)

The worldwide market for clean energy technology is growing fast. Between 2000 and 2008 wind energy was growing worldwide with 24% a year, biodiesel with 31% and solar with 53%.

With a total volume of EUR 630 billion a year in 2007 the clean energy technology market is already larger than the pharmaceutical industry worldwide. Sales form energy efficiency products was EUR 540 billion, and renewable energy technologies contributed EUR 91 billion. Despite the crisis it is expected that this growth will continue with 5% a year for efficiency and 15% for renewables (in a conservative IEA 450 scenario). This will result in a total market volume of EUR 1600 billion a year in 2020, making it one of the largest industries in the world.

*WWF made the first ever country ranking based on clean energy technology **sales** and it is topped by Denmark, Brazil and Germany*

If you look at relative income from sales (weighted by GDP) Denmark, Brazil and Germany are ranking highest. The Danes are world market leader in wind turbines and insulation, with which they are number one. Brazil is at number two because of her large scale production of bio-ethanol. Germany has a long tradition in building machinery and equipment which made a good basis for her clean technology industry. Germany excels in several technologies, particularly in wind- and solar energy.

Countries aiming to develop their Clean Energy Technology sectors should emulate the leaders and:

- Launch Technology Action Programs that develop a single technology from research to demonstration. This will make government support more consistent and bridge the gap between academia and industry.

- Central banks should encourage the integration of CO_2 risk into financial models to facilitate a shift towards "clean" investments. More capital must also be raised for seed investment in Clean Energy Technology ventures.

- Develop a strong home market for Clean Energy Technology applications by influencing the purchasing decisions of government, business and consumers through government procurement, greater stability in (policies on) sustainable energy subsidies and tax differentiation.

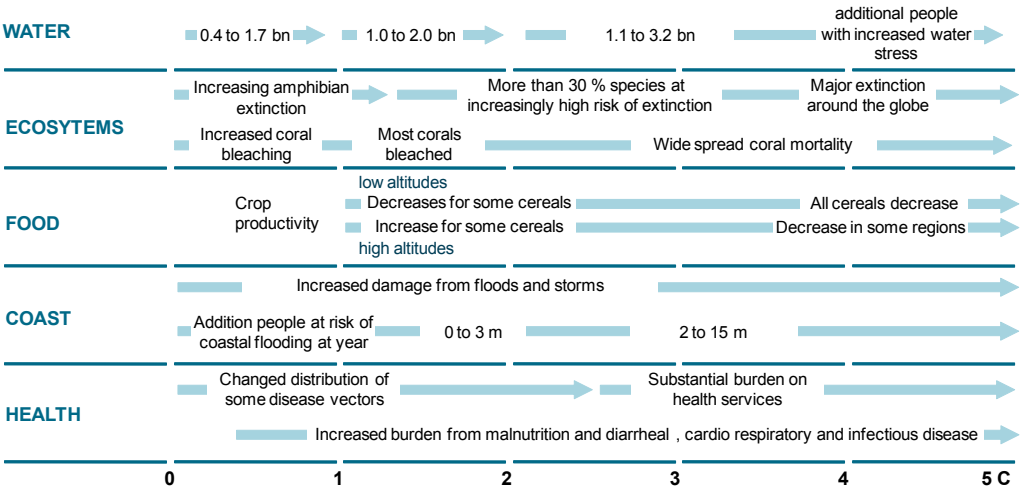
Contents

1 The urgency of Clean Energy Technology

Clean Energy Technology is essential to limiting global warming and protecting ecosystems by reducing CO_2 emissions through energy efficiency and renewable energy

Climate change comes at a cost to both our economy and our environment. As temperatures rise agricultural output will fall, damage from floods and storms will increase, (tropical) diseases will become more prevalent and access to water will become more of a problem for more people. The cost of inaction has been estimated between USD 20 and 26 trillion in 2100.[1] The Stern report commissioned by the British government put the cost at a 5 to 20% reduction in GDP. But that is just the financial aspect. The cost to our environment is greater and irreversible. The Earth's flora and fauna will suffer both directly from higher temperatures and indirectly through the damage to their habitats. Ecosystems will disappear. Even small temperature increases will cause coral bleaching and threaten some amphibians (see figure 1). Temperature rises of 3° or 4°C and more will lead to major extinctions around the globe.

