ISA Annual Convention 2011, Montréal, Québec, Canada
GLOBAL GOVERNANCE: POLITICAL AUTHORITY IN TRANSITION

Wednesday, March 16, 2011 – Saturday, March 19, 2011
Le Centre Sheraton (co-headquarters), the Fairmont Queen Elizabeth (co-headquarters), and the Marriott Chatêau Champlain.

PANEL "Geopolitics, Power Transitions, and Energy"

Saturday, March 19, 2011 10:30 AM
Room: Salon 1

Chair: David Criekemans
Discussant: Richard Chadwick

The geopolitics of renewable energy: different or similar to the geopolitics of conventional energy?

David Criekemans

First draft
Please do not quote without prior consent of the author

Dr. David Criekemans

- **Research-co-ordinator and Senior Researcher 'European and Global Relations', Flemish Centre for International Policy (FCIP), Antwerp (Belgium)**
- **Assistant professor in 'Belgian and Comparative Foreign Policy' at the University of Antwerp, Belgium**
- **Lecturer in 'Geopolitics' at the International Centre for Geopolitical Studies (ICGS), Geneva (Switzerland)**

Postal address:
Department of Political Sciences, Faculty of Political and Social Sciences, University of Antwerp, Meerminne-building, Sint-Jacobstraat 2, BE-2000 Antwerp, BELGIUM

Mobile (work): +32/472/22.35.96
E-mail: david.criekemans@ua.ac.be
Internet (current list of publications): http://anet.ua.ac.be/acadbib/ua/04095
Profile: http://www.ua.ac.be/david.criekemans

Keywords
geopolitics; national security; energy; foreign policy

Abstract

In this paper, the '*Geopolitics of Renewable Energy*' is compared to the '*Geopolitics of Conventional Energy*'. The international energy regime is pivotal to understanding the geopolitical relations between countries and regions in the world. As the world is taking its initial steps into a Green Energy-economy, one may ask to what extent the 'Geopolitics of Renewable Energy' will be different or similar to the '*Geopolitics of Conventional Energy*'? Exploring and developing conventional energy (oil, natural gas, coal) demands for huge capital investments and a military machine to control. Today, in an age of increasing scarcity, producer, transit and consumer countries are positioning themselves geopolitically so as to safeguard their energy security. The '*Geopolitics of Renewable Energy*' could potentially be different; developing it will demand much capital, but there is the potential that energy will be much more decentralized, which could have a positive impact upon geopolitical relations in the world. However, one might also argue for the reverse position based upon some observations of the impact of renewable energy. Some even apply Classical Geopolitics to renewable energy; "those who will control the new energy regime, will control the future". In addition, what internal geopolitical consequences could renewable energy generate?

Biography

Dr. David Criekemans is a Postdoctoral Researcher in International Politics at the University of Antwerp (Belgium). MA International Politics (Antwerp, 1996), European Master of Public Administration (Leuven, 1997), Ph.D. International Relations (Antwerp, 2005). In 2005, he completed and defended his Ph. D. on the intellectual history of Geopolitics (1890-2005), and its relation to Theory of International Relations. The manuscript (written in Dutch) was published by the Scientific Publisher Garant (Antwerp, Belgium / Apeldoorn, the Netherlands) under the *title "Geopolitics, 'geographical consciousness' of foreign policy?"* (original title in Dutch: *"Geopolitiek, 'geografisch geweten' van de buitenlandse politiek?"*), ISBN 90-441-1969-9.

Since 2007, David Criekemans became active as a Research Coordinator and Senior Researcher "European and Global Relations" at the newly established Flemish Centre for International Policy, located on the city campus of the University of Antwerp in Belgium. He is also a Lecturer in Geopolitics at the International Centre for Geopolitical Studies (ICGS) in Geneva (Switzerland). Previously, he taught at the Royal Military Academy in Brussels (Belgium), and at the Catholic University in Brussels (Belgium).

David Criekemans recently conducted a study 'Geopolitics of Renewable Energy: chances and opportunities for Flanders' (465 pages) at the Flemish Centre for International Policy.

The author recently edited a *Special Issue "Regional Sub-state Diplomacy Today"* which appeared as Volume 5, Number 1 of *The Hague Journal of Diplomacy* in March 2010. Later in 2010, this was also be published by Nijhoff as an edited book "Regional Sub-state Diplomacy Today", ISBN 978-90-04-18357-5 .

The geopolitics of renewable energy: different or similar to the geopolitics of conventional energy?

Dr. David Criekemans
University of Antwerp & Flemish Centre for International Policy

"Some day, incidentally, when coal and oil are exhausted, the Sahara may become the trap for capturing direct power from the Sun."

Halford John Mackinder, 1943,
Foreign Affairs, vol.21, nr.4, p.605.

"One thing that always struck me about the term "green" was the degree to which, for so many years, it was defined by its opponents — by the people who wanted to disparage it. And they defined it as "liberal," "tree-hugging," "sissy," "girlie-man," "unpatriotic," "vaguely French."

Well, I want to rename "green." I want to rename it geostrategic, geoeconomic, capitalistic and patriotic. I want to do that because I think that living, working, designing, manufacturing and projecting America in a green way can be the basis of a new unifying political movement for the 21st century. A redefined, broader and more muscular green ideology is not meant to trump the traditional Republican and Democratic agendas but rather to bridge them when it comes to addressing the three major issues facing every American today: jobs, temperature and terrorism."

Thomas L. Friedman, 15 April 2007,
'The Power of Green' in *The New York Times*.

"To truly transform our economy, protect our security, and save our planet from the ravages of climate change, we need to ultimately make clean, renewable energy the profitable kind of energy."
US President Barack Obama
Address to Joint Session of Congress, Feb. 24, 2009

0. Introduction

Geopolitics is the scientific field of study belonging to both Political Geography and International Relations, which investigates the interaction between politically acting (wo)men and their surrounding territoriality (in its three dimensions; physical-geographical, human-geographical and spatial) (Criekemans, 2007; Criekemans 2009). The field of Geopolitics has always been very interested in energy questions since *conventional energy sources* such as oil, natural gas and coal constitute physical-geographical variables of strategic importance. Within Geopolitics, it is recognized that the energy regime of the global system and the energy relations between producer countries, transit countries and consumer countries are important variables which can influence international relations. The factor 'location' –where the energy resources are, and via which routes can they be brought to (potentially rival) consumer countries– constitutes an important area of study within the field of Geopolitics. The 'Geopolitics of (Conventional) Energy' entails a whole literature in itself. Exploring and developing conventional energy (oil, natural gas, coal) demands for huge capital investments and a military machine to control. Today, in an age of increasing scarcity, producer, transit and consumer countries are positioning themselves geopolitically so as to safeguard their energy security. Of course, energy and location in themselves do not explain everything in international relations, otherwise one would lapse into geographic or energetic determinism. But the way in which societies shape their *energy mix*, is central to both their chances for development and survival. Countries and areas which have energy (technology) at their disposal potentially have better cards compared to other countries. Nevertheless all countries, regions and areas are interconnected when it comes to the complexity of energetic relations, which in itself is translated into international-political relations and power dynamics. We know what the Geopolitics of Conventional Energy entails, and how it becomes more prominent in times of resource scarcity. But as countries in the world will in the coming decades move towards more renewable energy in their respective energy mixes, *how will this affect geopolitical relations? What trends and developments can we see today? To what extend is the Geopolitics of Renewable Energy different or similar compared to the Geopolitics of Conventional Energy?* Remarkably enough the current literature in Geopolitics and international relations has only barely scratched the surface with regard to exploring the potential geopolitical effects of the transition towards more renewable energy sources. This paper can be seen as a first initial effort to bring some thoughts on this matter together.

Renewable energy has come into the picture in the past years as a result of a number of combing factors and trends. First, the last decades have clearly shown that the burning of non-renewable, fossil fuels leads to CO2-emissions, the exhausting of resources, local environmental degradation and climate change. Second, the entering into the world economic scene of a couple of billion people in especially Asia structurally impacts the demand for energy, as a result of which (conventional) energy scarcity could become a real possibility in the coming decades. All these elements push decision makers to make new choices in the direction of more renewable forms of energy. Also the markets influence this process, although this evolved jerkily in the past couple of years. When the stock markets think a situation of scarcity might develop, like was the case in the summer of 2008 (when a barrel of oil reached the staggering record price of 147$), then the prices of fossil energy can multiply in a short time frame and create volatility in the market. As a result of this, renewable energy becomes more interesting and economic in comparison to traditional forms of energy. When a few months later in 2008 the energy prices collapsed as a result of the economic crisis, a reverse process seemed to develop in the market – resulting finally in decreasing investments in renewable energy. Such dynamics make the study of renewable energy within a broader geo-economical and geopolitical context not very easy. Many variables are at play. Nevertheless, humanity will have to make the transition towards more renewable energy if she is to survive the century. The stakes could never have been higher. Who will be the winners, who will be the losers? And how will renewable energy reshape the global and macro-regional geopolitical landscape?

The insights which we developed in this paper are based upon a recent study *'Geopolitics of Renewable Energy: chances and opportunities for Flanders'* which was conducted at the Flemish Centre for International Policy. It is based upon some 30 interviews with key people in the sector of renewable energy working in Flanders and Brussels (with the EU), and also on the current available secondary and primary literature on renewable energy.

The paper tries to bring together some ideas on the specificity of the geopolitics of renewable energy. It is structured as follows:

- *First*, we try to define 'renewable energy' & illustrate the difference between 'renewable' and 'sustainable';
- *Second*, we will lay out some internal and external geopolitical consequences of the energy transition;
- *Third*, we explain that the transition towards renewable energy in fact entails an "energy technology-revolution" or ET-revolution;
- *Fourth*, we provide a global overview of the latest developments in renewable energy;
- *Fifth*, we will study the geopolitics of renewable energy in more detail – we will look at the global control over patents and knowledge *and* we will investigate the potential of renewable energy sources and their geopolitical consequences;
- *Sixth*, we will analyse some current "mega-dossiers" in renewable energy in Europe – *Desertec* and the *North Seas Countries Offshore Grid Initiative*;
- *Last but not least*, we will try to formulate some conclusions on the specificity of the geopolitics of renewable energy.

1. Defining 'renewable energy' & the difference between 'renewable' and 'sustainable'

The concept 'renewable energy' stands in contrast to conventional, non-renewable energy sources such as oil, natural gas, coal, etc. Typical of these energy sources is that burning them, from which 'energy' is extracted, is not a renewable process. As a result of the burning, CO_2-emissions among others are released, and the finite supply of fossil fuels will in the end become exhausted. Fossil fuels are in essence 'past solar energy' which built up for millions of years via deposits of plants and animals in layers, which eventually were covered. Because of the increasing pressure, they changed into coal, oil or natural gas. Once these supplies are exploited, they become exhausted, so other finding places have to be explored and developed. For this reason these energy sources are non-renewable.

In the United States of America, the *U.S. Energy Information Agency* uses the following definition of renewable energy:

> *"Energy sources that are naturally replenishing but flow limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy sources include: biomass, hydro, geothermal, solar, wind, ocean thermal, wave action and tidal action."*

In European policy circles, the following definition is often used:

> *"All natural energy flows that are inexhaustible (i.e., renewable) from an anthropogenic point of view: solar radiation; hydropower; wind; geothermal; wave, and tidal energy; and biomass."*

Common in these definitions is that energy sources are 'renewable' if they replenish themselves in a natural way. A disadvantage is that they are *'flow limited'*, for instance in wind energy – the wind doesn't always blow. The same can be said for solar energy – the sun doesn't always shine with an equal amount of force, because of cloud formations. Such 'flow limitations' are often not easy to reconcile with the typical peak consumption in the electric grid between 5 and 9 pm in the evenings.

In principle, 'renewable energy' can be any source of primary energy which does not exhaust by using it. Wind and solar energy are always renewable, but this cannot be said for biomass. Biomass *can* be renewable if its exploitation and usage is compensated by new growth. This is for instance the case when trees or other plants are again planted and sowed, to compensate for the harvest. Only then can biomass be catalogued under the banner 'renewable energy' (presentation by Andrii Gritsevskyi, Energy System Analyst with the International Atomic Energy Agency, IAEA).

The Dutch Protocol Monitoring Sustainable Energy [Pro 99] defines renewable energy as follows:

> *"Renewable energy sources are sources of energy which can be converted via energy conversion technologies into the secundary energy carriers such as electricity, heat and/or fuel."*

The difference between 'renewable' and 'sustainable'

Sustainable development can in general be described as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* This is the definition which was formulated in 1987 in the report "*Our Common Future*", written by the "World Commission on Environment and Development" (also known as the Brundtland Commission).

In the Dutch Protocol Monitoring Sustainable Energy [Pro 99] sustainable energy sources are defined as *"renewable energy sources which are less burdening the environment in terms of climate, acidification, waste, disruption, drying out, etc. as compared to conventional energy sources."*

Not every renewable energy source is as sustainable as the other. Testing the sustainability of energy sources in fact entails among others a lifecycle-analysis for each source and for each conversion technology. Other definitions take into account the *rational use of energy* under the concept 'sustainable energy'.

Renewable energy sources are often, but not always sustainable. Some examples of non-sustainable varieties of renewable energy:

- Implementing hydropower at a large scale without taking into account the negative aspects such as the loss of farming land, the disruption of local communities, etc.;
- The burning of bio-waste without harnessing the energy that comes free.

Also diverse energy conversion techniques may be more or less sustainable. Wood is a renewable energy source. It can be harnessed in a sustainable way via efficient techniques or it can be utilized in a stove which does not work efficiently.

In this paper, we will mainly focus on such *renewable energy sources* as solar power, wind power and biomass. In passing, we will also very briefly deal with smart grids and electric car batteries. In each energy source, different geopolitical and geoeconomical trends and dynamics are at play. Before that, first some words on the geopolitical consequences of the energy transition towards renewable energy in general.

2. Geopolitical consequences of energy transition

The coming energy transition towards renewable energy will produce far-reaching consequences, both from an internal-geopolitical and an external-geopolitical point of view.

From an internal-geopolitical perspective, the technological conversion which we will witness in the coming 25 years will be comparable to the industrial revolution at the end of the nineteenth to the beginning of the twentieth century. An energy transition constitutes one of the most sweeping turnarounds from both an economical and societal point of view, whether it constituted the shift from steam to coal, from coal to oil (and later natural gas), or today towards renewable forms of energy. It questions the economic fabric, it has implications for the societal structure, but also it touches upon the very core of politics. It is not a coincidence that most national states in Europe (and later also in the rest of the world) were established during an energy transition period from steam to coal and later to oil, which demanded huge piles of capital and a central political decision making. The national state and central power supply & distribution go hand in hand. They need one another. Those areas in the world with an exceptional large energy hunger, such as the United States of America or the People's Republic of China, will moreover feel the need to invest additionally in their respective military apparatus. They do this so as to secure their access to oil and natural gas. The fact that this sometimes puts democracy under pressure, is "a price which has to be paid". The imminent energy transition towards more renewable forms will be accompanied by a huge decentralisation of the energy supply. This will also impact upon the *res publica*, the organisation of political life. Local and regional governments will, if they invest heavily in renewable energy (and thus cleaner) technologies, dispose of more levers vis-à-vis their central counterparts than is the case today. This could potentially also be beneficial for the democratic standard of societies. At the same time, one can detect here also actors wishing to discourage this. The former central energy suppliers do not want to lose their monopoly position, and are willing to use various strategies and instruments so as to frustrate the growth of small renewable energy companies, or they just buy them. Here lies a role for all governments at all policy-levels to create an economic landscape which is more diverse, and which guarantees that no one is able to gain an upper hand (Criekemans, 2010).

From an external-geopolitical perspective, those countries who today invest in renewable energy sources and technology may become the dominant geopolitical players tomorrow. It is clear that the uni-multipolar order led by the US which came about after 1991, has waned. Some predict a duo-multipolar order (led by the US and China), others think that the external-geopolitical landscape of a world run on renewable energy will be more in terms of a *multipolar world* where power is more spread equally across the globe. We will come back to these ideas at the end of the paper.

3. The transition towards renewable energy entails an "ET-Revolution"

The transition towards more renewable energy in countries and regions entails more than a mere change in the energy mix. The transition entails the conversion of an energy industry which was merely based upon the extraction of fossil energy sources to a mainly technology driven sector. The energy industry will thus gradually become a technological sector, and will be combined with the decentralised developments from the IT-sector of the nineties. That is why the evolution towards renewable energy is sometimes called an *"ET-Revolution"*, or *"Energy Technology-Revolution"*. This technological revolution is certainly developing in the sectors of solar energy and wind energy. Critics could state that it is less visible in the area of biomass/bioenergy, because this source of energy potentially needs less technological innovations. To a certain extent this could be true. However, this traditionalist view does not take into account the awakening sector of *biobased chemistry*, which will gradually replace the petrochemical industry. As the oil production will peak somewhere between the short and medium term, it will become technologically necessary find replacements for all consumer products which are used and based upon oil. One would be amazed how dependent current societies still are upon oil, and how necessary it is to find replacement products in each and every of these domains. Moreover, one of the main reasons why the agricultural sector in the developed world is performing so well, is because fertilizers are used. Most of these are today still derivatives of oil products.

Those who study the geopolitics of renewable energy must thus take into account that technology plays a very important component in this. Here the geopolitical concept of Daniel Deudney, *'geotechnical ensemble'*, could be applied. The new technologies that are developed together with the geographical opportunities and limitations of certain geographical areas, will determine the new geopolitical context within which countries, regions and territories will be able to operate, create welfare and wellness, and develop a *power base* – literally but also figuratively. Those territories, who invest today in developing the technologies and the standards that accompany them, will therefore have a much better starting position from which to create that power base. On the other hand, most technologies in renewable energy and the clean tech sector are so complex, that international cooperation is needed to bring them about. Recently, Levi, Economy, O'Neill and Segal convincingly wrote in *Foreign Affairs* that *"an energy agenda built on fears of a clean-energy race could quickly backfire. Technology advances most rapidly when researchers, firms and governments build on one another's successes. When a clean-energy investment is seen as a zero sum game aimed primarily at boosting national competitiveness, however, states often erect barriers. They pursue trade and industrial policies that deter foreigners from participating in the clean-energy sectors of their economies, rather than adopting approaches that accelerate cross-border cooperation. This slows down the very innovation that they are trying to promote at home and simultaneously stifles innovation abroad."* (Vol.86,No.6,November-December 2010,p.111).

3.1. *The possibility of a positive 'societal revolution' if the new technologies are 'managed' in the right way*

With renewable energy, geopolitics is potentially also at play *within* societies. The decentralisation of both the energy production and consumption of *renewables* entails the possibility of a societal revolution, in which local and regional groups of people can organise themselves more independently. If renewables are also managed in a decentralised way, one would no longer be dependent of central energy companies as was the case in the conventional energy regime. At least, this could be true with regard to the production of energy. Regarding the distribution, the story is more complex. Important will be who will manage the new electricity and energy grids of the future. Technology also here offers some new opportunities. The very latest technological evolutions with regard to *'smart grids'* could eventually make it possible for consumers to send their excess in produced solar energy *peer to peer* to other consumers across the grid. Then it would become necessary to install 'smart meters' which have the capacity to detect instantly who has excess capacity and who does not. In this way, renewable energy potentially deals in a much more efficient way with energy shortages both within and between countries. Also the earlier mentioned problem of the *'flow limitedness'* (see supra; 1) of renewables can be dealt with. Different sources of renewable energy can thus complement one another in an efficent way via smart grids. When the sun does not shine, the wind may blow harder, or there might be more tidal waves on the sea. Potentially all these technological developments could give *"power to the people"*, as the American economist Jeremy Rifkin states. Rifkin calls this process a "re-globalisation from the bottom up".[1] Whereas the international energy regime of the oil age was top down, the energy regime of renewables will be bottom up, but only if individuals and societies take the chances to organise themselves and their energy needs. However, the central energy suppliers and network managers are not so pleased with these developments because it threathens the power structures upon which they base their activities. They offer to install renewable capacities in houses at reduced prices, as long as they get a service-monopoly. According to Rifkin, such an evolution could threathen the chances which renewable energy offers in the reinforcement of a country's own societal structures and nullify the advantages of a societal feeling of belonging together as a result of an interwoven web of *renewables* and smart grids. It is exactly in this *potential* for societal rejuvenation that the geopolitics of renewable energy is different from the geopolitics of conventional energy. However, the jury is still out of how this will further evolve.