Figure 1 – The impact of rising temperatures (examples)



Source: WWF NL, UN Intergovernmental Panel on Climate Change

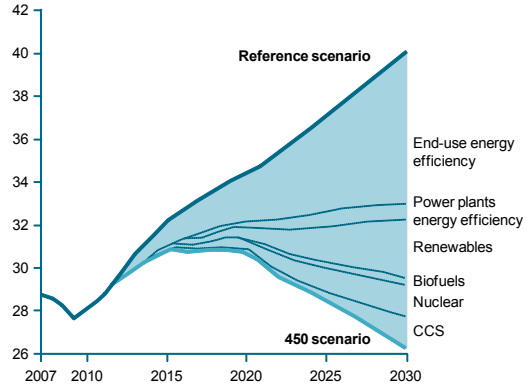
[1] *Average annual costs, based on Kemfert 2005, Watkiss, 2005 and Ackermann, 2006*

1.1 CO_2 emissions must be reduced to limit global warming to 2°C and limit the harmful and irreversible impacts on ecosytems

In 2009, G8 leaders agreed to CO_2 emission cuts that would limit global warming to 2°C above pre-industrial levels. Any rise above that level risks the extinction of 20-30% of the Earth's wildlife. Global warming's threat to the natural habitats of at least 2,500 species has placed these species on the "red list".[2] Examples include polar bears on melting ice caps, tigers competing with men for food and orang utans finding less and less fruit due to shifting rain patterns. If we assume no new government policies beyond those already adopted by mid-2008, the International Energy Agency (IEA) has calculated that global primary energy demand will expand by 45% percent between 2006 and 2030, putting us on a path towards a 6°C rise in global temperatures.

To limit global warming to 2°C, the IEA proposes a "450 Policy scenario" that aims to stabilize the amount of CO_2-eq in the atmosphere at 450 ppm (parts per million), which requires at most 26.4 Gigatons of CO_2 emissions by 2030.[3]

Figure 2 – World energy-related CO_2 emissions abatement and 2008 investments required [Gt, USD bn]



Source: IEA 2009

Figure 2 shows that energy efficiency and renewables deliver the highest contribution to CO_2 abatement options are the most important options to achieve the 450 scenario. It should be noted that even in the 450 policy scenario there is a 50% probability that temperature increases will exceed 2°C. It we are to stand a real chance of preventing worse damage to (inter alia) ice shields, forests and small island nations, we must eventually be below 350 ppm CO_2-eq. More needs to be done.[4] However, it is encouraging that in July 2009, in L'Aquila, G8 leaders committed themselves to the 2°C ceiling and to working towards an 80% reduction in their CO_2 emissions by 2050.

[2] *Based on database retrieval from the International Union of Conservation of Nature's red list*

[3] *From IEA World Energy Outlook 2009 excerpts*

[4] *The 450 policy scenario calls for significant mitigation measures to be taken immediately, achieving peak emissions as soon as possible (but no later than 2015) and reducing them by at least 3% annually thereafter. However, if we want to avoid additional irreversible consequences and (ecological and economic) costs, we need to cap emissions at 400 ppm CO_2-eq or even reduce levels to 350 ppm CO_2-eq (from today's estimated 396 ppm CO_2-eq).*

1.2 Clean Energy Technology reduces CO_2 emissions by increasing energy efficiency and enabling alternative sources like solar, wind and biomass

It is not energy use per se that causes global warming. It is the emission of CO_2 that results from burning fossil fuels to generate energy. Solutions should therefore be sought not only in reducing primary energy demand but in alternative sources that do not emit CO_2. In the 450 Policy scenario energy efficiency must result in a 16% reduction in total energy use relative to the reference scenario and renewable energy supply must increase by 42% – both by 2030 (see figure 3). Clean Energy Technology enables both.

Energy efficiency is the most cost-effective way to reduce CO_2 emissions. Simply put, using less energy not only saves fossil fuel but money. Thus the investments needed are offset by lower energy bills that result from lesser volumes and lower prices (due to falling demand). Clean Energy Technology contributes to energy efficiency by enabling, for example, low-energy lighting, better insulation and more effective energy storage.

Solar, wind and biomass sources do not cause CO_2 emissions. Solar and wind can be used to generate heat and electricity, and biomass has the additional advantage that it contains molecules that can be converted to liquid form to replace fossil-based transport fuels. Clean Energy Technology enables these solutions by developing solar cells and wind turbines, electric cars and biofuels.

Clean Energy Technology therefore is defined as those technologies that contribute directly to reducing CO_2 emissions. There are other technologies that are equally necessary and valuable, such as the recycling of fossil-based materials, material efficiency and carbon capture and storage. These, however, affect CO_2 emissions only indirectly or in the case of CCS, only present a solution after CO_2 has been created (end of pipe).