[1] Again according to Rifkin, globalisation from the top down, has failed. It was based upon a too narrow energy regime; it involved only a fraction of the world's population and needed an enormous concentration of capital and military power to keep together. Rifkin states that the financial-economic crisis of 2008 was not so much created by the housing bubble in the US, but rather by the high energy prices in the summer of 2008. Less than two months later, the economic crisis took hold. Rifkin sees a direct relation or "perfect storm" between the economic crisis, the (conventional) energy crisis and the climate crisis. In this, he sees evidence that the oil age has reached its dawn, and thus that a new energy regime –this time based upon *renewables*– will gradually take its place.

3.2. The choices which have to be made by governments: which renewable energy technologies should one invest in?

The current "Energy Technology-Revolution" makes it difficult for governments to make choices. The technological applications are often developing so fast that it is difficult to predict beforehand which technology will be economically more viable than the other. In the framework of the research for this paper, we had conversations will many people from different sectors and backgrounds. Most of them state that governments should not lay their eggs in one basket, but should rather support a multitude of initiatives in renewable energy. The task of the government should be to create a good investment and enterprise climate so that the society itself and the research centres within it can produce new varieties of renewable energy. The government should also invest in innovation policy, but in a way so as to trigger innovation within the society and ground the innovations via patents and licence agreements. In this vision, the government should also stimulate different types of renewable energy-applications, and not focus only on *transport* or on *energy usage at home*, but also on *consumer products.* These three pillars should be taken into account when a government tries to deal with the energy-technology revolution.

3.3. The choices which should be made by the government regarding the scale of the new technologies in which one should invest

Another aspect and consequence of the ET-revolution is that one must take into account the scales of renewable energy projects. From a geo-economical and geopolitical point of view, one could make a plea for governments to focus on those projects which in an international context offer much visibility, such as *Desertec*, a renewable energy grid in North Africa and the Middle East, or the *North Sea Offshore Grid Initiative*, a complex of thousands of windmills in the North Sea. These are *big projects*, which require a lot of international cooperation and coordination. However, from a geo-economic and geopolitical point of view, renewable energy projects are much more adaptable to different scales compared to conventional energy operations. Governments may want to invest in projects closer to home and *applications at a lower scale*, in houses (solar energy) or on the sea (wind energy and wave converter technology). A mass application of smaller projects in the existing energy systems would make renewable energy more stable and decentralised compared to conventional energy. The big projects in renewable energy suffer from similar security issues as compared to traditional energy projects. Important will be again where the power lines will run, and who will control them.

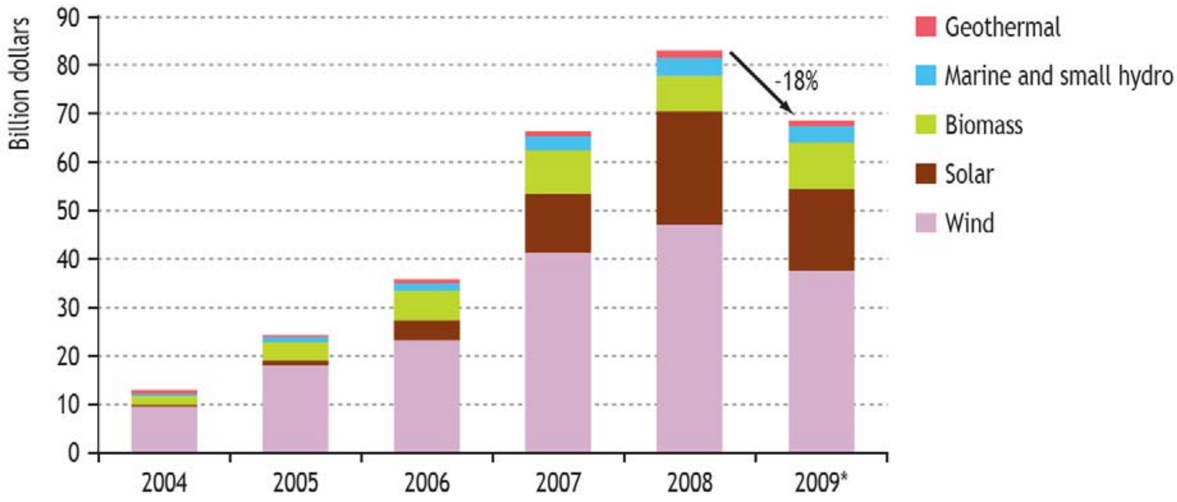
We will come back to this issue when we study the cases of *Desertec* and the *North Sea Offshore Grid Initiative* (see infra; 6.).

3.4. *New technologies vis-à-vis 'vested interests'*

A 'societal revolution' which brings energy closer to the people, in the end also offers chances to strengthen one's own democracy. It may even lead to lesser dependence vis-à-vis foreign energy companies, and the geopolitical objectives of some energy producer countries. However, much depends on how renewable energy is developed. Is it broadly developed within different parts of society, or is it rather developed by big, existing energy groups? Within Europe, we see different situations in different countries. For instance, in France mostly the big energy chains are the ones that are developing renewable energy in a rather centralistic way. In the Nordic countries, renewable energy is much more distributed. The Netherlands offers a more mixed situation – in first instance renewable energy seems much more distributed, on the other hand the vested interests of the bigger energy concerns such as the Gasunie are at play; biogas is only subsidized if it is pumped into the existing pipelines of the Gasunie and similar vested companies. This could potentially break the societal advantages that *could* be linked with the energy-technology revolution. Some interviewees state that one should not be naïve; only if renewable energy is applied everywhere in society, can the transition towards renewable energy take place. One needs a lot of capital to create this transfer and thus big energy companies will remain players, and there will remain a collusion between the economic and political elites on the bigger geo-economic and geopolitical stakes in the energy business. The only difference will be that the form of energy upon which this process will be based, will be another one, or many different forms of renewable energy.

4. Developments in renewable energy: global overview

According to the *World Energy Outlook 2009* of the *International Energy Agency* (IEA), the investments in new capacity of renewable energy have risen enormously in the last years (p. 161). The record year was 2007, with an annual growth of 85%. The activities in renewable energy kept growing until the third quarter of 2008, but then rapidly imploded as a result of the financial-economic crisis. This resulted in a drying up of the finances for new projects, as well as in lower energy prices as a result of which renewable energy became less interesting as an investment. The last available data of the first half of 2009 show that the investments in *'renewables'* hit a low point, with an annual decline of 47%. In the second quarter of 2009, the annual decline had shrunk to 21%. For the whole year of 2009, the IEA suspects that this number was about minus 18%. During 2010, diverse *'stimulus packages'* of different governments, did have a positive impact. Without such measures, the IEA predicts that the investments in renewable energy would have shrunk by 29%. Today, both *private equity* and *venture capital* return gradually to the sector of renewable energy. The figures below offer a good overview of these developments:

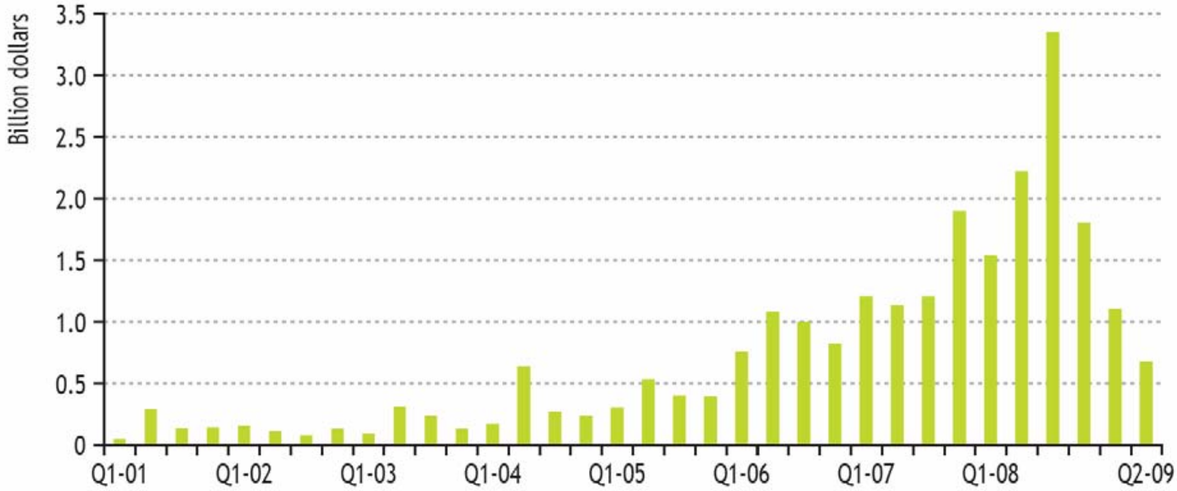


* IEA projection taking account of preliminary data for the first half of the year and the impact of fiscal stimulus packages.

Sources: New Energy Finance databases; IEA analysis.

Global investments in renewable energy-generating 'assets'

(IEA World Energy Outlook 2009, p. 162)



Source: New Energy Finance databases.

New investments in 'clean energy'-companies

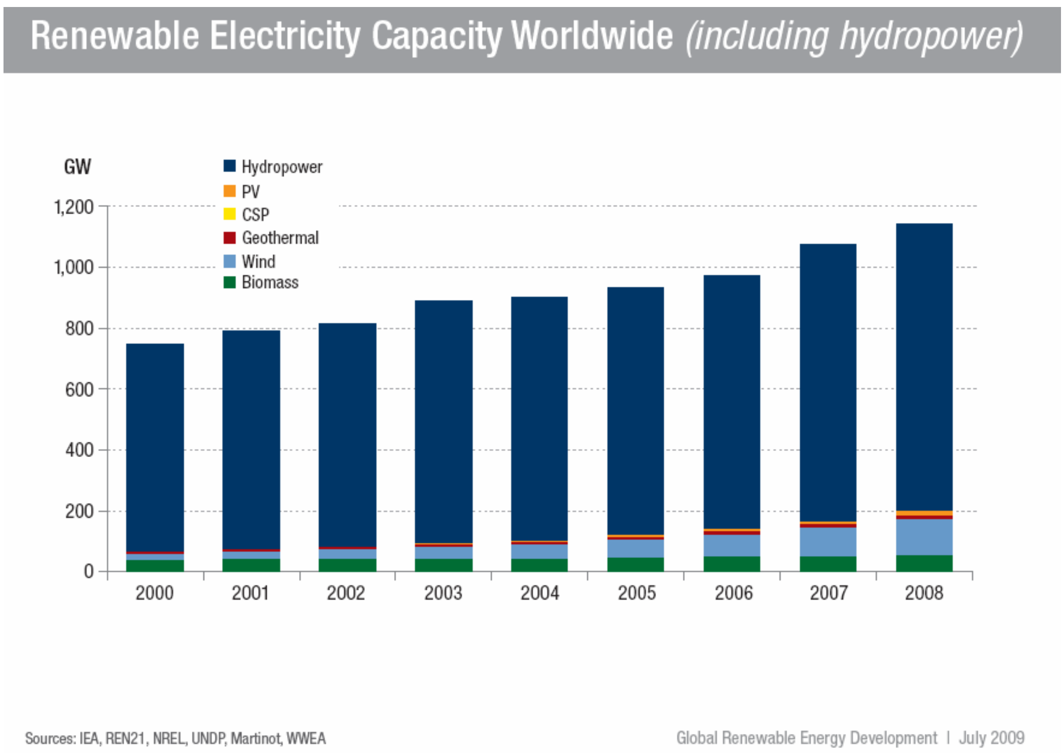
by venture capital and private equity, 2001-2009

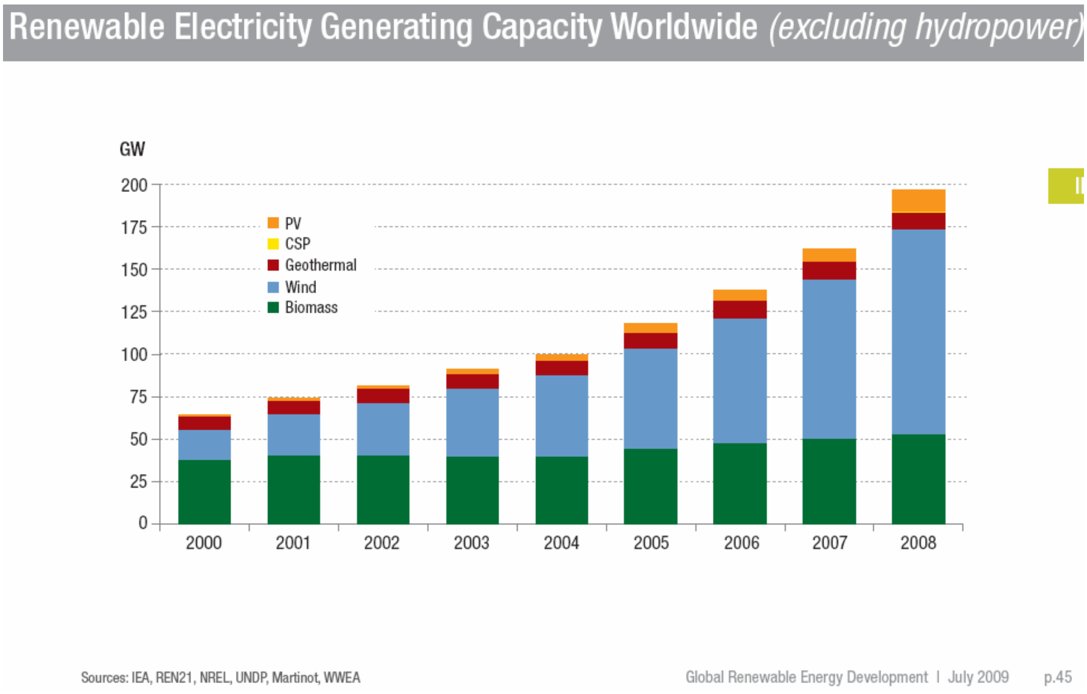
(IEA World Energy Outlook 2009, p. 162)

According to a study of the American *National Renewable Energy Laboratory* (NREL), the following trends can be detected in renewable energy at a global scale (NREL, 2008: 43):

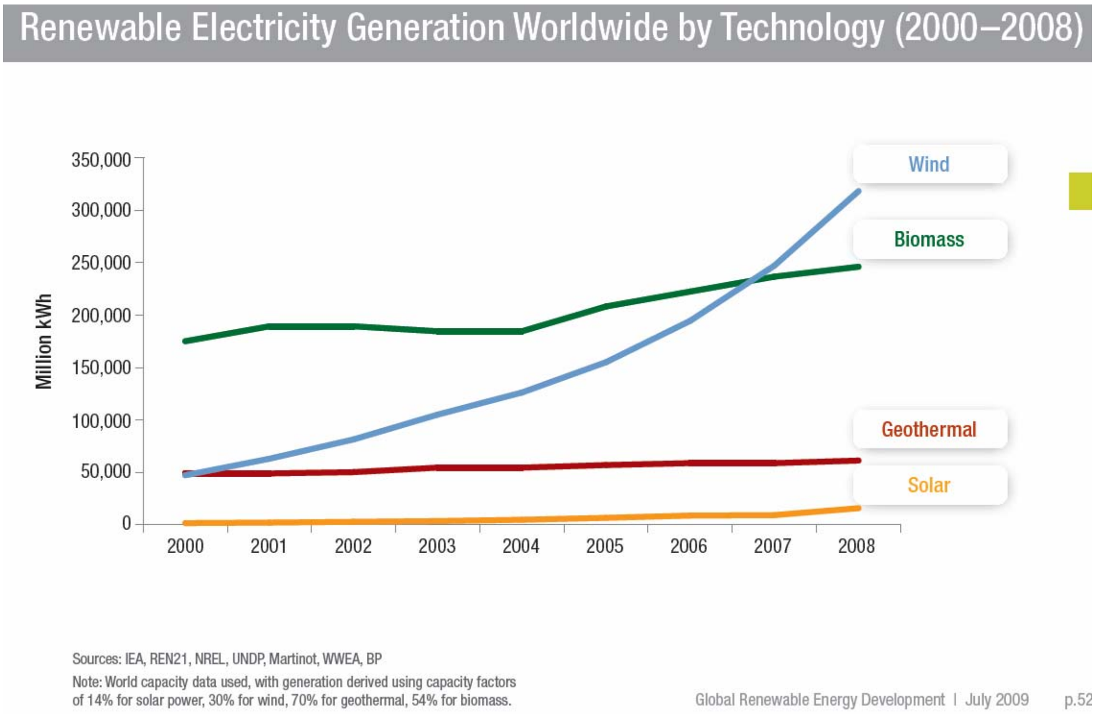
- Between 2000 and 2008, electricity power stations on renewable energy (with the exception of hydropower) have more than tripled.
- If one takes *'hydropower'* into account, one can state that today 18% of all electricity generated comes from renewable energy sources. Without hydropower however, this share drops to merely 2.5%.
- Of all sources of renewable energy, wind energy is growing the fastest; between 2000 and 2008 with a factor 7.
- In 2008, Germany was the country in the world that had installed the most photovoltaic solar panels, a direct consequence of the policies that were pursued in this country during the past fifteen years. The US on the other hand are world leaders in wind energy, geothermal energy, biomass and *concentrated solar power* (CSP).

This analysis was of course based upon the situation in 2008, and does not take into account what other countries in the world have planned with renewable energy, amongst others China. The *National Renewable Energy Laboratory* (NREL) also offers some other interesting data (NREL, 2008: 44-45):

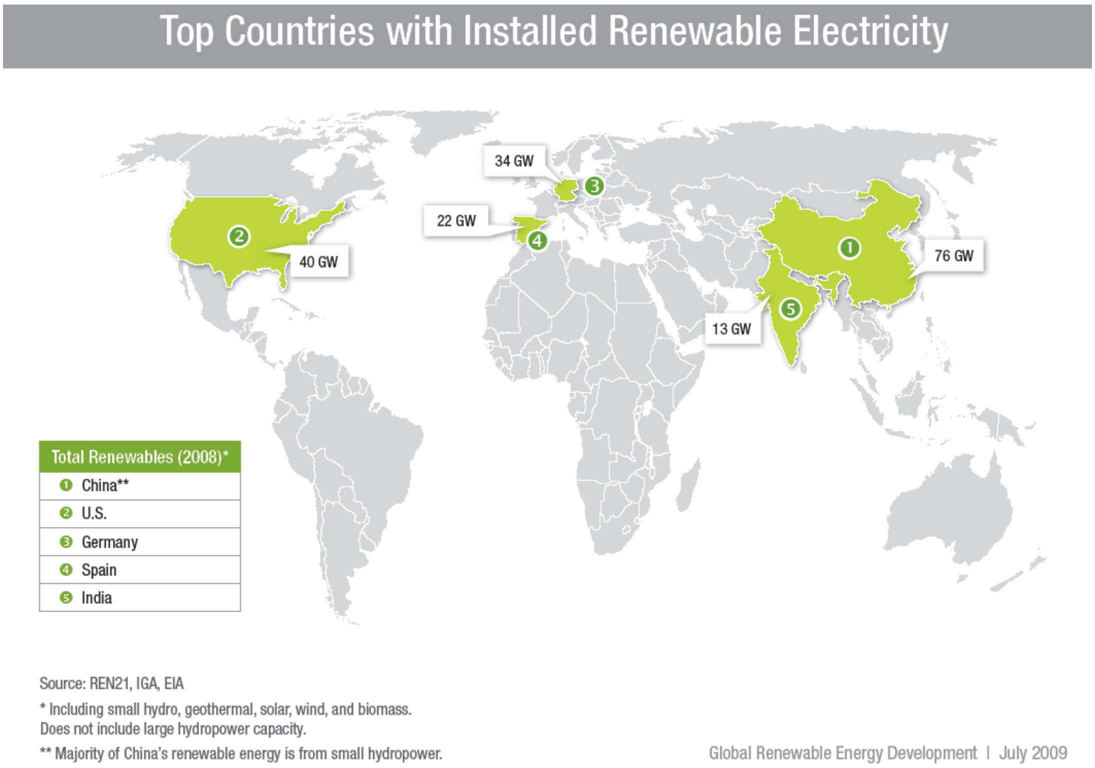




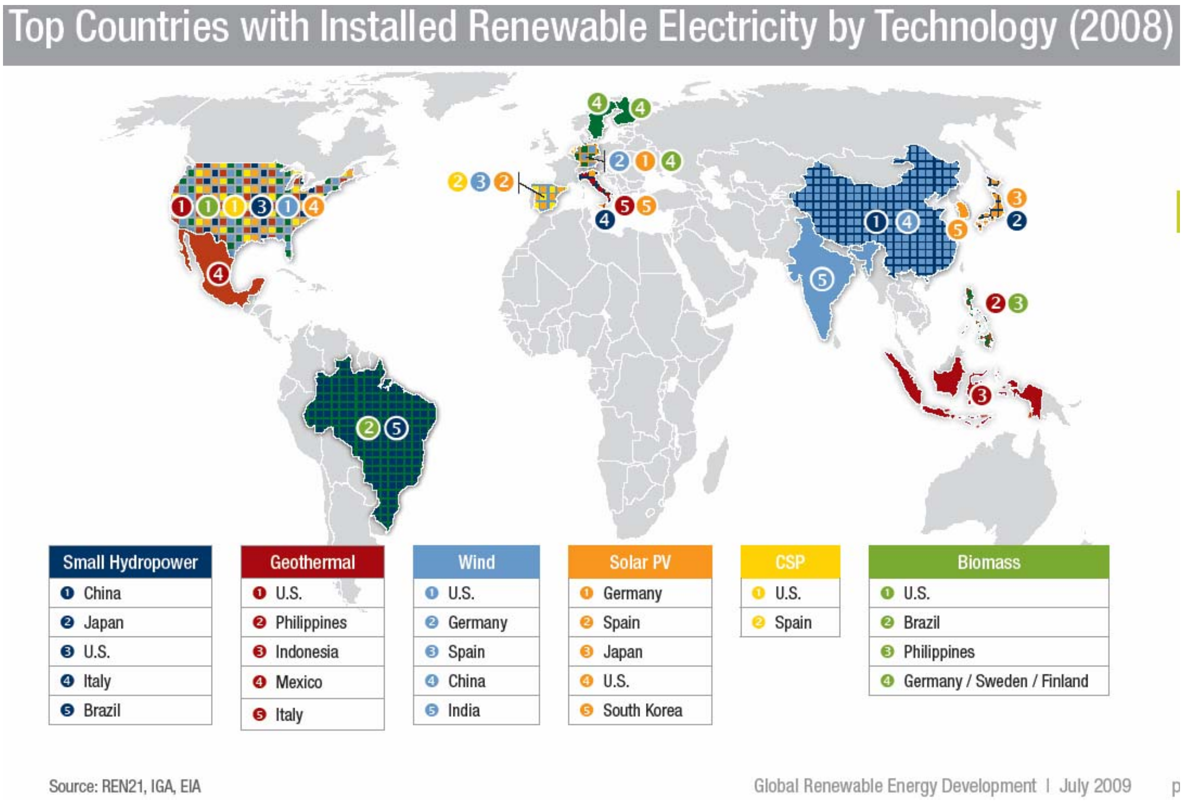
The following diagram offers a good overview of the global growth in renewable energy in the electricity production. Especially wind energy is remarkable, and to a lesser extent biomass and solar energy (NREL, 2008: 52):



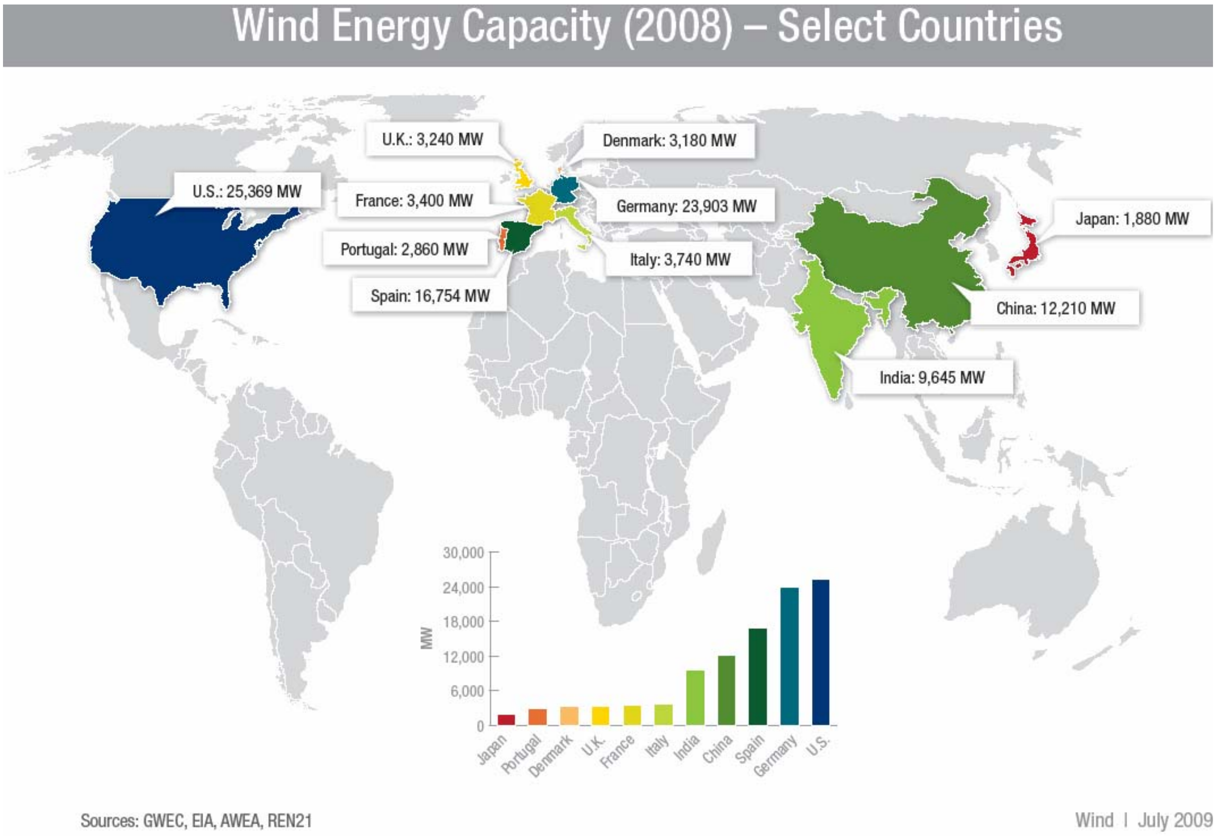
If we then look at the top five of countries which have installed renewable electricity, the following countries are detected; China, the United States of America, Germany, Spain and India (NREL, 2008: 54):



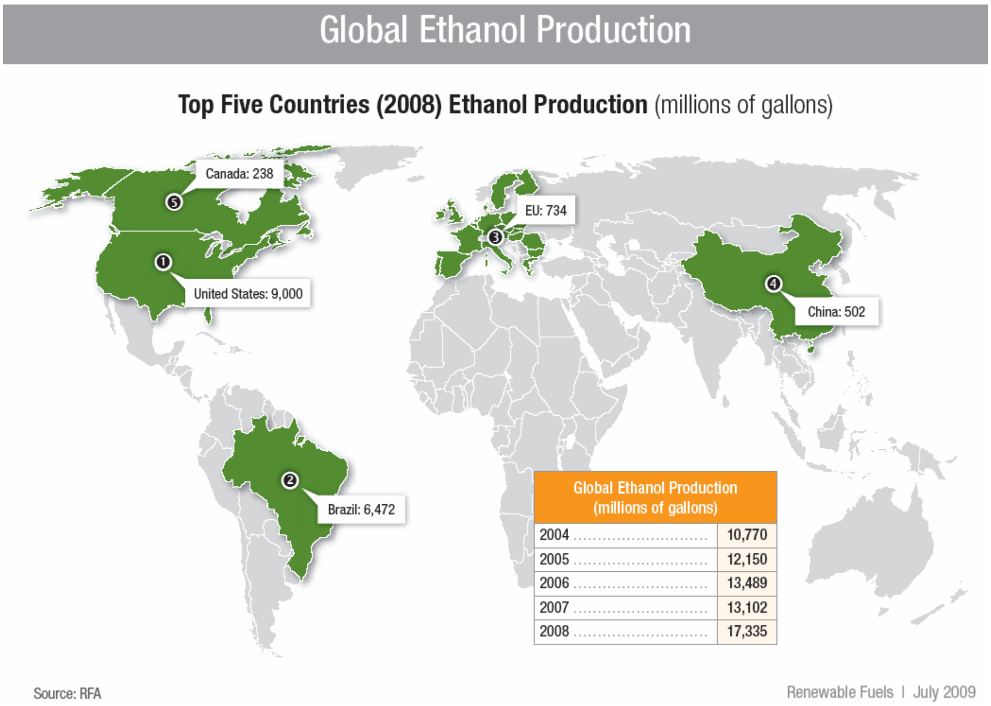
The installed renewable electricity devided by country offers a different picture (NREL, 2008: 55):



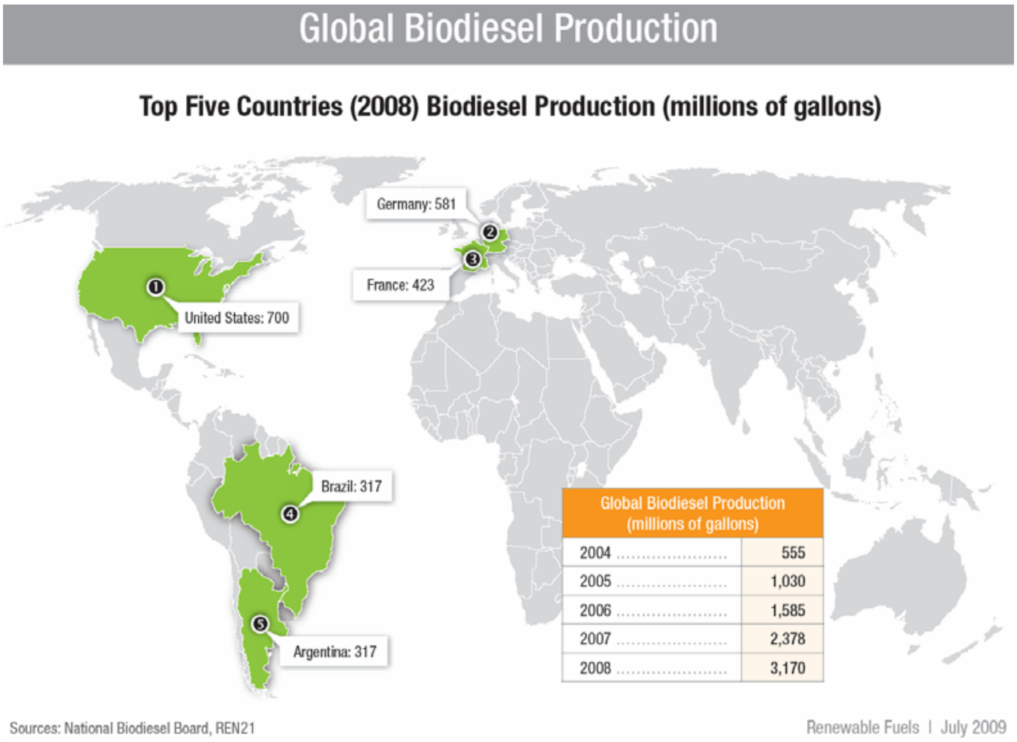
Since wind energy is so important, we offer here an extra overview of the installed capacity in **wind energy in some select countries** (NREL, 2008: 60).



A last variety of renewable energy sources, somewhat controversial because it potentially competes with the food production, are the biofuels such as bioethanol and biodiesel. Globally, the bio-ethanol market looks like this (NREL, 2008: 102):



In biodiesel, the situation is as follows (NREL, 2008: 106):



5. The Geopolitics of Renewable Energy in more detail

5.1. The global control over patents and knowledge

According to Guillaume Sainteny, there are also some other geopolitical dimensions in the global developments related to renewable energy. One can speak of *a global struggle for the control over companies and the added value that they will produce.* In order to determine the position of countries and regions, one could utilize three criteria; (1) how many patents are awarded; (2) the relative weight of the capital investments in renewable energy, and (3) the presence of leading companies in this new industry. What is interesting, is that an application of these parameters leads to similar countries popping up on the radar screen of the researcher (Sainteny, 2010).

For the period 2001-2005, the figures with regard to the awarded patents, are as follows:

- In the *wind energy-industry*, Germany owned 24% of all patents in the world, Japan 23%, the US 10%, followed by China 5%, Russia 5%, South Korea 5%, Denmark 4.5%, the United Kingdom 3%, Spain 3%, and France 2%;

- In the *solar energy-industry* Japan owned 50% of all patents, South Korea 11.5%, the US 11%, China 7%, Germany 6.5%, followed by Russia 1.5%, the Netherlands 1.5%, Australia 1%, the United Kingdom 1%, and France 0.8%;

- With regard to *fuel cells (on hydrogen)* Japan owned 60% of all patents, the US 14%, Germany 7%, South Korea 7%, China 3%, Canada 3%, the United Kingdom 2%, and France 1%.

From this overview one learns that again and again the same countries seem to have patented a lot of know-how in renewable energy.

With regard to capital investments, the figures are moderately different dependent on the sources one uses, and the way in which one defines a domain. Often the best indicator of investments in renewable energy, is to look at the figures official bodies publish on *'cleantech'* or *'clean technology'*. Internationally this is often accepted as a useful indicator. Between 2003 and 2008, the production of energy, the conserving of energy and energy-efficiency constituted about 60% of all investments in the *clean tech*-industry in the United Kingdom. In Israel this figure was 85%, and in France 80% for the same period. In general, all aspects of renewable energy in Europe constitute about 75% of all investments in the *clean tech*-industry.

Based upon the *2008 Annual Review and 4Q08 Investment Innovation* of the Cleantech Group LLC in 2009, the following countries are the most important investors in the world in *clean* technologies:

Country	Total capital investment in *clean tech*
United States of America	5.6 billion US dollar
United Kingdom	974 million euro
Germany	544 million euro
China	430 million euro
Ireland	423 million euro
Spain	288 million euro
India	277 million euro
Israel	247 million euro
Norway	188 million euro
Sweden	156 million euro
France	120 million euro

As regards the leading companies in the sector, the following countries seem to be important:

- *American companies* (Sharp, SunEdison, SunPower, EverGreen Solar, General Electric, Tesla, Panasonic, Quantum Fuel Systems);
- *Canadian companies* (Ballard Power Systems, FuelCell Energy, Dynetek Industries Ltd.);
- *German companies* (Enercon, Nordex, Q-Cells, Conenergy, SolarWorld, Siemens);
- *Spanish companies* (Gamesa, Acciona, Isofotón, Iberdrola);
- *a Danish company* (Vestas);
- *Japanese companies* (Tokuyama, Kyocera, NEC, Sanyo, Toyota, Honda);
- *an Indian company* (Suzlon);
- *Chinese companies* (Suntech, BYD).

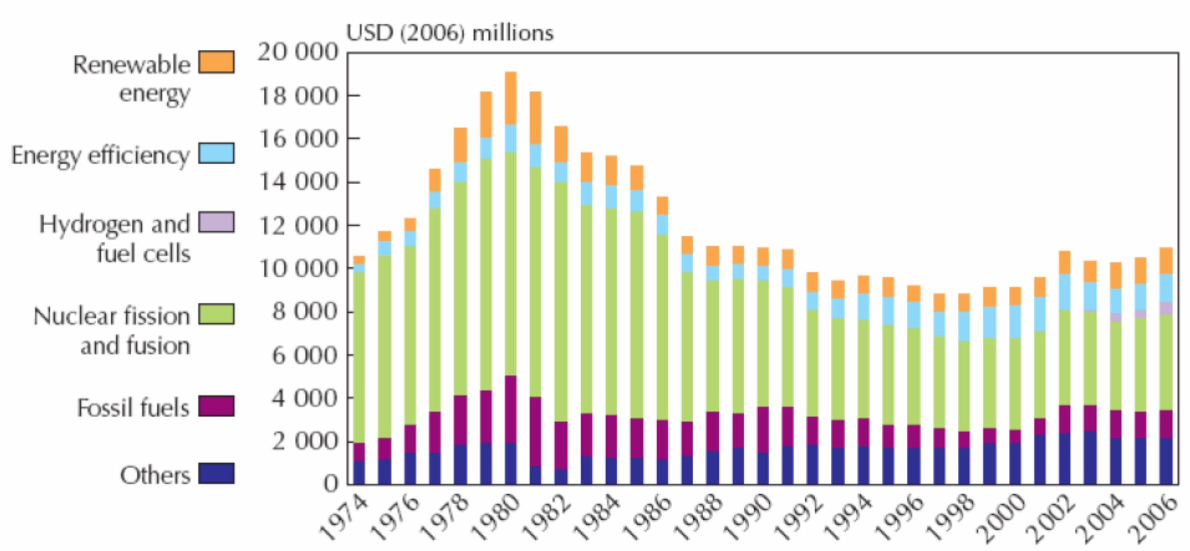
Taking all factors into account, it is interesting to note how active Asia (and more specifically Japan, India, China, South Korea) is in the domain of renewable energy. Also the United States of America, Germany, Denmark and Spain are clearly on the world map. France is less present, probably because the country diverts so much attention to the nuclear sector. The Netherlands are very good in *research & development*, but does not have any real leading companies of world class such as it has in the conventional energy sector (Shell, Gasunie).

What is also interesting from a geopolitical and geo-economical point of view, is that many companies in Asia are trying to position themselves in niches in which they can generate added value. As the old economy will gradually be replaced by a new, greener economy, Asia will thus be able to take a more strategic position. In other words, one could today already speak of a *certain geo-economical power shift* in favour of Asia. An extra advantage is that countries such as China and India have lower costs for the assembly and construction of renewable energy projects, that is why they are sometimes more faster and competitive compared to companies in e.g. Western Europe. From a geo-economic and geopolitical point of view, it will not be long before Western countries in the OECD group demand to create a *'level playing field'* with Asia in terms of tariffs and non-tariff obstructions to the Asian markets. Interviewees in the sector of the solar industry raise the question whether the competitive conditions upon which Asian countries work, are correct. China produces today "cheaper photovoltaic solar panels" (PV) with which they could in time flood the market, but do these reflect the real price? First, one can observe that the Chinese government invests substantial amounts of capital in PV. Second, there exists a distorted exchange rate between the yuan on the one hand and the euro and dollar on the other hand, which according to critics does not reflect the "real" economic position of China. Many of the advantages in efficiency within the sector PV which exist in Europe and the US are thus nullified. Thirdly, the labour cost in China is low while the price for electricity remains relatively cheap, exactly because China has so many energy plants working on coal… Interviewees think policy officials should strive towards measures and arrangements with countries such as China in order to remove the trade imbalances, but this will be a long term effort. Interviewees also state that in the PV-sector, real innovation remains rather an OECD-story. What Asia does best is applying existing technologies in larger scales. This is true in the solar energy sector, but also in the wind energy sector. With regard to Asia, Japan is the exception to the rule. With Japan, most other OECD countries have a genuine level playing field, and can enter the Japanese market, although in itself the Japanese home market for renewables is rather limited compared to other countries in Asia.