Clean Energy Technologies, thus defined, are urgently needed to cut CO_2 emissions, limit global warming and protect crucial ecosystems. The market is responding. The next chapter analyzes the size and growth of Clean Energy Technology markets and the leading countries therein.

2 Clean Energy Technology and its global market leaders

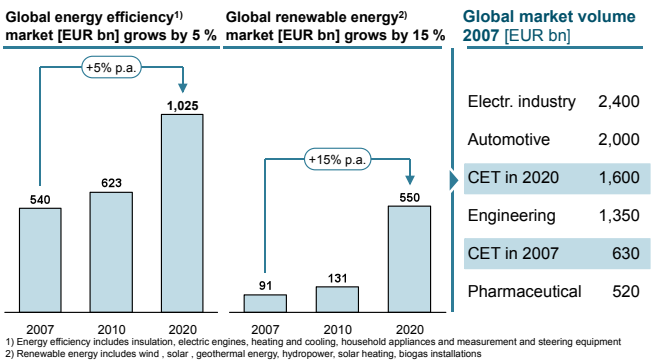
The market is responding to climate change by developing Clean Energy Technologies.

In the 450 policy scenario, energy efficiency and renewable energy solutions must be applied on a large scale. Clearly that implies significant business opportunities for any technology that enables these solutions. Clean Energy Technology is set to become the next economic boom, similar to the internet in the 1990s. This chapter analyzes that market, its expected growth and the relative position countries when compared by their (GDP-weighted) Clean Energy Technology sales.

2.1 Clean Energy Technology is a growth market that is expected to reach EUR 1.6 trillion by 2020 and thus an attractive business opportunity

Clean Energy Technology is already a large and growing market today. With total sales of EUR 630 billion in 2007, it is bigger than the global pharmaceutical industry. The Clean Energy Technology market consists of two segments. Energy efficiency sales in 2007 totaled EUR 540 billion, renewable energy added EUR 90 billion (see figure 3). By 2020, Clean Energy Technology will be one of the world's main industries. In a business-as-usual scenario, the energy efficiency and renewable energy segments will grow by 2.5% and 9% per year to EUR 790 billion and 275 billion respectively in 2020. This is not surprising. Between 2000 and 2008, worldwide annual growth averaged 24% for wind energy (from 4 to 27 GW annual installed capacity), 53% for solar (0.3 to 5.6 GW annual installed capacity), 31% for biodiesel (2 to 11 Mton output) and 29% for energy-saving light bulbs (from 528 million to 2.4 billion units sold).[5]

Figure 3 Market development energy efficiency and renewable energy 2007-2020 [EUR bn]



Source: GreenTech made in Germany 2.0, Roland Berger Strategy Consultants

[5] *Based on figures from GWEC, EPIA, Emerging Markets and World Watch Institute, energy-saving light bulbs includes figures from 2000 to 2006.*

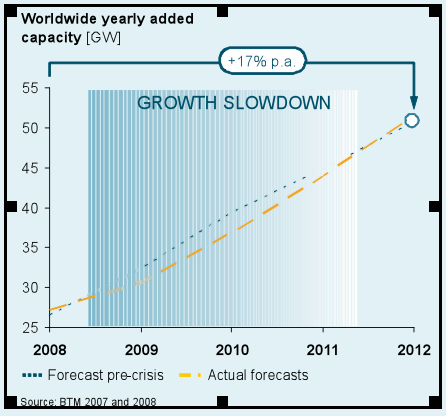
In the 450 policy scenario, average annual growth is expected to be even higher: 5% for energy efficiency and 15% for renewable energy.[6] That will result in a EUR 1,600 billion total market for Clean Energy Technology in 2020, making it one of the world's biggest industries after automotive and electronics. We have used this 450 scenario to show what is possible and necessary in the Clean Energy Technology sector even if this scenario is not sufficient enough to lead to a well-below 2 degree world. Imagine where Clean Energy Technology will be if are more ambitious in fighting climate change.

Government targets will drive this market. The EU objectives of 20% renewable energy supply in 2020 alone translate into an annual additional market demand for more than 47 Gtoe in 2020, which shows an annual growth of 27% between 2012 and 2020. The US has no targets at the federal level, but 19 states have set targets for energy efficiency and 29 for renewable energy (of which 17 aim for 20% or more). China wants to see a 15% share of renewable sources in primary energy demand by 2020, but already has plans to increase it to 20 % and has included a reduction in energy consumption per unit GDP of 20% per 2010.[7]

The financial and economic crisis will have limited impact on forecasted growth. (Private) investments may be delayed, but most public stimulus packages contain (incentives for) sustainable investments. Wind is one example (see box insert). In short, we can expect robust growth in demand for Clean Energy Technology and attractive business opportunities for companies that can make it work.

BOX: Pre- and post-crisis forecasts for wind energy

Before the crisis, wind energy was expected to add 17% of capacity (in gigawatts) each year between 2008 and 2012. In 2009 this growth is now expected to slow to about 10-11% , due to financing conditions (15-30% equity now required), low oil prices (less urgency, longer paybacks) and general economic uncertainty.



However, this will pick up. In 2012, worldwide capacity is still expected to reach 50 GW (see graph). Both incidental and structural drivers remain. Wind is especially supported in most economic stimulus packages, growth will be strong in countries less dependent on financial markets (most notably China), governments have set ambitious targets in the US, Europe, China and India, and Europe's Emissions Trading Scheme (ETS) carries cost penalties for fossil energies.

[6] *BMU Greentech 2.0 and Roland Berger analysis*

[7] *Based on Laura Fulley, American Council for an Energy-Efficient Economy, Directive 2009/28/EC of the European Parliament and of the Council and The Guardian (2009), Martinot (2007)*

The bottleneck to the large-scale application of Clean Energy Technology will clearly not be a lack of demand. True, wind parks will have to be built, solar cells installed, houses insulated and electronic and biodiesel fueled cars bought – all in large volumes. The business cases for such investments depend in part on macro-trends such as energy security (becoming less dependent on oil and gas from unreliable or politically undesirable sources), oil prices, CO_2 pricing schemes and consumer and electoral appetites for sustainable products and policies. These level the playing field between Clean Energy Technology and fossil-based alternatives. However, these macro-trends are hard to influence and already increasingly favor cleaner solutions.

The challenges are more on the supply side. To reach the targets, new technologies must be developed, technologies that exist today in the lab must be made to work and demonstrated under real-life conditions, and working applications must be made cost-competitive with existing alternatives. In other words, Clean Energy Technology businesses are needed to develop and deliver turbines, solar cells, cars, batteries, insulation materials and low-energy products – to name but a few examples. If and when Clean Energy Technologies become commercially available, they will be used. Contrary to the macro-trends that impact demand, the development of this supply side can be influenced. That makes stimulating these businesses, encouraging start-ups and helping ventures develop and grow, the best lever for accelerating the large-scale application of Clean Energy Technology.

2.2 WWF launches the first ever worldwide country ranking by Clean Energy Technology sales; the list is topped by Denmark, Brazil and Germany.

The need and potential for Clean Energy Technology, both ecological and economic, have clearly been established. However, until now a ranking of countries' sales in Clean Energy Technology does not exist anywhere. Yet there is no better way to assess both the technical and commercial viability of a country's technologies and their success in finding large-scale application. If Clean Energy Technology products and services are actually supplied to and bought by customers, those customers must find them both useful and valuable.

In this report we have therefore compiled the first such ranking. It includes the 27 EU member states and all G7 and BRIC countries and the major renewable energy and energy efficiency segments (see appendix 1 for a full list of countries and segments analyzed). Renewable energy consists of five major technologies to create heat, electricity and transportation fuels. The energy efficiency technologies are those that are only dedicated to increasing efficiency or replacing less efficient technologies. For example, insulation is only used to retain heat or cold in buildings. Heat pumps replace the older central-heating boilers. We have not included products in which incremental advances have or can be made, such as household appliances. Although the contribution of such products can be high, they are not solely dedicated to reducing CO_2 emissions.

It is important to note that we have excluded hydro power in this ranking. The environmental damage that hydro power and hydro dams may cause also contributes to global warming. Also, hydro power has been used for more than a century and so does not represent a new or innovative application of (Clean Energy) technology. We acknowledge that this is an important industry sector in countries like Austria, Germany, France and China.

Country market shares and overall volumes are listed by technology, with each step in an individual technology's value chain analyzed separately. For example, in solar we look into silicon, cells and modules.