According to Sainteny, the awakening *'geopolitics of renewable energy'* will structure itself around three geographical zones and three thematical playing fields (Sainteny, 2010: 114). The three geographical zones are the European Union with Germany as a core country, the United States of America and Asia (with China, India, South Korea and Japan as core countries). The three thematical playing fields are: (1) the control over the technologies which have to be developed further, and the division of the added value these technologies will generate, (2) diminishing energy dependence, and (3) the impact on national development models in the post 2012-era of climate policy. These last two thematical playing fields urge policy-makers to invest more in renewable energy so as to realize win-win-scenarios. The most 'exciting' geopolitical game will however play out in the first domain, the "control" over the technologies that are to be developed further. With regard to *'downstream'*-activities in renewable energy, the European Union and the United States of America are still dominant. One can expect that this general head start can be retained for a while longer, although the developments in Asia can go fast. If the US and the EU are to retain their position, then it will become necessary to invest more in all facets of renewable energy. In the United States of America, often a triple approach is utilized; *"research / capital investment (including in demonstration projects) / start-up of new companies".* Europe often gets stuck in phase 1 or 2. Within Europe, Germany succeeds best in trying to activate its research community, firms and SME-network in structurally linking together the three phases.

On the front of investments in research, one can detect serious differences both through time and between different countries. The share of research into energy questions compared to the total research budgets has dropped in the IEA-member states (OECD countries) from 11% in 1985 to 3% in 2006. The average company in Europe invests only 3% of its turnover into research (compare to the cell phone industry, where this percentage lies at around 15%). This is why more public-private partnerships in renewable energy energy research are so important in the near future. The figures for the OECD-countries between 1974 and 2006 are as follows:

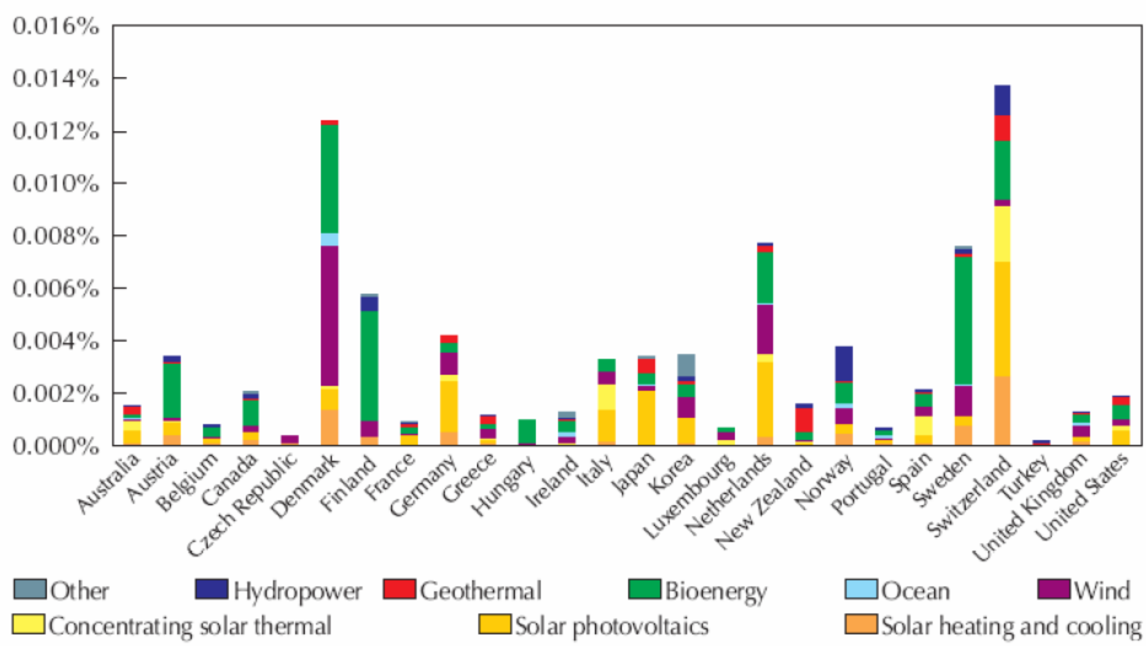
Figure 1. **All IEA member country energy RD&D spending, 1974-2006**



Source: IEA (2007a).

Moreover, one can detect serious differences between OECD-countries in the percentage of money devoted to renewable energy:

Figure 6. **Average annual renewables RD&D budgets, as a percentage of GDP, 1990-2006**



Bron: IEA (2008), Deploying Renewables

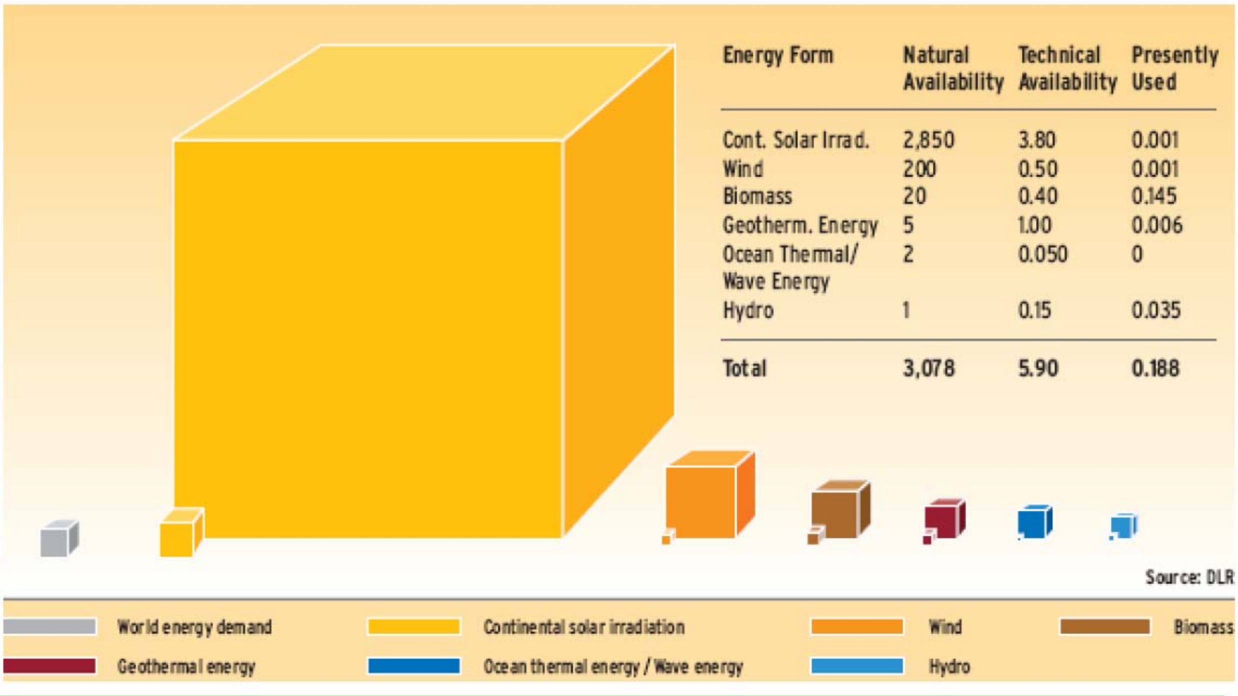
Countries which early on invest in renewable energy are often those who are successful on the international field. However, the case of the Netherlands shows that investments in demonstration projects and "roll out" are equally as important to make research investments pay off in the longer term. The Netherlands is lagging behind on both.

5.2. The potential of renewable energy sources and their geopolitical consequences

According to Professor Marianne Haug [2] of the University of Hohenheim, in Stuttgart, the transition in the direction of *'renewables'* creates at least five geopolitical challenges:

(1) Imbalances in the locations where these sources can be developed (a problem very similar compared to conventional energy sources);
(2) traditional biomass linked to problems of poverty, health and gender;
(3) hydropower and its disruptive effect on its surroundings;
(4) *"new renewables"* – solar, wind, geothermal, waves and tides – the question of central vis-à-vis decentral production;
(5) the challenges of a sustainable bioenergy sector – is this feasible?

Current technologies in renewable energy only capture a fraction of the available solar energy, wind energy, biomass, geothermal energy, ocean thermal energy, wave energy and hydropower, as Haug shows very interestingly:



Energy Form	Natural Availability	Technical Availability	Presently Used
Cont. Solar Irrad.	2,850	3.80	0.001
Wind	200	0.50	0.001
Biomass	20	0.40	0.145
Geotherm. Energy	5	1.00	0.006
Ocean Thermal/ Wave Energy	2	0.050	0
Hydro	1	0.15	0.035
Total	3,078	5.90	0.188

[2] Marianne Haug is among others president of the Board of Directors of the *'Forum für Zukunftsenergien'* in Berlin, an independent think tank on energy policy. She is also member of the advisory group *OMV Future Energy Fund*. For the European Commission, she is president of *AGE7 – Advisory Group for Energy for the 7th Framework Programme* and member of the *High-level Advisory Council for the European Technology Platform on Hydrogen & Fuel Cell*. Between 2001 and 2005, she was Director in the *International Energy Agency* (IEA) in Paris, responsible for the *'Office of Energy Efficiency, Technology and R&D'*.

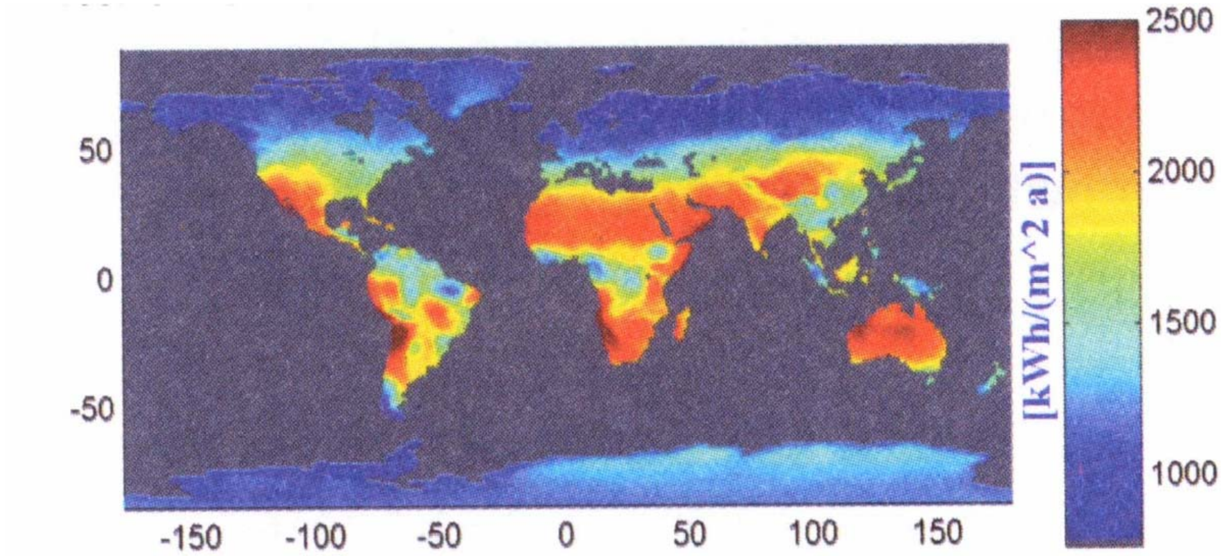
Next to the technological factor, also the geographical factor is at play. Potential geopolitical tensions, solutions, or potential for cooperation is linked very specifically with each type of renewable energy, and also with the natural resources which are available in a country. We already referred to Daniel Deudney's concept of the *'geo-technical ensemble'*. The new technologies that are developed together with the geographical opportunities and limitations of certain geographical areas, will determine the new geopolitical context within which countries, regions and territories will be able to operate, create welfare and wellness, and develop a *power base* – literally but also figuratively. As it is the case in the 'Geopolitics of Conventional Energy', also the 'Geopolitics of Renewable Energy' creates geo-technical opportunities and limitations. Countries are most successful if they can maximize the opportunities while reducing the importance of the limitations as much as possible.

Every energy source has its own specific characteristics and creates its own *'geo-technical ensemble'* which generates an impact upon the macro-regional and international relations. In a world in which renewable energy would dominate as the most important source of energy, those relations could potentially be very different as compared to a world dominated by conventional energy. Moreover, the network of dependencies will be considerably more complex in a renewable energy world, exactly because different types of renewable energy create their own specific *'geo-technical ensemble'*. And to make matters even more complex, these relations can be susceptible to new advancements at the technological front. Hereafter, we will briefly "zoom in" to the potential in renewable energy domains such as solar, wind and biomass, and their geopolitical consequences.

A last element which is sometimes forgotten, is that more renewable energy in the energy mix sometimes may create *new* dependencies upon the outside world for natural resources such as lithium (which is being used in batteries of electrical cars), or silicium (which is being used in solar panels). This entails an unexpected geopolitical side effect of the rapid growth of renewable energy. Hereafter we will study some of these developments in different areas in the world.

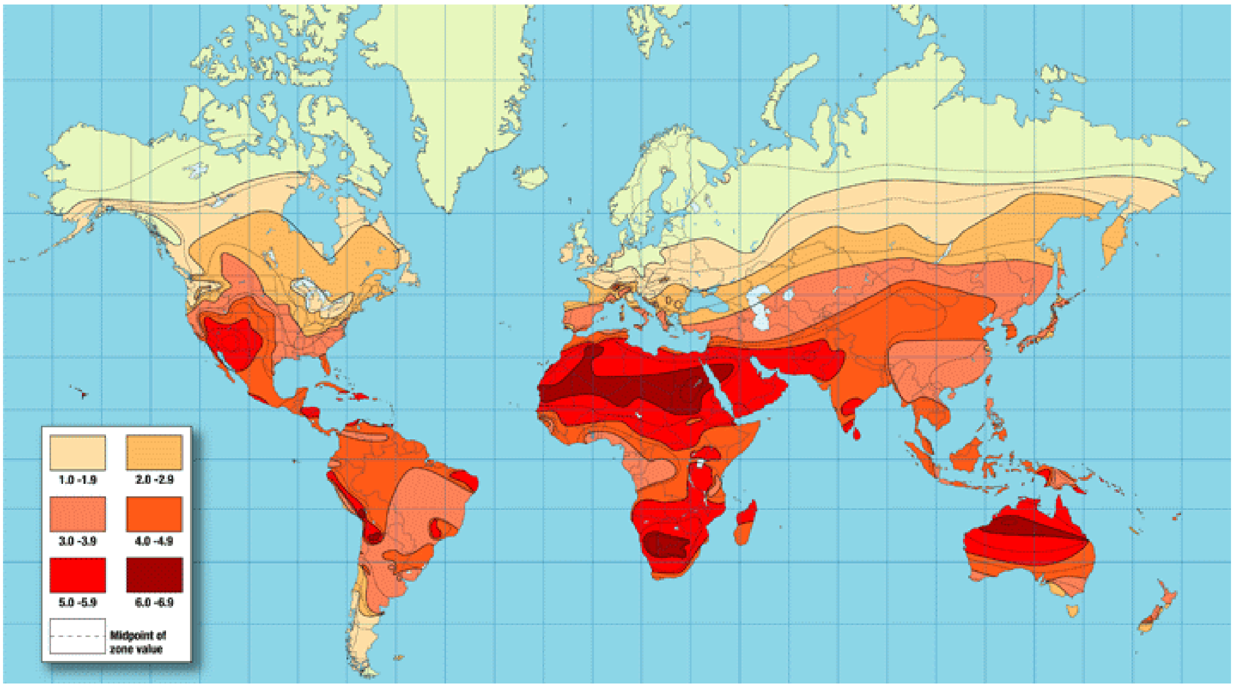
5.2.1. Solar power potential and its geopolitical consequences

Certain areas in the world are much more interesting to 'harvest' sun light then others because the number of sun hours in the world is higher each month or because the sun shines with a greater intensity. The following world map by Haug shows this more clearly:



SOURCE: Meteorological data form European Centre for Medium Range Weather Forecast (ECMWF), ISET/IPP, 2000
Note: Values (in kWh per m² and year) are given in terms of global horizontal irradiation (1983 to 1992).

The map by Haug shows a belt beginning in California over Mexico, crossing the Sahara desert over into the Middle East and then going into Central Asia. Also Southern Africa and Australia clearly are on the map. These regions are ideal to invest in solar energy. Another, more accurate map [3] provides a better overview of solar insolation in hours:



From a geopolitical point of view, it is not so difficult to imagine what kind of relations between producer, transit and consumer countries might be developed provided the necessary power lines are invested in. In the Americas it might bring about a closer cooperation between Mexico and the United States of America for example. California and its neighbouring states could be transformed into a power house. In South America one

[3] Source: http://www.scorigin.com/diy_-_solar_power

could also imagine interesting new cooperations between countries, although the terrain will make it difficult to actually build the necessary power lines. Between Europe and Northern Africa and the Middle East, an interesting geopolitical and geo-economic relationship might develop. The plans are already in the making; the so-called Desertec project. We will briefly study this project, its *potential* and *drawbacks* in point 6 of this paper. In Asia, India may very well be able to cover its own needs, although China's territory only offers possibilities in very specific regions.

In the northern hemisphere, countries such as Canada, the Nordic countries in Europe and the Russian federation will not be very big players in the solar energy market. They will have to invest in other niches of renewable energy.

The Middle East might be able to retain part of its position as an energy producer. In fact, we see interesting developments in the region on this issue. All countries in the region have excellent possibilities with regard to solar power, with values between 4 to 8 kWh/m. The sun is positioned higher in the sky and clouds are less numerous compared to e.g. Europe. Both *concentrated solar power* (CSP) and *photovoltaic panels* (PV) have a good *return on investment* here. The most important country of all for the moment in renewable energy technologies in general is the United Arab Emirates (UAE). One of the most prominent initiatives is the *'Masdar initiative'*, the creation of the first CO2-neutral city in the world, in Abu Dhabi. Best available technologies will be implemented there. The project combines waste management with renewable technologies such as solar and wind. Also energy efficiency is part of the concept of 'Masdar'. The UAE also plans building gigantic energy islands [4] off the coast, based upon solar technology. The concept is currently tested in the region by Dr Thomas Hinderling of the *Swiss Centre for Electronics and Microtechnology* (CSEM).[5] With projects such as these, the UAE may very well become a very important player indeed. On the other hand, one notices that countries such as Saudi Arabia, who have large oil reserves, are somewhat lagging behind compared to some smaller countries in the region.

Another country in North Africa which is embracing solar energy is Morocco. The country is investing 6.6 billion euros in the next years into solar projects. By 2020, Morocco will have five solar energy power stations operational, enough to cover 20% of the country's energy needs. The relative internal stability of the country compared to some other countries in Northern Africa may well result in Morocco becoming an important player, also because of its interesting location not so far from Europe.