All segments sales are added to yield the world's first aggregate country ranking by sales. A country's position in the ranking reflects its ability to produce and sell products and services that reduce CO_2 emissions. High ranking countries also generate high economic value and employment for a skilled workforce. Many have strong domestic demand and so the spin-off employment to install Clean Energy Technologies locally is also high. These so-called "green

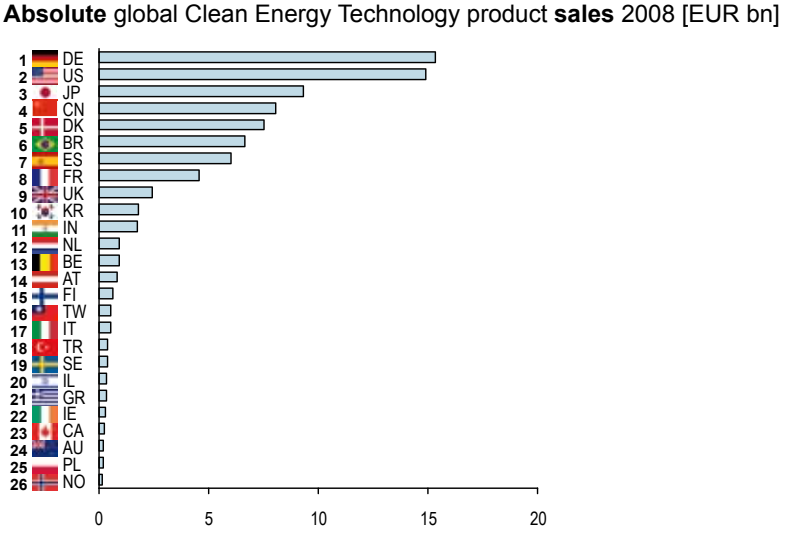
collar jobs" are local, not threatened by outsourcing and available to relatively low skilled workers.

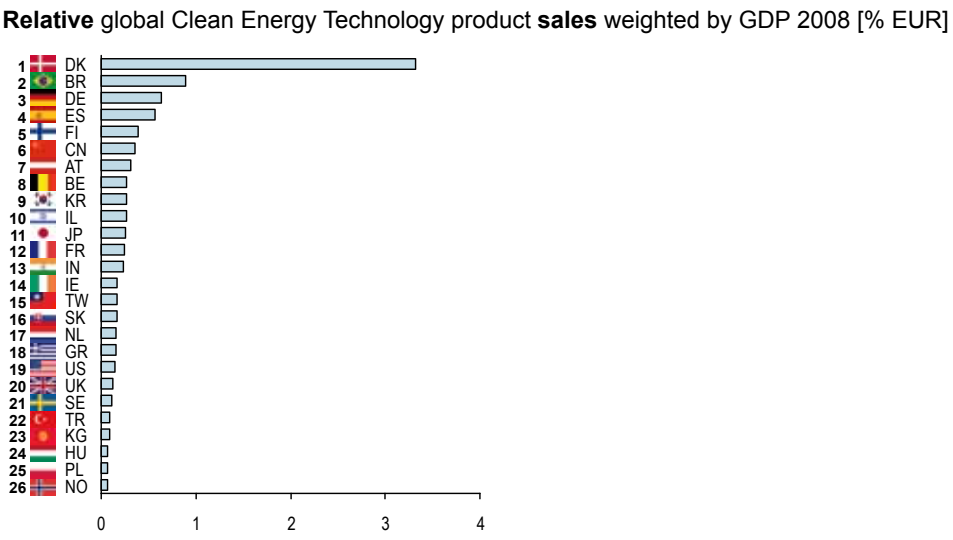
A broad range of sources was used to obtain and validate the necessary data (see appendix 1 for complete details):

- **Industry trade organizations** – e.g. the Global Wind Energy Council, European Photovoltaic Industry Association, European Biodiesel Board;
- **Broker and industry reports** – e.g. from Sarasin, HSBC, Douglas-Westwood, Frost & Sullivan, Global Data, Jefferies;
- **Company sources** – e.g. annual reports, company websites, investor presentations, press releases;
- **Other sources** – e.g. IEA working group documents, Eurostat, data and insights available from expert group members (see appendix 2).

Based on this comprehensive study, figure 4 presents the first Global Clean Energy Technology ranking by aggregate product sales over 2008 in absolute (EUR billion) and relative terms (as a % of GDP).

Figure 4 Clean Energy Technology sales by country 2008 in absolute and relative terms [EUR bn, % GDP]





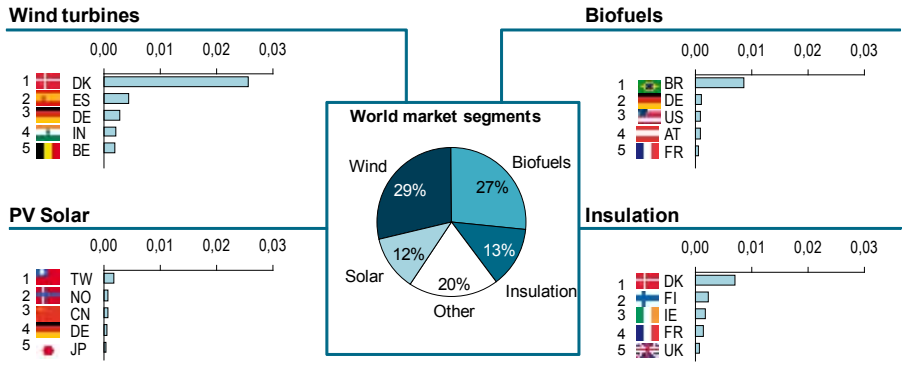
Denmark, Brazil and Germany top the GDP-weighted rankings. Denmark has been able to capture a large share of the global wind market. Danish wind turbine manufacturer Vestas has a 20% market share, but component manufacturers like LM Glasfiber and offshore installation contractors such as A2Sea have also made Denmark their home. In energy efficiency, Danish Rockwool is a leader in global insulation markets.

Brazil owes its second place almost exclusively to the large-scale production of bioethanol. Brazilian sugar cane provides its most efficient feedstock. The switch to bioethanol domestically has also made Brazil much less dependent on foreign oil.

Germany has a long tradition in building machinery and equipment and this is the basis for its leading Clean Energy Technology industry. Germany excels in a broad range of technologies. Repower, Siemens and Enercon have strong positions in wind. Qcells is the world's largest manufacturer of photovoltaic solar cells. Knauf is a European leader in insulation. Next to biodiesel, Germany is home to most of the world's biogas installations.

Wind energy and biofuels are the most important markets in Clean Energy Technology worldwide (with 29% and 27% of total sales respectively). The rapid expansion of wind power capacity in Europe, the US and China in recent years has created a 27 GW (capacity) market in 2008. The relatively low cost of wind and biomass favors their use over solar (12% of the overall market). The largest energy efficiency market is insulation with 13% of total Clean Energy Technology sales in 2008. Figure 5 shows the top 5 countries in each of these major segments.

Figure 5 Top 5 in major Clean Energy Technology segments 2008 – weighted by GDP [%]



In wind, three of the four leaders (Denmark, Spain and Germany) hold sway; the fourth (Brazil) leads the field in biofuels (followed by Germany). Many lower ranked countries, however, show up in the top-5 in individual segments. Belgium owes its top-10 position overall to its strong position in wind (#5). Hansen transmission employs more than 1,300 people in Belgium. The US is 19th overall, but third in biofuels thanks to its extensive, mainly first generation ethanol production in the Midwest. The UK (20th overall) has a strong domestic insulation market with the company Kingspan, which takes it into the fifth position in that segment, behind France (8th overall), Ireland (14th), Finland (5th) and the leader Denmark. In PV solar, the ranks are led by Taiwan (15th overall) and Norway (26th overall). Norway is a dominant supplier of silicon for solar cells; Taiwan has become the major producer of PV solar cells.

3 Lessons from leading Clean Energy Technology countries

Countries aiming to expand their Clean Energy Technology sectors should learn from the leaders Denmark, Brazil, Germany and Spain that this requires early and consistent government support, high investment and a strong home market

Building a strong Clean Energy Technology industry will mean creating more and larger companies. Countries with such ambitions can find inspiration in the best practice examples of Denmark, Brazil, Germany and Spain that lead the country rankings in Clean Energy Technology sales. This chapter seeks to understand the reasons behind their success and make recommendations to countries that would emulate that success.

3.1 The leaders Denmark, Brazil, Germany and Spain achieve success through early and consistent government support, high investment and a strong home market

We have analyzed the success of the top-4 countries in Clean Energy Technology – Denmark, Brazil, Germany and Spain – and found that they share three distinct key success factors:

- Early and consistent **government support** over the innovation cycle;
- High **investment** in sectors with a strong domestic fit; and
- Strong **home markets** for Clean Energy Technology applications.

Brazil has become the world leader in ethanol research since the early 1970s. Research focused on raising the yield of sugar cane and improving the efficiency of ethanol plants. Public research centers initiated the development of full ethanol and flex fuel vehicles, which was later taken up and accelerated by (private) industry. The government also strongly stimulated the development of a home market through mandatory blending and price support. Government support also adapted to changing market circumstances, e.g. low oil prices or ethanol shortages. Thus government support was early, (pro)active and consistent over the entire cycle: from R&D through product development to market development.

The same holds for Denmark and Germany. In 1977, Denmark set up a comprehensive program for wind energy R&D at the Risoe National Laboratory and the Technical University of Denmark. The government gave strong (financial) support to the testing of prototypes and since the early 1980s

stimulated an early home market with investment subsidies for wind parks and *feed-in* tariffs.[8] The German government has likewise stimulated the home market for wind and solar energy, invested in wind and solar demonstration projects and set up government funded R&D programs targeting business and academia.