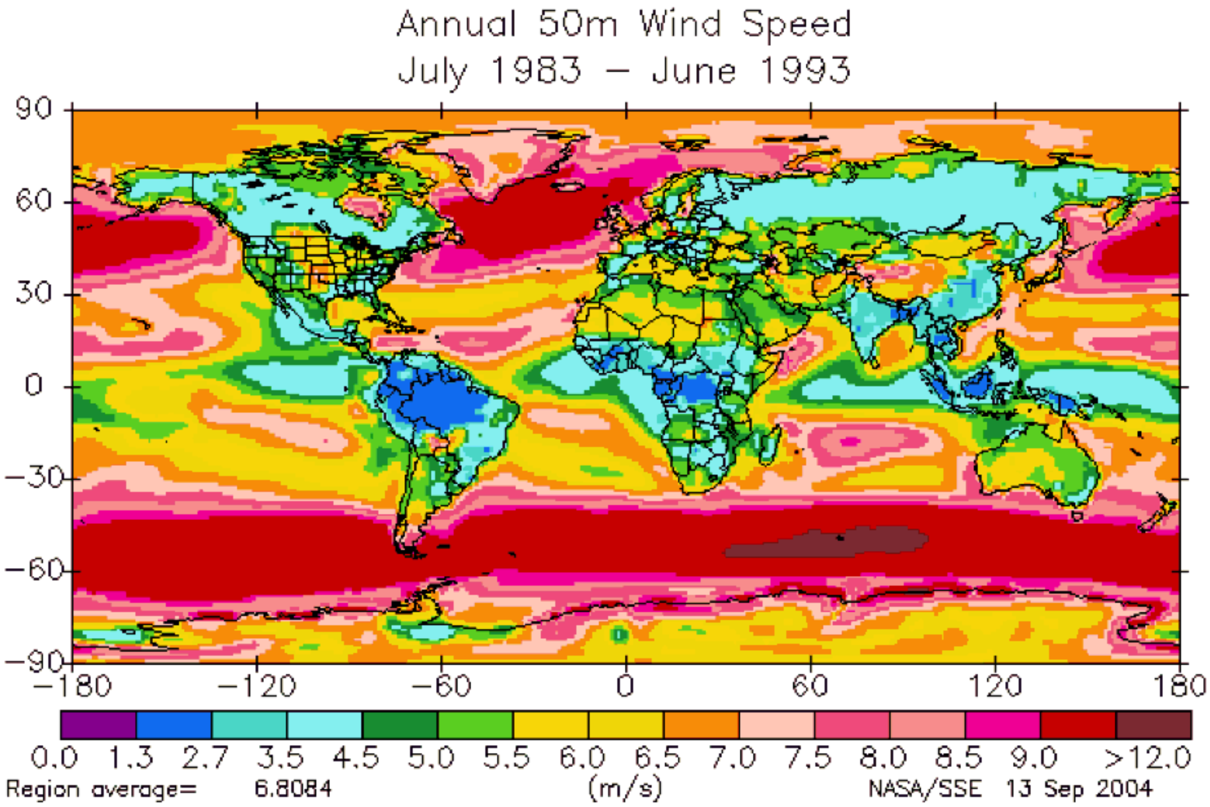
Hence, one can see that solar power can potentially create new and interesting shifts in geopolitical power relations for those countries who have the potential and invest in it.

---

[4] See film on 'solar islands': http://www.youtube.com/watch?v=D1XyR3YOVZQ&feature=related
[5] See: http://www.uaeinteract.com/docs/RAK_to_test_floating_solar_island/28331.htm

5.2.2. Wind energy potential and its geopolitical consequences

The following map [6] offers an interesting idea of wind power potential in the world:

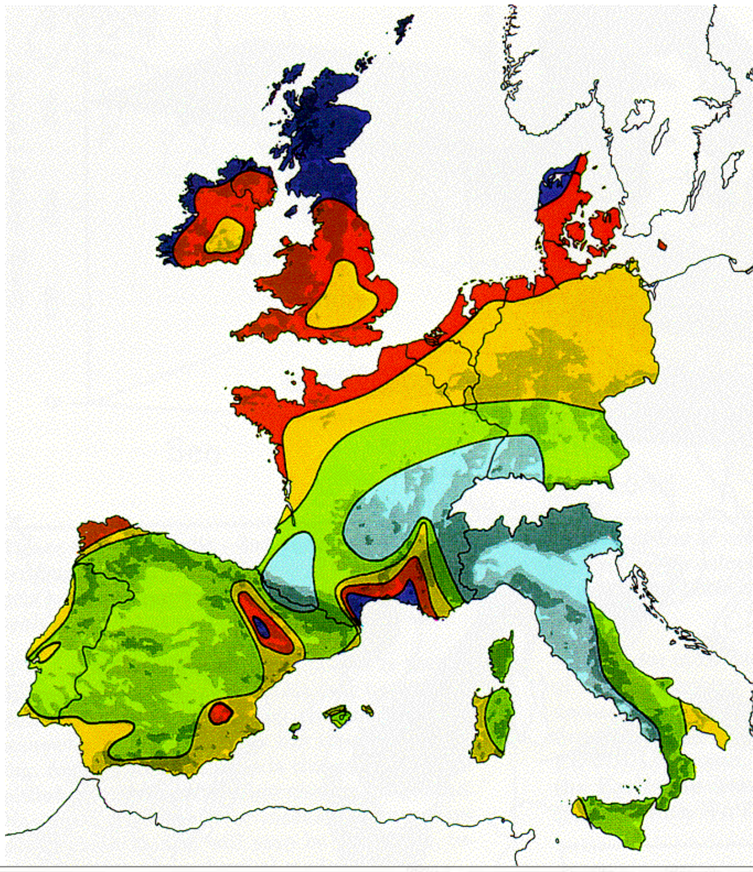


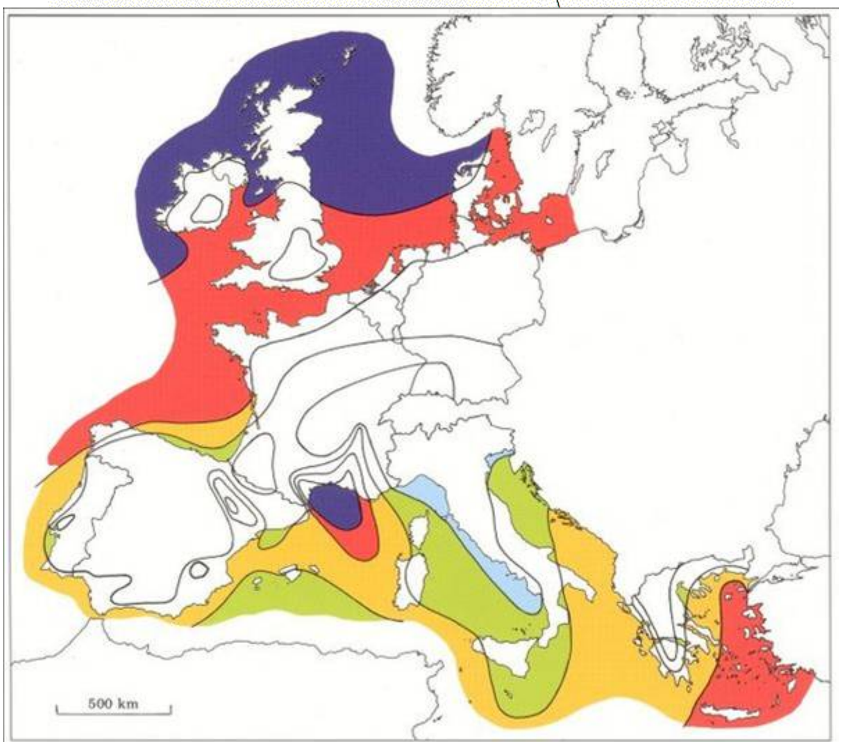
Wind energy at roughly 7 meters/second (m/s) and faster are economically worth exploiting today even in higher-cost offshore locations; those are the orange, pink, and shades of red and brown in the figure above. In many areas, especially on land, the 6 m/s areas are already economically viable, those are the yellows. We see that the largest wind resources are above the oceans and mid-continental plains of each of the major continents. The coastal oceans are of special interest because they have strong winds and they are close to most of the world's population and electric use. How much of the vast ocean wind resource is likely to be tapped? Current offshore wind towers available today are rated to 20m water depth (some manufacturers say 30m). Designs now under development would extend this to the entire continental shelf areas (up to 150-200m depth) (see footnote 6).

If we look again at the data above with a geo-economical and geopolitical lens, then one could state that of all renewable energies, wind is most dispersed. However, when one looks at the areas in the world which are more economically viable compared to other regions, another picture arises. Central America and a big part of South America seem to be the biggest losers with regard to wind power energy. The same can be said for Central Africa & Indonesia. The reason is quite straight forward; because they are at the equator.

[6] See: http://www.ceoe.udel.edu/windpower/ResourceMap/index-world.html

Other parts of the world are more interesting with regard to wind energy, but the situation within each continent is very specific indeed. Let us now briefly look at Europe: [7]





Wind resources over open sea (more than 10 km offshore) for five standard heights										
	10 m		25 m		50 m		100 m		200 m	
	$m s^{-1}$	Wm^{-2}	$m s^{-1}$	Wm^{-2}	$m s^{-1}$	Wm^{-2}	$m s^{-1}$	Wm^{-2}	$m s^{-1}$	Wm^{-2}
	> 8.0	> 600	> 8.5	> 700	> 9.0	> 800	> 10.0	> 1100	> 11.0	> 1500
	7.0-8.0	350-600	7.5-8.5	450-700	8.0-9.0	600-800	8.5-10.0	650-1100	9.5-11.0	900-1500
	6.0-7.0	250-300	6.5-7.5	300-450	7.0-8.0	400-600	7.5- 8.5	450- 650	8.0- 9.5	600- 900
	4.5-6.0	100-250	5.0-6.5	150-300	5.5-7.0	200-400	6.0- 7.5	250- 450	6.5- 8.0	300- 600
	< 4.5	< 100	< 5.0	< 150	< 5.5	< 200	< 6.0	< 250	< 6.5	< 300

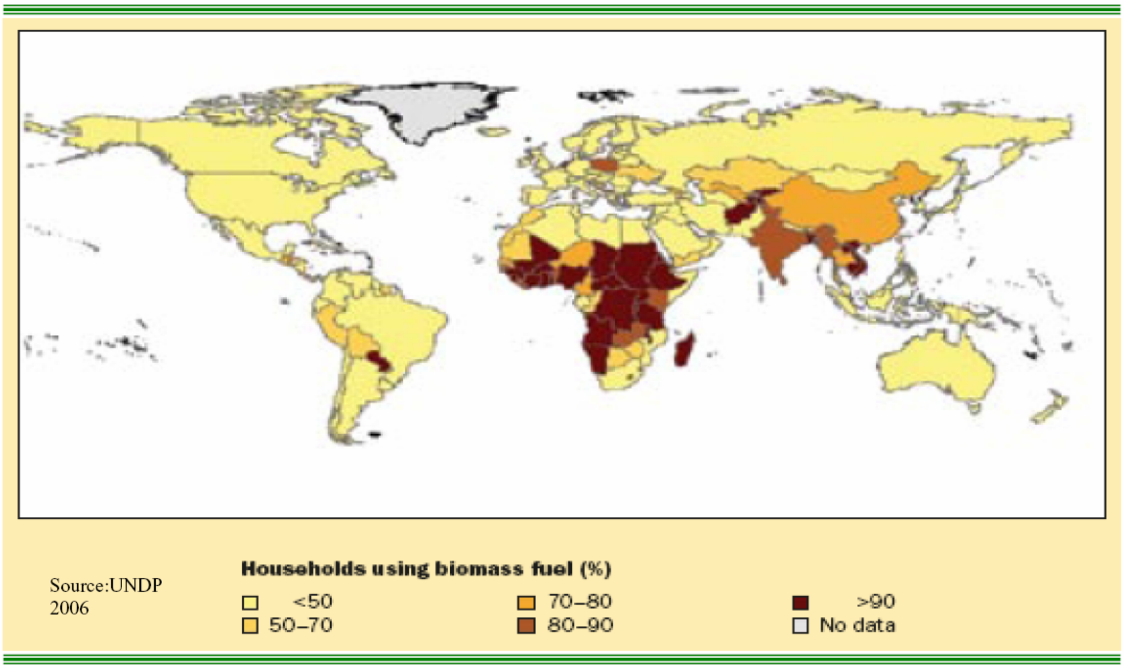
[7] See: http://stro9.vub.ac.be/wind/windplan/ ;
http://www.all-creatures.org/hope/gw/GD_wind-offshore_potential_Europe.jpg

In the Mediterranean, only the shores of the coast of southern France are interesting for wind energy. The same can be said for some islands in the east of Greece. The most potential can be found in the North Sea. It is therefore not a coincidence that the European Commission has proposed the creation of a North Sea Countries Offshore Grid. We will study this project briefly in point 6. of this paper. What especially seems important from a geopolitical and geo-economic point of view, is the interconnection between this project and the European mainland.

5.2.3. Bio-energy potential and its geopolitical consequences

In first instance, biomass does not seem as 'sexy' as other sources of renewable energy. Its applications are multifarious, that is why biomass is much more difficult to capture in its potential from a geo-economical and geopolitical point of view. Who says biomass, may think of biofuels. This may immediately spur debates on the deontological questions regarding biofuels and their competition with the food production. However, this reflects only a fraction of the story, biomass entails much more than this. Biomass has many different manifestations. Not using biomass would be like excluding a very important source of renewable energy.

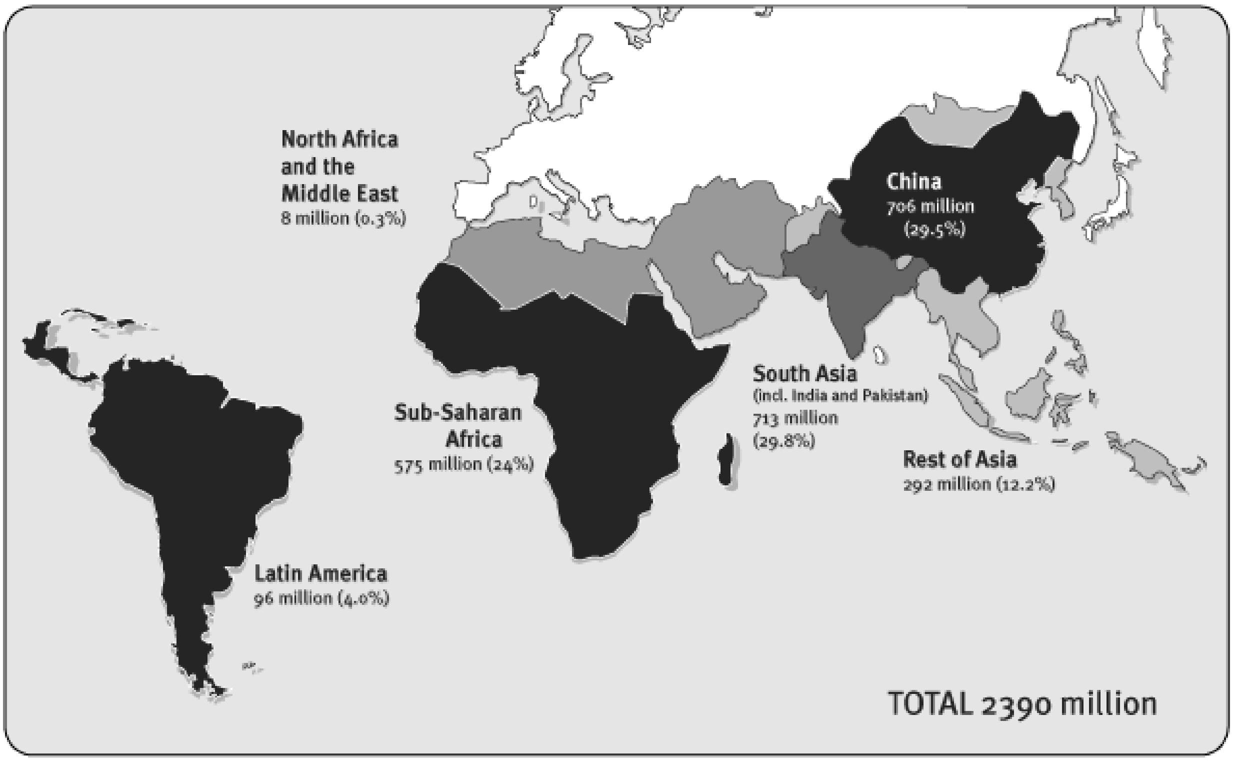
Biomass can make an important contribution in geo-economical and geopolitical terms to reducing poverty in the world. As Haug indicates, many households in the world, and especially in Africa and Asia use biomass as their most important source of energy, but not in an efficient way. Modern biomass-stoves and similar more efficient technologies, could become *'game changers'* in the developing world. Some groups such as *BioPact* make a plea for a geopolitical cooperation, "a green energy pact", between Europe and Africa.[8]



© Marianne Haug

[8] Zie: http://news.mongabay.com/bioenergy/site/goals.html

A more detailed map [9] on the usage of biomass in households:



But this is not the only aspect of the *Geopolitics of Biomass*. Some claim that a biomass-revolution is at hand.[10] Central in this is the idea that the current economy focuses too much on fossil fuels and conventional energy sources. These are not only used in transport, but also in many products which we use in daily life. Oil is for instance also used in fertilizers. The industry which makes this all happen is the petrochemical industry. The big petrochemical clusters in the world, e.g. in Houston, Texas (ranked first in the world) or in Antwerp, Belgium (ranked second in the world), will in the coming decades come under pressure. For each of the products that they produce, alternatives will have to be found which are not based upon oil, but rather based upon biomass. This suddenly places biomass centre stage in the international energy regime of the future.

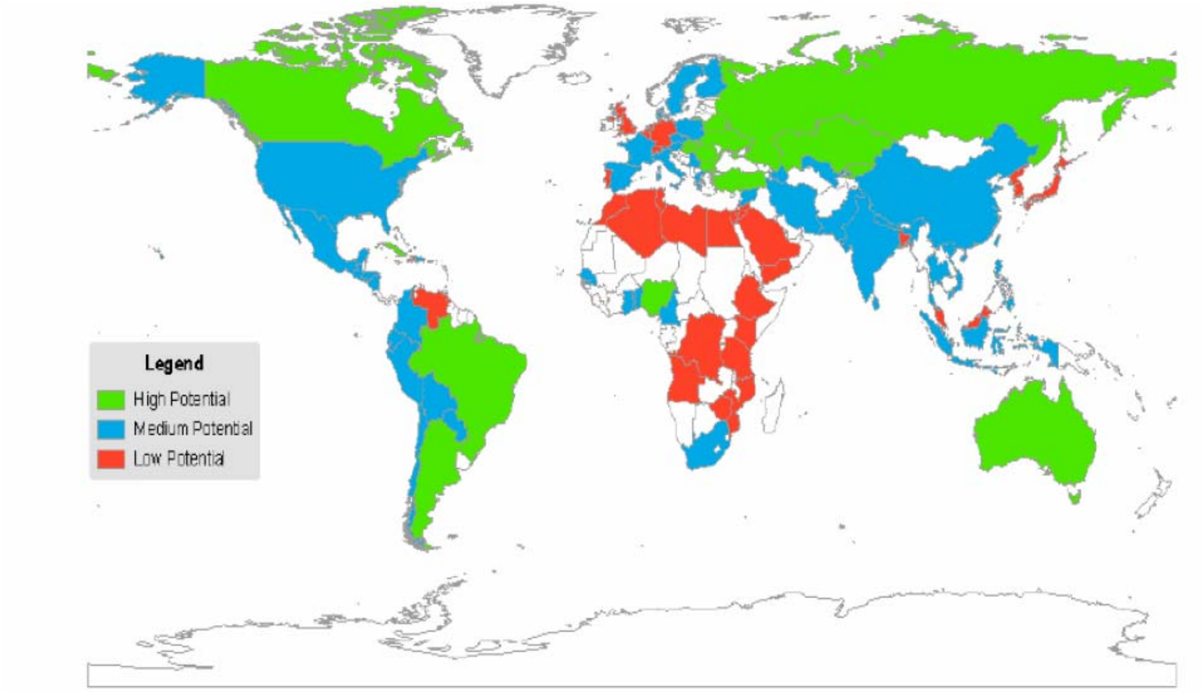
One of the leading countries in the world with regard to the *bio-based economy*, is the Netherlands. In October 2007, the Dutch ministry of Agriculte, Nature and Food Quality published the document *'Closing The Chain'*. In it, the government vision is presented on the role the *bio-based economy* can play in the green transition in the Netherlands. Some of the pillars are: the efficent use of biomass via biorefinery (the unraveling of biomass into green raw materials as the base for a wide diversity of products), sustainable production of biomass worldwide (for which specific criteria are developed), the production of green gas and sustainable electricity. Next to this, the government sees it as its task to reduce the risk of a possible competition with the food production. Even more important is that the Dutch sector of the petrochemical industry has defined the goal in twenty year's

9 See: http://practicalaction.org/smoke_report_2
10 See: http://tegenlicht.vpro.nl/nieuws/energie/2010/april/achtergrondartikel-biomassa.html

time of having 30% of all its applications based upon biomass instead of oil. In the Netherlands, a process has started to bundle all existing competences and create a *Biorefinery Cluster*. The Netherlands has special assets with regard to the biomass-revolution, especially in the combination of its logistical role with its technological expertise and its agricultural tradition as second exporter in the world. The Netherlands' case also shows that in the biomass-revolution, a special role will be assigned to the harbours. In this regard, Rotterdam, Delfzijl and even the Belgian harbour of Antwerp are mentioned as possible hubs in biomass trade in the world. Some even plea to install a world exchange in biomass in the Netherlands & Flanders. The study which we conducted at the Flemish Centre for International Policy also shows that Flanders (the northern part of Belgium) and the Netherlands are quite complementary as regards to know-how in biomass, which could be the basis for a further cooperation between these two entities.

The transition towards biomass will be knowledge-intensive. This will mean that a lot of investments will be needed to make biomass a more efficient and applicable source of energy around the world. Only certain industrial centres in the world are currently equipped to deal with this transition, whereas other parts in the world –often in the southern hemisphere and in Russia– have a strong position in the fact that they have the biomass themselves. New relations between importer en exporter countries will thus arise and shape the Geopolitics of Biomass. However, there is a danger of new dependencies.

With regard to *biofuels*, similar concerns can be raised which could influence global geopolitical and geo-economical relations. The map below developed by the International Food Policy Research Institute (IFPRI), offers an idea of the potential countries have with regard to *biofuels*:



Source: IFPRI, 2008

Among the potential leaders with regard to the export of biofuels, the following countries can be mentioned; Brazil, Argentina, Canada, the Russian federation, Turkey, Belarus, the Ukraine, Kazachstan, Uzbekistan, Romenia, Hungary, Australia and Nigeria. If these countries invest in biomass and biofuel applications, then they could become actors which play a role in the geopolitical relations which will be shaped around biofuels. Today, we can already detect a fierce competition between the United Stated of America and Brazil for a *control over* and more importantly *access to* markets – which already is played out at international fora such as the World Trade Organization. Often this 'battle' is fought via technical measures and standards.

In 2006, the International Energy Programme of the Dutch Institute for International Relations 'Clingendael' published an interesting study on *'Future Fuels and Geopolitics: The Role of Biofuels'.*[11] In this document, bioenergy and *biofuels* are seen as important so as to bridge the energy gap which many countries will experience. Especially bio-energy is important from a geopolitical point of view, since it can be produced locally. The import-portfolio of countries producing it will change, and they will become less dependent upon fossil fuels. It will also foster the scientific and technological development of these countries, and stimulate international trade. Biofuels are more easy to implement because the adaptations which have to be made on an infrastructural level are less sizeable compared to electrical cars or cars on hydrogen. Bioenergy also clearly affects the geopolitics of energy. Regions with a high production potential for bioenergy can gradually decrease their dependence from the Middle East and unstable countries in the world (e.g. Nigeria) and become themselves exporters of energy. Regions with a lower production potential for bioenergy will have to develop other strategies.

The Clingendael International Energy Programme refers to studies of the *IEA Bioenergy Task 40* [12] in order to identify some potential 'winners' and 'losers'. According to these projections, Sub-Sahara Africa seems to encompass the biggest potential with regard to bioenergy, closely followed by South America and the Russian federation. The European Union and the United States of America are in the 'middle group', and could become potential biofuel-importers. Asia seems to be a more complex story; East Asia in general and China in particular have a clear potential, there where Japan finds itself in a less comfortable position. Southeast Asia in general and India in particular have a clear potential, but this is not in proportion to its rapidly growing population. Australia and the islands in the Pacific Ocean will probably become major exporters, six times more than their domestic consumption. The biggest loser in the story of bio-energy seems to be the Middle East. But the Middle East does not necessarily need bio-energy. In our opinion, these projections can considerably be influenced by the degree to which countries may succeed in developing specific technologies, and link these to innovative sales strategies.

[11] See: http://www.clingendael.nl/ciep/events/20051209/20051209_CIEP_VanGeuns.pdf
[12] See: http://www.bioenergytrade.org/

Also important is whether the countries will be vigilant in detecting trade obstructions. Nevertheless, from a geopolitical point of view, biofuels and bio-energy will probably offer important chances to parts of Africa and South America.

With biomass, there is now a new chance –the first real one in 200 years– to strengthen the economic function of agriculture in national and regional economies. For two centuries, agriculture has decreased as a percentage of the economic activity in places across the globe. The transition towards biomass and bio-energy creates a new role for agriculture, not only in the production of food, but also in energy and raw materials for a biobased economy. With biomass, the energy production and –consumption could be again brought into a balance. In the long term, this may lead to more autonomy in terms of energy or energy security. A new international import- and export market may be developed, and certain countries and regions may play a pivotal role in this.

5.2.4. Electric cars, solar panels and the rising Geopolitics of Rare Earth Materials

Up until now, this paper identified some potential positive aspects of the transition towards renewable energy. However, there is also another side of the coin. Ryan Hodum wrote in his article *'Geopolitics Redrawn: The Changing Landscape of Clean Energy'* about another, less benign aspect of the transition towards renewable energy systems; the Geopolitics of Rare Earth Materials (Odum, 2010). Notwithstanding the progress that has been made, significant problems remain. The production of wind turbines and electric vehicle batteries is dependent upon rare earth materials, which raises concerns among technology developers and national security planners. Wind turbines are among others composed of steel, concrete, magnetic materials, aluminium and copper. The magnets used in wind turbine gearboxes require *neodymium*, a rare earth element. The increasing demand for neodymium may strain production and lead to dependency on insecure supplies. The world's largest rare earth deposits are situated in China. In 2007, almost 90% of the U.S. rare earth imports came from China.

Just as demand for rare earth elements needed to produce sophisticated electronics is exploding, China, which has a monopoly on supply over the metals, is cutting back on exports, citing *industry restructuring* and *environmental concerns*. Beijing slashed export quotas in 2010 by around 40 percent from 2009 levels, saying it must protect its reserves that have been recklessly exploited over the past 20 years. Government officials contend that with one-third of the world's known reserves of 'rare earths', China has satisfied more than 90 percent of the world's need for those elements (Becker, 2010).

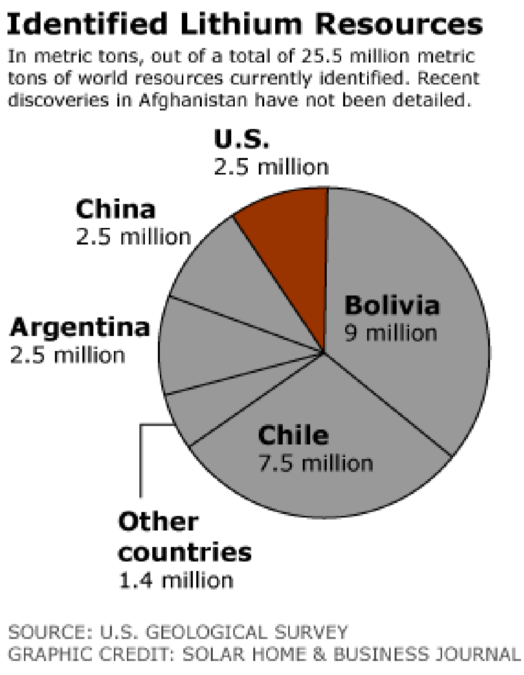
The 21st Century Economic Herald newspaper, stated the following in 2010; *"China is the land of rare earths in the same way that the Middle East has oil and Australia has iron ore. But China has not enjoyed the handsome profits that those countries have ripped from* *their control over precious resources"*. Former Chinese leader Deng Xiaoping said once during a tour of China's export zones in 1992: *"The Middle East has oil, China has rare earths".* Beijing has repeatedly denied that it would use its dominance of this crucial industry as a "bargaining tool" with rival nations. Hillary Clinton, U.S. Secretary of State, stated in October 2010 in Hanoi that she had received assurances from her Chinese counterpart, Yang Jiechi, that Beijing had *"no intention of withholding these minerals"* from the world market. However, the question remains a sensitive one.

With electric vehicles, not only the abovementioned rare earth materials are problematic, but also the lithium used in lithium-ion batteries. Half of global lithium reserves are located in Bolivia, though they are not yet economically recoverable. The majority of the world's recoverable reserves are to be found in neighbouring Chile (Odum, 2010).

Also China has important lithium reserves, which it is using strategically. It is not a coincidence that China is developing electric cars. One of the big companies in this new car sector is BYD (*'Build Your Dreams'*), a company from Shenzhen, in the southeast of China. It was started 14 years ago and currently has 130.000 personnel. BYD originally started with the production of Lithium ION-batteries, and only six years ago diversified into electric cars. In a very short time it became an important player. A similar company with an equal amount of know-how is the Japanese company Nissan. Recently, Nissan tried to sell its electric car on the Chinese market, the only market in the world where it would be possible to a sell relatively high volume in a short time (Nissan aims at 400.000 a year). An important asset is this is Nissan's own Lithium ION-battery. But, in order to produce this car in China, it needed to have access to the Chinese Lithium-supplies.[13] Japan does not have as many supplies. The Chinese government does not allow foreign players to alone develop activities with regard to the electric car. The access to the Lithium-mines was blocked for Nissan until it agreed to set up a *joint venture* with a Chinese partner, promising also a technology-transfer. The story on the electric car in Asia thus transforms into a tale with a geopolitical nature; a battle for the access to raw materials linked to know-how on battery technology. Today, China is clearly protecting its own market in electric cars so as to be in better shape to sell cars tomorrow to the US and Europe. All this produces a new picture of the transition to renewable energy, which isn't always as benign as thought in advance.

The following map [14] offers an overview of the world's lithium supply:

[13] Some observers are today only asking the question whether it will be possible to have all future electric cars in the world work on Lithium ION-batteries. According to this group, this would soon lead to shortages on the world's markets in raw materials…
[14] See: Coyle, Pamela, (2010) 'Lithium: Searching for a Metal That Can Help Power the World' http://solarhbj.com/news/lithium-searching-for-a-metal-that-can-help-power-the-world-0855



On the other hand, solar photovoltaic panels require among others indium, gallium, germanium and silicon (Odum, 2010). The US depends completely on foreign gallium and indium, and for over 80% on germanium. In addition to China, these materials are also located in Central Africa and Russia. The *Geopolitics of Renewable Energy* may in this sense look more similar compared to the *Geopolitics of Conventional Energy*; whereas the West might be trying to wane its dependence on e.g. the Middle East, new dependences may be developed, for instance on Chinese minerals…

Of all the countries in the world, the United States of America are among the first countries to develop a *Critical Materials Strategy* with regard to clean energy components.[15] The U.S. Department of Energy (DOE) recently published an overview of the relation between rare earths and renewable energy:[16]

		CLEAN ENERGY TECHNOLOGIES AND *COMPONENTS*				
		Solar Cells	Wind Turbines	Vehicles		Lighting
	MATERIAL	*PV films*	*Magnets*	*Magnets*	*Batteries*	*Phosphors*
Rare Earth Elements	Lanthanum				●	●
	Cerium				●	●
	Praseodymium		●	●	●	
	Neodymium		●	●	●	
	Samarium		●	●		
	Europium					●
	Terbium					●
	Dysprosium		●	●		
	Yttrium					●
	Indium	●				
	Gallium	●				
	Tellurium	●				
	Cobalt				●	
	Lithium				●	

The document also identifies rare earths with supply risks for the short and medium term:

Figure 1. Short-Term (0–5 years) Criticality Matrix

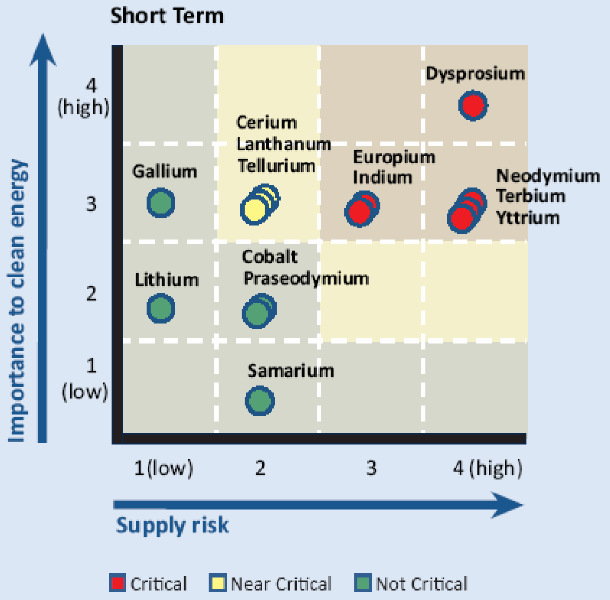
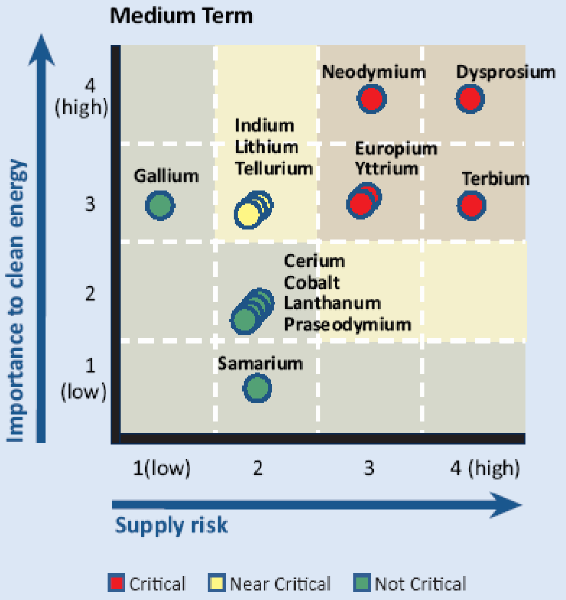


Figure 2. Medium-Term (5–15 years) Criticality Matrix



[15] U.S. Department of Energy (2010) *Critical Materials Strategy – Summary Report*, http://www.energy.gov/news/documents/Critical_Materials_Summary.pdf
[16] Koshmrl, Mike (2010) *What "rare earth" metals mean to renewable energy*, http://www.ases.org/index.php?option=com_myblog&show=What-a-rare-eartha-metals-mean-to-renewable-energy.html&Itemid=27

The Strategy evaluates the extent to which widespread deployment of these technologies may increase worldwide demand for rare earth elements and certain other materials. It also considers likely trajectories for future supply of these materials and the potential for supply-demand mismatch. Conclusions include:

- Several components of the clean energy technologies— including permanent magnets, batteries, photovoltaic (PV) thin films and phosphors—depend on materials at risk of supply disruptions in the short term (0–5 years). Those risks will likely decrease in the medium (5–15 years) and long term.
- Clean energy technologies currently constitute about 20 percent of global consumption of critical materials. As clean energy technologies are deployed more widely in the decades ahead, their share of global consumption of critical materials will likely grow.
- Of the materials analyzed, five rare earth metals (dysprosium, neodymium, terbium, europium and yttrium) and indium are assessed as most critical (Figures 1 and 2). In this report, "criticality" is a measure that combines importance to the clean energy economy, and risk of supply disruption.
- Rare earth metals are not in fact rare. They are found in many countries, including the United States, Canada and Australia. However, at present, more than 95% of production for rare earth metals is currently in China. Bringing new mines online requires long lead times and large capital outlays.
- Critical materials are often only a small fraction of the total cost of clean energy technologies. Therefore, price increases for these materials may not have significant impact on price of the final product or demand for the technologies. The lack of response to price signals suggests the possibility of supply shortages.
- Sound policies and strategic investments can reduce the risk of supply disruptions, especially in the medium and long term.
- Data with respect to many of the issues considered are sparse.

In this report, DOE announces its plan to (i) develop its first integrated research plan with respect to critical materials, building on three workshops convened by the Department during November and December 2010; (ii) strengthen its capacity for information gathering on this topic; and (iii) work closely with international partners, including Japan and Europe, to reduce vulnerability to supply disruptions and address critical material needs. DOE will work with other stakeholders—including interagency colleagues, Congress and the public—to shape policy tools that strengthen the United States' strategic capabilities. DOE also announces its plan to develop an *updated Critical Materials Strategy*, based upon additional events and information, by the end of 2011. The work done by DOE is very important, and will enhance international insight into these issues. Upon these data also other countries (e.g. in the OECD) will be able to establish new policies.

5.2.5. Does a renewable energy regime foster a multipolar world order?

One of the most intriguing questions one can ask with regard to the transition to a world with a renewable energy regime, is what impact it will have on the international system.

The conventional energy regime fostered the accumulation of capital and military power, so as to be able to develop oil and natural gas fields. Much of the military power of the United States of America was built in the first half of the twentieth century, when the US was the 'Saudi Arabia' of its time. Equally, the Soviet Union was gifted with a wealth in oil, natural gas and other material resources, which formed the base of much of its economic, military and political power. We can detect for instance a correlation between the high energy prices of the seventies in the last century, and the elevated position of the Soviet Union during the Brezhnev era. In 1945, President Roosevelt grasped the idea that the US eventually would become dependent on foreign oil. He pioneered a foreign policy based on oil, by having a political agreement with Saudi Arabia (security for oil) – to make up for the decline of American reserves. This agreement became a dominant factor in American foreign policy in the decades thereafter. This later culminated in the Carter Doctrine which stated that an attempt by any outside force to gain control of the oil in the Middle East, would be considered an attack upon the vital interests of the United States. In effect, it is not a coincidence that the international oil regime eventually was one of the more important background variables which fostered the development of the international system into a *bipolar* one. During the end of the bipolar system, between 1989 and 1991, oil prices were relatively low (20 US$ / barrel), with the exception of the times during the Gulf War (40 US $ / barrel). The nineties were years in which the global search for diversity in oil fields produced a stable international regime, a *uni-multipolar* one, led by the US under the banner of 'globalisation'. From the beginning of the 21^{st} century, the smaller oil fields in many areas outside the Middle East gradually depleting. As a result of this, the oil price rose once more and this time more structurally because hundreds of millions of consumers in Asia (India and China) entered the global economic scene. The power of the US gradually declined in relative terms, and the Russian Federation used this period to re-install parts of its international stature in the world. But the bipolar system was no longer in the cards. Henceforth power was more distributed, and one can debate whether the world today finds itself between a *uni-multipolar order* and a genuine *multipolar one*. Especially the financial-economical crisis of 2008, strengthens this debate.

If we agree with the assumption that the oil age has now gradually begun its long decline, which will take more than several decades, what kind of international system will come after this? This paper shows that much will depend upon the investments made by countries in renewable energy technologies, but also upon their access to several rare earth materials. Based upon these factors, one could build a strong case that the international system will most likely in the coming ten to twenty years evolve further into a *duo-multipolar system*. This means a world in which power is shared on a more equal basis among different regions in the world, but one in which the United States of America and the People's Republic of China play a pivotal role. For this argument, we can refer to two factors; (1) the research and money currently invested into renewable energy, and (2) the factor of rare earth materials.