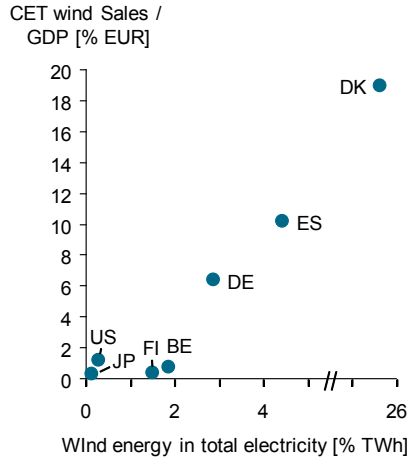
A common characteristic of these countries is that they started their development during the oil crises in the 1970s. Absence of natural resources in the form of oil and gas created the incentive to find alternatives. The controversy surrounding nuclear energy in the 1980s has led to a reinforcement of governments' renewable energy policy.

Capital is a necessary, if not sufficient, condition for building a Clean Energy Technology industry. In Denmark, Germany and Spain strong sales in Clean Energy Technology are correlated with high investments in technology and private equity. Particularly in Denmark and the US, companies are accelerated by venture capital.[9] In Germany, many small and medium sized, family-run businesses invested in the field. Also in Germany and in Spain, large corporations like Siemens and Abengoa provided capital for expansion to successful innovators. Most investments in these countries were made in segments with a strong domestic fit, i.e. the same technologies that benefitted from government support throughout their innovation cycles.

Last, but not least, a strong home market is indispensible. It allows companies to experiment, gain experience and quickly traverse the learning curve – both giving them a competitive lead and providing them with reference and showcase projects. For smaller countries, this means benefitting from a first mover advantage. Denmark captured first mover advantage in wind in the early 1980s and its Clean Energy Technology sales in wind were driven by the domestic demand for wind energy it established early on (see figure 8). Other early movers in wind, like Spain and Germany, demonstrate the same effect.[10] Sweden is a front-runner in heat pumps since it installed the first in 1979, Brazil has led the ethanol market since the early 1970s and Austria has been the European leader in solar thermal applications since the end of that decade.

[8] *An incentive structure that obligates utilities to buy renewable electricity at above-market rates set by the government.*
[9] *EVCA year book 2007, 2008, fDi Intelligence*
[10] *See Joanna I. Lewis and Ryan H. Wiser (2007)*

Figure 6 Home market versus wind sales [%GDP]



Source: IEA, Roland Berger analysis

3.2 Countries aiming to grow their Clean Energy Technology sectors should launch Technology Action Programs, mobilize capital and develop strong home markets

Looking at the example of the countries that top this first global Clean Energy Technology country ranking, WWF has developed three recommendations for countries aiming to emulate their success and build strong domestic Clean Energy Technology sectors of their own. These countries should:

- Launch Technology Action Programs that develop a single technology from research to demonstration. This will make government support more consistent and bridge the gap between academia and industry.

- Central banks should encourage the integration of CO_2 risk into financial models to facilitate a shift towards “clean” investments. More capital must also be raised for seed investment in Clean Energy Technology ventures.

- Develop a strong home market for Clean Energy Technology applications by influencing the purchasing decisions of government, business and consumers through government procurement, greater stability in (policies on) sustainable energy subsidies and tax differentiation.

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II. Interviewees

- Jos Peeters, Capricorn
- Ruud Koornstra, Tendris
- Marcel Wubbolts, DSM
- Rob Voncken, BioMCN
- Dolf van Griethuyzen, Ballast Nedam
- Dick Tommel, Stichting Platform Bio-Energie
- Marco Waas, Technische Universiteit Delft
- Michel Hendrik, E2 Cleantech

III. Country ranking

Countries analyzed

- EU 27
- Brazil
- India
- China
- Russia
- United States of America
- Switzerland
- Taiwan
- Australia
- Canada

- Norway
- Japan
- South Korea
- Turkey
- Israel
- Mexico
- Malaysia
- New Zealand

Segments analyzed

- Wind energy
- PV solar
- Thermal solar
- CSP
- Geothermal
- Biodiesel
- Bioethanol
- Biogas
- Heat pumps
- Insulation
- Lighting
- Electric vehicles
- Fuel cells
- Flywheels

Data sources

Asociación de la Industria Fotovoltaica – Presentado el Informe anual de ASIF 2009: "Hacia la consolidación de la energía fotovoltaica en España"
Asociación de la Industria Fotovoltaica – Hacia un suministro sostenible de electricidad
Asociación de la Industria Fotovoltaica - Situación en el mundo
Biofuels Platform - statistics
BMU Greentech 2.0
Bosch Thermotechnik - The market for thermotechnology
BSRIA - Super Successful Heat Pumps
BTM Consult - World Market Update
Bundesverband Solarwirtschaft - Statistische Zahlen der deutschen Solarstrombranche (Photovoltaik)
Bundesverband Solarwirtschaft - The Photovoltaic and Solar Thermal
Central Bureau of Statistics – Statline database
Clean Edge – Clean Energy Trends 2008
Comext – External trade database

ConvergeNet - UPS Systems: What are the Options?
Emerging Markets Online – Biodiesel 2020: Global Market Survey, Feedstock Trends and Forecasts
Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell
EurObserv'er - Barometer (various versions)
European Biodiesel Board - statistics
European Photovolatics Industry Association – Global Market Outlook for Photovoltaics until 2013
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European Solar Thermal Industry Association – Concentrated Solar Thermal Power – Now!
Eurostat – Statistics database
Geothermal Energy Association - Geothermal Industry Employment: Survey Results & Analysis
Global Wind Energy Council – Global Wind Report 2008
GlobalData - Global Geothermal Energy Market Analysis and Forecasts to 2012
GlobalData – Global Solar Thermal Power Market Analysis and Forecasts to 2013
Globalinsulation magazine - On the Chinese insulation industry
IEA-SHC - Solar Heat Worldwide Markets and Contribution to the Energy Supply 2006, edition 2009
Interconnection Consulting - Thermal Insulation in Europe 2008 Development and Trends
International Geothermal Association- IGA News 72
Jefferies - CleanTech Primer
Lux Research - The $41 billion energy storage market: the next big energy investments
MAKE Consulting – The Wind Forecast – Supply side, Demand side Manufacturers Survey."
Markets in Germany - Status Quo and Perspectives
Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries, Japan -Biofuels Policies in Asia
Power Electronics Technology - Energy Storage Device Market to Hit $12 Billion By Decade's End
Renewable Fuels Association - statistics
Roland Berger - various reports
Sarasin – Sustainability report
Societe Generale - Green New Deal
Solar Energy Industry Association – US Solar Industry in Review 2008
Solarbuzz - Marketbuzz 2009
Sonne Wind & Wärme – Der Markt wächst

Worldwatch Institute - Strong Growth in Compact Fluorescent Bulbs Reduces Electricity Demand

Investor presentations, annual reports, press releases, websites from and broker reports on various companies:

- Bosch
- CRH
- Danfoss
- GE
- Kingspan
- NEM
- Osram
- Philips
- Recticel
- Rockwool
- Saint Gobain
- Siemens
- Solel
- Synbra
- Vestas
- Schott Solar

V. Dutch Clean Energy Technology companies

- **Business associations** – including Holland Solar, Stichting Platform Bio-Energie and incubators such as Yes!Delft;
- **Newspapers and magazines** – including Het Financieele Dagblad, NRC Handelsblad, FEM Business and the Energiegids;
- **Market research reports** – including reports by BTM, Global Data and Frost & Sullivan;
- **WWF NL and its partners** – including FME, ECN, the Universities of Utrecht and Delft, Rabobank and Roland Berger Strategy Consultants;
- **Other sources** – including company databases (e.g. REACH), government reports and websites (e.g. SenterNovem, Energy transition platforms) and the "Koplopersloket".

Appendix 2 Expert group and jury

Expert group

- Donald Pols, WWF NL
- Arjette Stevens, WWF NL
- Kees van der Klein, ECN
- Chris Hellinga, Technische Universiteit Delft
- Daan Dijk, Rabobank
- Wouter de Ridder, Rabobank
- Paul Veendrick, Rabobank
- Charley Droste, FME and Cleantech Holland
- Hans van der Spek, FME and Cleantech Holland
- Arnoud van der Slot, Roland Berger

Jury

- Donald Pols, WWF NL
- Arjette Stevens, WWF NL
- Kees van der Klein, ECN
- Chris Hellinga, Technische Universiteit Delft
- Daan Dijk, Rabobank
- Wouter de Ridder, Rabobank
- Paul Veendrick, Rabobank
- Charley Droste, FME and Cleantech Holland
- Hans van der Spek, FME and Cleantech Holland
- Arnoud van der Slot, Roland Berger
- Sjoerd van Keulen, Holland Financial Centre and WWF NL

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