First, the research in this paper shows the dominance of the US in terms of research money and patents in the area of clean tech. Indeed, the European countries individually also invest a lot of money and know-how into clean tech and renewable energy, but often their efforts do not lead to final products. Of all European countries, Germany has been able to acquire a pivotal position, but this position was achieved at a high cost relatively speaking. Whereas Europe pioneers a lot of projects in renewable energy, it is less clear whether the EU will be able to translate this into a power position. The People's Republic of China is less on the cutting edge of technology and know-how, but does what it does best; marry available technologies in renewable energy with the factor it has plenty of – labour. In the past five years, Chinese officials have increasingly realised the strategic importance of renewable energy, and have made the decision that China should strategically invest in it. In just a few years, China has already become one of the world's largest producers in solar energy, wind energy and electric batteries. This gives China a lead over other countries. One can detect similar developments in e.g. India and the United Arab Emirates, but nowhere in the world are renewable energies combined with a deliberate strategy to strengthen the country's position in the world as is being done today by China.

Second, the factor of rare earth materials. As this paper shows, a whole range of rare earth materials is needed for renewable energy technologies to work. As the need for these technologies will rise, different countries will benefit from it. China however is uniquely endowed with some of these crucial rare earth materials – for instance lithium, but the same can be said for a number of other rare earth materials. China is deliberately pursuing a policy whereby it wants to protect its own reserves. This creates potential dependencies, and will perhaps force other countries to be more subservient to China's wishes, or export cutting edge technological know-how in exchange. This forms an added argument why China may well develop its position as a power, a position in the world it will probably share with the United States.

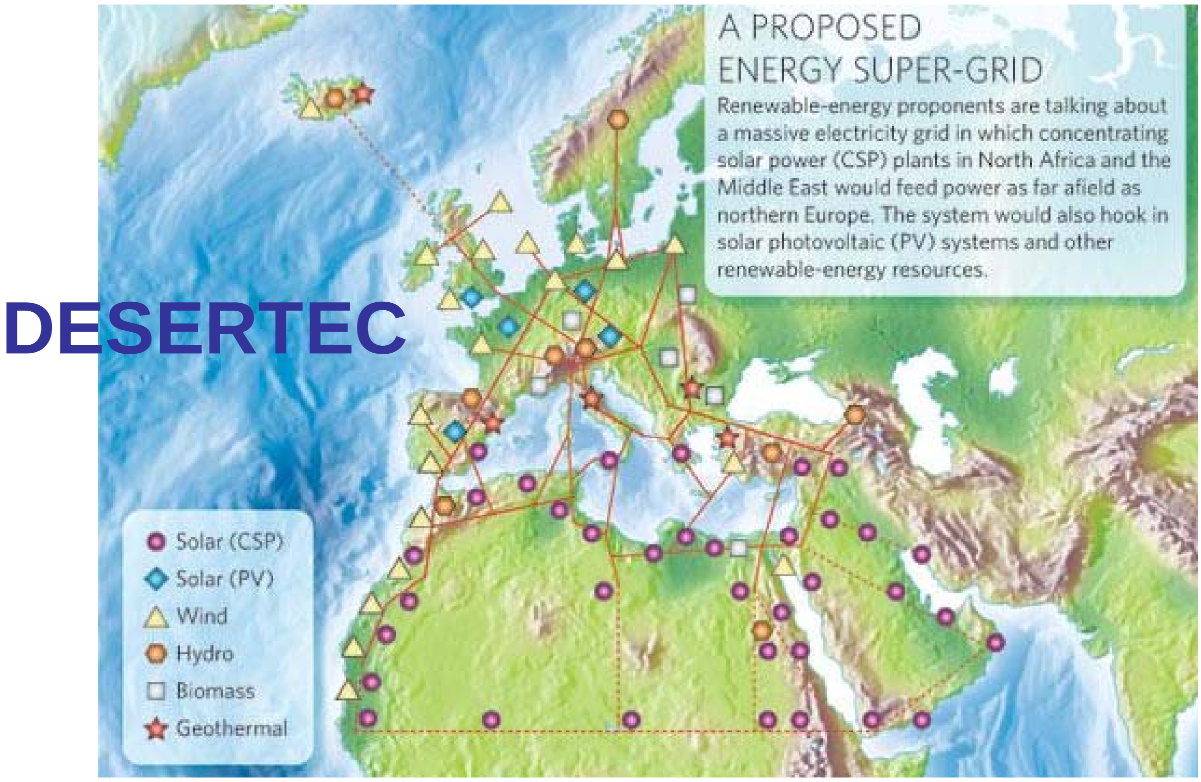
It might be however, that this period of a duo-multipolar order will again subside in favour of a genuine multipolar one if the technologies are developed in such a way that they are less dependent upon 'rare earths'. Generally speaking, renewable energies are quite complementary spread across the globe: for instance countries where the sun shines hardest, have less possibilities with regard to biomass, and vice versa.

6. Analysing some current "mega-dossiers" in renewable energy in Europe: Desertec and the North Seas Countries Offshore Grid Initiative

To end this paper, let us briefly study some of the current "mega-dossiers" in renewable energy in Europe. Of all the projects that are being developed in Europe, two stand out as particularly geopolitical and geo-economical in nature; the *Desertec Industrial Initiative* on the one hand, and the *North Seas Countries Offshore Grid Initiative* on the other hand.

6.1. Desertec Industrial Initiative (DII)

Prince Hassan bin Talal of Jordan –the former president of the Club of Rome– presented in December 2007 the *'Desertec Industrial Initiative'* (DII) to the European Parliament. This project was launched by a consortium of banks, enterprises and insurance companies, originally often of German origin, but in the meantime expanded to different countries in Europe, the Middle East and North Africa. The purpose of this project is to build a network of gigantic solar centrals –mostly concentrated solar power (CSP)– and wind parks in northern Africa and in the Middle East. This infrastructure would be interlinked and connected to Europe via electrical power lines. In this way, Desertec is designed to geo-economically and geopolitically link Northern Africa and the Middle East to Europe via renewable energy projects. Theoretically, it could *eventually* fulfil 15 percent of Europe's energy needs provided the necessary power lines are built between Europe and North Africa. The electricity would initially come from small pilot projects (by 2015) to eventually (by 2050) reach the thousands of megawatts as the project gathers steam. Desertec as a whole is a vision for the next 20 to 40 years with an estimated investment of 400 billion euros (approximately $496 billion) (Murray, 2010).



Among the companies involved are Deutsche Bank, the energy groups Eon and RWE, Siemens AG, the insurance company Munich Re, the Spanish company Abengoa Solar and the Algerian company Cevital.[17] The Desertec scheme has been described by its promoters as being part of an overall intention to create *"a new carbon-free network linking Europe, the Middle East and North Africa."* The project intends to install among others a network of concentrating solar power systems over an area of 6,500 square miles (17,000 km²) in the Sahara Desert, to produce electricity that would be transmitted to European and African countries by a super grid of high-voltage direct current cables[18] (Rhodes, 2010). Next to the realisation of 130 km² in solar power stations, 100 different 800MW intercontinental transmission lines would have to be built. Desertec's main focus is on CSP based upon thermal solar power. A network of parabolic mirrors captures the solar rays, which are then concentrated on tubes containing special oil that can be heated up to 500 degrees Celsius. These oil tubes then release their heat to steam turbines, from which electricity is generated. Next to this, Desertec will also include PV-technology and wind parks.

Many interviewees underline that Desertec should also be seen as a broader, in orgin German geo-economical project in which the company Siemens plays a pivotal role.[19] This company has all the necessary expertise to materialise every stage in the development of Desertec. With this initiative, it is the first time since the 1940's that Germany and its economic elite has developed a genuine interest for the region of the Mediterranean, traditionally a zone of influence of the French and the British. The project is getting bigger all the time, also the consortium of companies which wants to realise it. On 21 May 2010, the *European Energy Review* reported that the consortium had grown to 17 partners. Next to Germany also Spain, Italy, France and Morocco are directly involved.[20] Now that a large coalition of companies and country support has been built, the consortium is today working hard in gathering the necessary political support, which seems to go relatively well. The European Commission in general and the Commissioner for Energy Oettinger in specific has welcomed the Desertec Industrial Initiative. In a speech on 26 October 2010, Oettinger stated: [21]

---

[17] The Desertec Industrial Initiative currently has 16 private companies as shareholders, in addition to the Desertec Foundation: ABB (Switzerland), Abengoa Solar (Spain), Cevital (Algeria), Deutsche Bank (Germany), Enel Green Power (Italy), Eon (Germany), HSH Nordbank (Germany), MAN Solar Millennium (Germany), Munich Re (Germany), M+W Group (Germany), Nareva Holding (Morocco), Red Eléctrica (Spain), RWE (Germany), Saint Gobain Solar, (France), Schott Solar (Germany), Siemens (Germany). First Solar, a US company, has recently joined as an "associated partner".

[18] A study of the German Space and Aircraft Institute has said that Desertec requires 100 new 800 MegaWatt (MW) transmission lines to be built in transit countries.

[19] See company movies: http://www.youtube.com/watch?v=_3nYFvsFZz8&feature=related , and http://www.youtube.com/watch?v=RMuS7ZlZh_8&feature=related

[20] See: http://europeanenergyreview.eu/index.php?id_mailing=57&toegang=72b32a1f754ba1c09b3695e0cb6cde7f&id=1827

[21] http://www.europa-nu.nl/id/vijsoa9cleyg/nieuws/toespraak_eurocommissaris_oettinger?ctx=vhcogpdu91mg

"We believe that - beyond the first pilot projects - large scale investments in the renewable energy sector will only be possible if the right framework conditions are put in place. Several of our partners in the South have started ambitious energy sector reforms and regional market integration is starting to gain momentum. The EU is accompanying these initiatives through its bilateral and regional programmes. Our interventions will continue to focus on setting the right framework conditions for investments in renewable sources."

It thus looks like the European Commission is supporting the idea of Desertec. Oettinger also stated that the Commission shares the objectives of the Desertec Initiative as it was presented to the European Parliament in 2007. The Commission welcomes the support and enthusiasm of the private companies from the EU, Middle East and North Africa in creating dynamism and furthering progress in implementing sustainable energy: *"We should make use of every natural resource that has been given to us – to reach the sustainable energy supply objective: solar, wind, hydro, even wave power in the future."* The Desertec Industrial Initiative is seen as a "forward-looking initiative", and "private sector financing is definitely key for transformation to a low-carbon future, both in Europe and in North Africa". However, Oettinger stressed that the project has to be developed in cooperation with countries of the region on an equal footing; it can not be imposed from the outside. Action of the regulator and the policymakers at national, European and global level has to go hand in hand with this initiative.

One of the biggest challenges of the project will be the actual building of hundred 800 Megawatt transmission power lines in the involved transit countries. The geopolitical consequences of this geo-economical project would be that North Africa, parts of the Middle East and Europe would become *partners* in energy cooperation. Critics such as the late Hermann Scheer, member of the German Bundestag and president of the *European Association for Renewable Energies* (Eurosolar) think that it would be better to invest in decentrally generated, small-scale sustainable energy instead. Scheer called Desertec "a mirage" that is hampered by geopolitical and technological hurdles (Murray, 2010).

Lars Josefsson, CEO of Vattenfall, sees Desertec as *"complex, too risky and too expensive".* Michael Liebreich, CEO of Bloomberg New Energy Finance recently voiced another sharp criticism: *"I am not sure we want to be dependent on North Africa for our electricity supply when anyone with a shoulder-launched missile can take out the electricity supply for Europe."* (Source: Bloomberg).[22] The opinions on Desertec are very divergent. One can suspect that the societal and especially the political debate will further gain momentum in the coming years. Some interviewees stress the benefits of the project,

[22] http://europeanenergyreview.eu/index.php?id_mailing=57&toegang=72b32a1f754ba1c09b3695e0cb6cde7f&id=1827

but others voice sharp criticism. The sceptics have interesting arguments which cannot easily be set aside.

Other criticism[23] states that placing installations such as those of Desertec in the hostile environment of the Sahara, will not be an easy undertaking. It will in all probability have an impact upon the maintenance cost, which will be very high indeed. The life expectancy of equipment and materials in the desert is significantly less (three to five times shorter). This will mean that the business case and hence also the geo-economical dimension of Desertec will be impacted; the investments will have to be replaced much sooner than would normally be the case. Critics think that the subsidies allocated to this project will be insufficient to cushion the bills. There are environmental issues too, in that the Earth's deserts act to cool the planet by reflecting heat energy, and if they are instead covered with heat-absorbing installations there may be a contribution to global warming (Rhodes, 2010).

Geopolitically speaking, one could ask the question whether Desertec does not do more than replacing the problem of energy security which Europe currently has in oil, by a very similar problem in solar energy. The political stability of Northern Africa and the Middle East can also affect the risks linked to the Desertec project. Moreover there are serious risks in terms of terrorism, sabotage or theft, which will be difficult to deal with because the project encompasses hundreds of square miles, a vast area difficult to secure.

The Desertec project is only one possibility for renewable energy in Europe, but one in which strangely enough the *geopolitics of renewable energy* bares significant *similarities* with the geopolitics of conventional energy. Issues like the security of supply and the physical safety of the installations in areas of political instability are very similar in the Desertec-project. Although the project decentralizes renewable energy sources, it is done in such a way that its management is centralised and thus the possibility for security risks is acutely there. Furthermore, the Desertec project *continues the dependence* of Europe on external powers outside its immediate zone of influence. In that sense it may contribute to resource diversity, but it will further prolong the current weaknesses of Europe in its external energetic relations. *What if the delivery of energy is hampered for political reasons or reasons of acute security?*

All these questions have spurred European countries to look in first instance at the possibilities which Europe *itself* has with regard to its potential in the different domains of renewable energy. Another "mega-project", this time one in Europe itself, is the *North Seas Countries Offshore Grid Initiative*, which we will briefly study next.

[23] Read: http://www.energie-blog.com/2010/09/20/desertec-tussen-waanzin-en-hoop/en/

6.2. North Sea Countries Offshore Grid Initiative

The *North Sea Offshore Grid* was proposed by the European Commission in November 2008, in the *Second Strategic Energy Review*. This initiative identified this project as one of the six priority energy-infrastructural actions of the European Union. According to the Commission, the *North Sea Offshore Grid* could develop into one of the corner stones of a future European super grid. The political statement of the *North Seas Countries Offshore Grid Initiative* was signed on 7 December 2009 in the Energy Council of the European Union. This statement was signed by Germany, the United Kingdom, France, Denmark, Sweden, the Netherlands, Belgium, Ireland and Luxemburg. On 9 February 2010, the directors-general of Energy of the ten countries endorsed the proposals for a Memorandum of Understanding. On Friday 3 December 2010, in the run-up to the formal Council of Energy and during the Belgian EU Presidency, the ten states signed a cooperation agreement in order to jointly develop the offshore wind parks of the Northern Seas (the North Sea, the Channel, the Celtic Sea, the Irish Sea), a surface of 760.000 km^2 in total. This agreement constitutes an important step in the further development of renewable energy, since the theoretical energy capacity of European *offshore* wind energy is almost as big as the petroleum which is found in the Middle East.

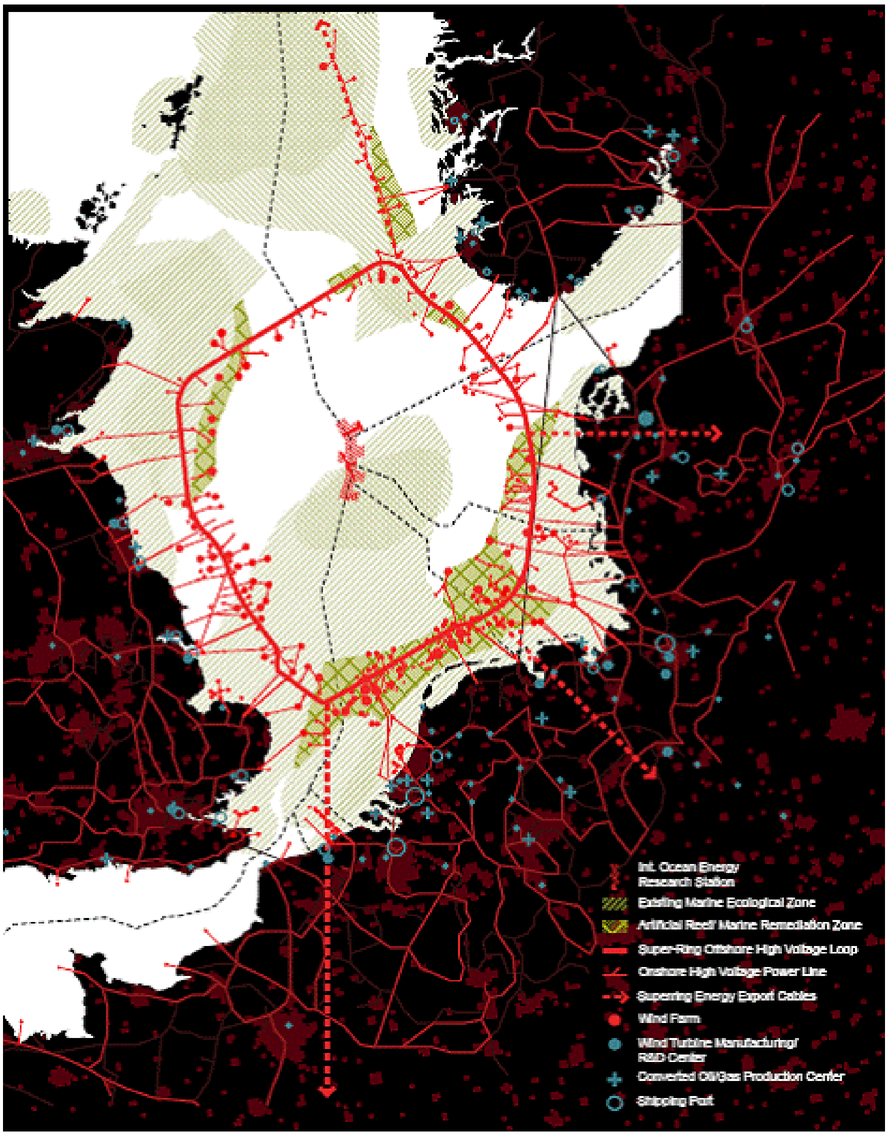
The European Commission participates in het *North Seas Countries Offshore Grid Initiative* as an observer. If necessary, it tries to facilitate, and contribute to a closer cooperation between the countries involved.[24] Until now, this mainly involved activities such as formulating in detail the priorities of *and* the contributions to the plans. Also, it involved the broader context of both the national plans and the European efforts in establishing further integration in the electricity market, while at the same time developing the infrastructure where necessary. In this context, the European Commission asks for the attention of the participating countries to the research findings of major studies and analyses, e.g. within EU-financed projects as OffshoreGrid, WindSpeed, Tradewind, NORSEWInD, POWER-cluster en Twenties (a new project worth 32 million euros under the 7th Framework Programme on Research, Technology and Demonstration).

In this project, electricity would be transmitted via high-voltage direct current cables, allowing it to be sold and exchanged in all involved countries. It would also make it easier to optimise energy production (XXX, 2009). Norway's hydroelectric power plants could act as a "giant battery", storing the power produced and releasing it at peak times, or when wind strength is low. Several high-voltage direct current interconnectors such as a proposed cable between Norway and the United Kingdom have been seen as integral parts of the project. In a study for the European Commission, De Decker and Woyte identified

[24] http://www.europeanenergyforum.eu/archives/european-union/eu-institutions-activities/european-parliament-activities/parliamentary-questions/wind-energy-in-the-north-sea

four offshore grid scenarios for the North and Baltic Sea (De Decker & Woyte, 2010). The exact positioning of the grid, and the required size, are still under study.[25]

Christian Kjaer, chief executive officer of the European Wind Energy Association (EWEA), said *"the [agreement] is an indispensable step to create an offshore electricity grid, critical for developing a single European market for electricity".* Greenpeace welcomed the move as a *"promising signal"*.[26] Overall, the *North Sea Offshore Grid* has had a better reception compared to Desertec. The grid will also be a catalyst to start building a European electricity supergrid.[27] The idea of an offshore supergrid has been around for many years, and one of its main evangelists is Dr. Eddie O'Conner, CEO of Mainstream Renewable Power. In 2002 O'Conner helped to conceive *Friends of the Offshore Supergrid* (FOSG), an industry-led body that was formally set up in March 2010 to push for speedier development of grid infrastructure. Despite the recent progress there remain a number of unresolved issues over who will own and operate the grid, who will pay for it and who will profit. There are various different ownership models and operator models. This is something that the *Third Package* in the EU's energy policy is looking at.[28]



[25] For more information, see: http://www.offshoregrid.eu/index.php/results
[26] Read: http://www.euractiv.com/en/energy/eu-countries-launch-north-sea-electricity-grid-news-500324
[27] See video on the European Supergrid: http://www.renewableenergyworld.com/rea/news/article/2011/01/european-supergrid-slowly-coming-into-focus
[28] Ibid., see footnote 27.

The *Third European Energy Package* contains much of the policy basis for an offshore grid, with its emphasis on market liberalization and unbundling of grid ownership, energy generation and transmission. Despite some opposition France and Germany, the package was adopted in 2009. New pan-European bodies such as European Network of Transmission System Operators for Electricity (ENTSO-e) and Agency for the Cooperation of Energy Regulators (ACER) have been established to help improve communication and coordination across the sector.[29]

The calculated costs of offshore grid investments in Northern Europe are between 32 billion euros (base case) until 2020 leading to a total 90 billion euro spent by 2030 for a business-as-usual case where wind farms are radially connected to the shore, project by project. If wind farms are clustered at offshore hubs where this is considered a cheaper substitute to individual radial connections, the total offshore grid investment costs by 2030 can be reduced from 90 to 75 billion euros.[30]

From a geopolitical and geo-economical point of view, the *North Sea Offshore Grid* will be very important for the countries bordering the North Sea. It might become even more important for the Netherlands and Belgium, one or both countries will probably have to build an *interconnector* between the wind parks in the North Sea and the European continent. A pilot project in this regard will be of high importance and will contribute to the energy security of Europe. However, there remains a lack of clarity with regard to a host of technical issues. Interviewees are all rather positive with regard to this project, and detect less negative fall out from it. A crucial feature is however that off-shore wind power in Northern Europe is a European project, not limited to coastal states. Thus, an integrated European approach is needed for releasing the full offshore potential.[31]

---

[29] Ibid., see footnote 27.
[30] See: http://www.offshoregrid.eu/images/pdf/pr_pr100978_d8.1_pu_f.pdf
[31] See: http://ec.europa.eu/energy/infrastructure/tent_e/doc/off_shore_wind/2009_off_shore_grid_workshop_session_summary.pdf

7. Conclusion

This paper studied the *geopolitics of renewable energy*. The question was asked whether it was different or similar compared to the geopolitics of conventional energy. The answer to this question seems to be a mixed one.

On the one hand, the answer could be that it is potentially *different*. Renewable energy is more decentralised in nature compared to conventional energy. An interwoven net of *renewables* combined with smart grids could potentially be more reliant and entails the *potential* for societal rejuvenation in the sense that it could empower people and regional authorities vis-à-vis central governments and interests. Moreover, those countries who invest in renewable energy may well become central players in the future. The US and China, but also some individual EU-countries such as Germany, are actors that invest a lot in renewable energy technology. As renewable energy will grow and gains a higher percentage of the energy mixes in countries, it will also alter their geopolitical positions. Countries which geopolitically enjoy pivotal positions in the conventional energy world, will not necessary enjoy the same position in a world in which *renewables* grow in importance (e.g. Saudi Arabia). Eventually, geopolitical relations across the globe could be affected.

On the other hand, the answer could be that it is *similar*. The bigger projects in renewable energy suffer from very similar security issues as compared to traditional energy projects. The question for instance lies with where certain pivotal power lines will run, and who will control them. What about the physical security of these power lines? In addition, the *Geopolitics of Renewable Energy* also creates geo-technical opportunities and limitations. One of the major problems with which countries will be faced, concerns the issue of the rare earth materials that are needed in the technological advances of renewable energy technology. Rothkopf convincingly wrote that the green geopolitical crises might look similar to those of the conventional energy regime. There might be green protectionism in the western world, but also the condition of oil producing countries might be problematic in a world where renewable energy is growing fast (Rothkopf, 2009).

In all probability, the geopolitics of conventional energy and that of renewable energy will exist next to each other for a period of several decades. Decision makers will have to be creative in trying to cancel out the drawbacks of one source of energy with the advantages of the other. In that sense, the geopolitics of energy will become more complex, and will have to deal with a variety of issues in foreign policy, diplomacy and international security. Instead of approaching this issue in *antithetical* terms, one should rather try to pursue more *synthetical* approaches in the study of geopolitics, power transitions and energy.

* * * * * * * * * * * * * * * * *

8. Extended bibliography on this topic

- **ARTICLES**

Becker Antoaneta, (2010) 'China Closes In Around its Rare Earth', *Global Geopolitics & Political Economy / IPS*, 6 November 2010, http://globalgeopolitics.net/wordpress/2010/11/06/china-closes-in-around-its-rare-earth/

Burrows, Mathew & Treverton, Gregory F. (2007) 'A Strategic View of Energy Futures', in: *Survival* 49(3): pp. 79-90.

Criekemans David (2010), 'Post-Copenhagen from a geopolitical perspective: the US, China and Europe', in: *American Diplomacy* (2010.04.12), http://www.unc.edu/depts/diplomat/item/2010/0406/comm/criekemans_copenhagen.html

Deese, David A. (1979-1980) 'Energy: Economics, Politics and Security', in: *International Security*, Vol. 4, No. 3, p.140.

Friedman, Thomas L. (2007) *'The Power of Green'*, *The New York Times*, 15 april 2007.

Hodum, Ryan (2010) 'Geopolitics Redrawn: The Changing Landscape of Clean Energy', in: *World Politics Review*, 16 Feb. 2010, http://www.dgardiner.com/doc/WPRgeopolitics_redrawn2-18-10.pdf

Kanter, J. (2009) 'Solar Power and Geopolitics in the Mediterranean', in: *The New York Times*, February 13, 2009.

Levi, M., Economy, E., O'Neil, S., Segal, A. (2010) 'Globalizing the Energy Revolution. How to Really Win the Clean-Energy Race', in: *Foreign Affairs*, November-December, pp. 111-121.

Mackinder, H. J. (1943) 'The Round World and the Winning of the Peace', in: *Foreign Affairs*, Vol.21, No. 4 (July)

Nye, Joseph S. (1982) 'Review Article: Energy and Security in the 1980s', in: *World Politics*, Vol. 35, No. 1: pp. 124-126.

Parfit, M. (2005) 'Future Power. Where will the world get its next energy fix?', in: *National Geographic*, Vol. 208(2 – August): pp. 2-31.

Rothkopf, David J. (2009) 'Is a green world a safe world? Not necessarily. A guide to the coming green geopolitical crises', *Foreign Policy*, September/October 2009.

Sainteny, G. (2010) 'Les enjeux géopolitiques des énergies naturelles renouvelables', in : *Questions Internationales*, n°45, septembre-octobre.

Slingerhand, S., van Geuns, L., van der Linde, C. (2008) 'Van zwarte naar groene energie. Geopolitiek van mondiale energietransitie', in: *Internationale Spectator*, Jg. 62, Vol. 5: pp. 259-263.

Slingerhand, S., van Geuns, L. (2006) 'Van Lissabon tot Kyoto. De ambities van het Europese energie-innovatiebeleid', in: *Internationale Spectator*, Jg. 60, Vol. 4: pp. 193-196.

XXX, (2005) 'After Oil – Powering the Future', in: *National Geographic Magazine*, August: pp. 2-31.

Yergin, Daniel (1992) *The Prize. The Epic Quest for Oil, Money and Power.* New York: Free Press: 885 p.

- **BOOK CHAPTERS**

Criekemans, D. (2009) 'Geopolitical schools of thought: a concise overview from 1890 till 2015 and beyond', in: Csurgai, Gyula [edit.] *Geopolitics: schools of thought, method of analysis and case studies*, ISBN 2970039559 - Geneva, Penthes, p. 5-47.

Giradet, H., 'Creating Sustainable and Liveable Cities', in: Giradet, H., (2007) *Surviving the Century. Facing Climate Chaos & Other Global Challenges.* London: Earthscan: pp. 103-126.

Greene, O., 'Environmental Issues', in: Baylis, J., Smith, S. (2005) *The Globalization of World Politics. An Introduction to International Relations.* Oxford: Oxford University Press: pp. 451-478.

Scheer, H. 'Renewable Energy is the Future', in: Giradet, H., (2007) *Surviving the Century. Facing Climate Chaos & Other Global Challenges.* London: Earthscan: pp. 35-56.

- **BOOKS**

Barton (2005) *Energy Security. Managing Risk in a Dynamic Legal and Regulatory Environment.* Oxford, OUP.

Braungart, M., McDonough, W. (2007) *Cradle to Cradle.* Heeswijk: Search Knowledge: 237 p.

Chauprade, A. (ed.) (2004) 'Géopolitique de l'énergie', in: *Revue Française de Géopolitique*, n°2: 336 p.

Criekemans, D. (2007) *Geopolitiek: 'geografisch geweten' van de buitenlandse politiek?*, ISBN 90-441-1969-9 - Antwerpen: Garant, 2007.- 848 p.

DeGunther, Rik (2009) *Alternative Energy for Dummies.* Hoboken, NJ: Wiley: 362 p.

Deudney, D. H. (1989). *Global Geopolitics: A Reconstruction, Interpretation, and Evaluation of Materialist World Order Theories of the Late Nineteenth and Twentieth Centuries.* Princeton University Press (ongepubliceerd proefschrift).

Dow, K., Downing, T. (2007) *The Atlas of Climate Change.* Brighton: Myriad Editions Ltd: 112 p.

Friedman, Thomas L. (2009) *Hot, Flat and Crowded. Why We Need a Green Revolution and How It can Renew America.* New York: Picador: 516 p.

Gauthier, C. (2008) *Oil, Water and Climate. An Introduction.* New York: Cambridge University Press: 366 p.

Giddens, A. (2009) *The Politics of Climate Change.* Cambridge: Polity Press: 264 p.

Giradet, H. (ed.) *Surviving the Century. Facing Climate Chaos & Other Global Challenges.* Padstow, UK: Earthscan: 210 p.

Goodstein, David (2004) *Out of Gas. The End of the Age of Oil.* New York: W. W. Norton & Company: 148 p.

Hoffman, Jane & Hoffman, Michael (2008) *Green. Your Place in The New Energy Revolution.* New York: Palgrave Macmillan: 254 p.

Klare, Michael T. (2005) *Blood and Oil. How America's Thirst for Petrol is Killing Us.* London: Penguin Books: 265 p.

Klare, Michael T. (2008) *Rising Powers, Shrinking Planet. The New Geopolitics of Energy.* New York: Metropolitan Books: 339 p.

Klare, Michael T. (2002) *Resource Wars. The New Landscape of Global Conflict.* New York: Henry Holt and Company: 289 p.

Mitchell, C. (2008) *The Political Economy of Sustainable Energy* (Energy, Climate and the Environment Series). Hampshire (UK) & New York (USA): Palgrave Macmillan: 304 p.

Rifkin, J. (2002) *The Hydrogen Economy. The creation of the worldwide energy web and the redistribution of power on Earth.* Oxford: Blackwell Publishing: 294 p.

Scrase, I., MacKerron, G. (2009) *Energy for the Future: A New Agenda* (Energy, Climate and the Environment Series). Hampshire(UK) & New York(USA): Palgrave Macmillan:236p.

Smil, Vaclav (2010) *Energy Transitions. History, Requirements, Prospects*. Santa Barbera, California: Praeger: 178 p.

Troen, I., Petersen, E.L. (1989) *European Wind Atlas*. Risø National Laboratory: Roskilde.

Weiss, C., Bonvillian, W. R. (2009) *Structuring an Energy Technology Revolution.* Cambridge, Massachusetts: Massachusetts Institute of Technology: 318 p.

- **REPORTS, POLICY DOCUMENTS & CONFERENCE PAPERS**

Aurelio dos Santos, Marco (s.d.) *A Brief History of energy Biomass in Brazil*, http://www.rio6.com/download/Biomass_use-in-Brazil.pdf

Bradley, Doug (2005) *Biomass in Canada - Development and Trade Options, Business Forum on Sustainable Biomass Production for the World Market*. Campinas, Brazil, http://www.bioenergytrade.org/downloads/bradleynovdec05.pdf

Bradley, Douglas (2007) *Canada-Sustainable Forest Biomass Supply Chains.* Ottawa: Climate Change Solutions: 31 p.

Bryant, Cynthia & Yassumoto, William Y. (2009) *Bagasse-based ethanol from Brazil gearing up for export market*, http://www.bioenergy.novozymes.com/files/documents/2009-24322.pdf

Buijs, B. (2009) *China, Copenhagen and Beyond. The Global Necessity of a Sustainable Energy Future for China.* Den Haag: Clingendael International Energy Programme: 103 p.

COMMISSION OF THE EUROPEAN COMMUNITIES (2007) *COM(2006) 848 final - COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT: Renewable Energy Road Map Renewable energies in the 21st century: building a more sustainable future.* Brussels: European Commission: 20 p.

COMMISSION OF THE EUROPEAN COMMUNITIES (2008) *COM(2008) 19 final - 2008/0016 (COD) - Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources.* Brussels: European Commission: 61 p.

Cleantech Group LLC, (2009) *2008 Annual Review and 4Q08 Investment Innovation.*

Commission on Energy 2030, (2007) *Belgium's Energy Challenges Towards 2030 Final Report* (zie ook: http://www.ce2030.be/finalrep_publ.htm)

Criekemans, D. (2010) *Lecture on the 'Geopolitics of Energy'*. Geneva: International Centre for Geopolitical Studies (ICGS).

Departement Economie, Wetenschap en Innovatie, studie over *"Energietechnologie in Vlaanderen en Europese opportuniteiten"* (2010).

De Decker, Jan & Woyte, Achim (2010) *Four Offshore Grid Scenarios for the North and Baltic Sea.* Brussels: 3E: 16 p.

de Jong, J, van Schaik, L, (2009) 'EU Renewable Energy Policies: what can be done nationally, what shoud be done supranationally?', *Clingendael Seminar Overview Paper for the Seminar on EU Renewable Energy Policies*, 22-23 October 2009, Den Haag: Clingendael Instituut.

De Ruyck, ApereEDORAValbiom Memorandum (2006), *Renewable Energy Evolution* (2004), *Optimal Offshore Wind Energy Developments in Belgium* (2004).

EUR-LEX (2009) *DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*, in: Official Journal of the European Union (5.6.2009): L 140/16 - L 140/62.

European Commission, (2007) *Renewable Energy Road Map. Renewable energies in the 21st century: building a more sustainable future*. Brussels: European Commission: 20 p.

European Commission, (2008) *Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources.* Brussels: European Commission: 61 p.

Europese Commissie, (2010) The European Strategic Energy Technology Plan - Set –Plan – Towards a Low Carbon Future. Brussel: Europese Commissie: 16 p.

European Environment Agency (2009) *Europe's onshore and offshore wind energy potential. An assessment of environmental and economic constraints*. Kopenhagen: EEA.

Greenpeace International & European Renewable Energy Council (EREC) (2007) *Energy (r)evolution. A sustainable world energy outlook.* Utrecht: Greenpeace & EREC: 96 p.

Haddouche, A. (2006) *RENEWABLE ENERGY POLICY AND WIND ENERGY IN MOROCCO.* Morocco: CDER: 31 p.

Hirsch, R. L. (2007) *Peaking of World Oil Production: Recent Forecasts – DOE/NETL – 2007/1263.* Brussels: US National Energy Technology Laboratory.

International Energy Agency (IEA) (2004) *Renewable Energy: Market & Policy Trends in IEA Countries.* Paris: IEA: 670 p.

International Energy Agency (IEA) (2005) *Energy Policies of IEA Countries: Belgium 2005 Review.* Paris: IEA: 205 p.

International Energy Agency (IEA) (2007) *Renewables in Global Energy Supply. An IEA Fact Sheet.* Paris: IEA: 31 p.

International Energy Agency (IEA) (2008) *Deploying Renewables. Principles for Effective Policies.* Paris: IEA: 8 p.

International Energy Agency (IEA) (2007) *World Energy Outlook 2007.* Paris: IEA: 674 p.

International Energy Agency (IEA) (2008) *World Energy Outlook 2008.* Paris: IEA: 578 p.
International Energy Agency (IEA) (2009) *World Energy Outlook 2009.* Paris: IEA: 698 p.

U.S. Department of Energy (2010) *Critical Materials Strategy – Summary Report*, http://www.energy.gov/news/documents/Critical_Materials_Summary.pdf van Geuns, Lucia (2005) Future Fuels and Geopolitics: the Role of Biofuels. Clingendael, Den Haag: Clingendael International Energy Programme: 36 p.

XXX, (2009) DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, EN Official Journal of the European Union (5.6.2009), Brussel, L 140/16 – L 140/62.

XXX, (2008) *Global Renewable Energy Development*. Washington: National Renewable Energy Laboratory (NREL).

- **INTERNET SOURCES**

Coyle, Pamela, (2010) 'Lithium: Searching for a Metal That Can Help Power the World' http://solarhbj.com/news/lithium-searching-for-a-metal-that-can-help-power-the-world-0855

Gibbs, Walter (2010-08-17). Norway hydro can aid Europe move to renewables-IEA, *Fox Business (FOX News Network)*. http://www.foxbusiness.com/markets/2010/08/27/norway-hydro-aid-europe-renewables-iea/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed:%20foxbusiness/latest%20%28Internal%20-%20Latest%20News%20-%20Text%29

Haug, M. (2008) *The Geopolitics of Renewable Energy*, at the *'Geopolitics of Energy Seminar'*, Oxford Institute for Energy Studies, 11 juni 2008. http://www.oxfordenergy.org/presentations/Haug.pdf

Koshmrl, Mike (2010) *What "rare earth" metals mean to renewable energy*, http://www.ases.org/index.php?option=com_myblog&show=What-a-rare-eartha-metals-mean-to-renewable-energy.html&Itemid=27

Murray, Terrence (2010) Desertec: Electricity from the Sahara in Five Years, *Green Energy Reporter*, http://greenenergyreporter.com/renewables/solar/desertec-electricity-from-the-sahara-in-five-years/

Rhodes, Chris (2010) *Desertec: Energy from the Sahara to Europe*, http://blogs.forbes.com/energysource/2010/06/30/desertec-energy-from-the-sahara-to-europe/?partner=contextstory

XXX, (2009) *Nine countries sign up to develop Europe's first offshore wind grid.* Science Business, http://bulletin.sciencebusiness.net/NewsArticle.aspx?ArticleId=68619

http://www.scorigin.com/diy_-_solar_power

http://www.youtube.com/watch?v=D1XyR3YOVZQ&feature=related

http://www.uaeinteract.com/docs/RAK_to_test_floating_solar_island/28331.htm

http://www.ceoe.udel.edu/windpower/ResourceMap/index-world.html

http://stro9.vub.ac.be/wind/windplan/

http://www.all-creatures.org/hope/gw/GD_wind-offshore_potential_Europe.jpg

http://news.mongabay.com/bioenergy/site/goals.html

http://tegenlicht.vpro.nl/nieuws/energie/2010/april/achtergrondartikel-biomassa.html

http://www.clingendael.nl/ciep/events/20051209/20051209_CIEP_VanGeuns.pdf

http://www.bioenergytrade.org/