

THE ENERGY INDUSTRY IN DENMARK

- Perspectives on Entrepreneurship and Venture Capital

Vækstfonden

Vækstfonden is a government backed investment fund. Operating as an independent entity in the capital market, we facilitate the supply of venture capital in terms of start-up equity and high-risk loans. Our financing is provided on commercial terms. Our investment strategy extends across a wide range of industries. We invest in companies with high growth potential that offer innovative product solutions and new business models. Furthermore, we invest in private venture funds specialising in specific industry sectors. Our vision is to create the best market for innovation finance in Europe.

Our capital base is € 300M.

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1. INTRODUCTION

The energy industry plays an important role in the global economy. First and foremost, it is the largest industry in the world. Moreover, energy is the most traded product in the World and serves as a prerequisite for more or less all economic activity. Finally, the energy industry is a global growth area.

Throughout the World, there has been an increased focus on production and consumption of energy. This is also the case in Denmark, where concerns about the impact of energy production on the environment play a prominent role. In particular, the Danish government ambitiously plans to reduce CO₂ emissions by 21% through increased use of renewable energy sources.

Experience from the development of the Life Sciences and ICT industries in Denmark indicates that it is essential to stimulate entrepreneurship in the energy sector in order to create and broaden Danish strongholds within that sector. For the energy industry to succeed it is therefore crucial that venture capital investors find it attractive to finance and develop new companies. But what are the international tendencies and how does Denmark build an entrepreneurial community that is capable of attracting venture capital?

In short, this report concludes that the proportion of energy start-ups in all start-ups globally has fallen from approximately 0.45% in 2000 to 0,27% in 2004. Yet, venture capital investments in energy start-ups continue to make up a growing share of all investments, rising from approximately 1% in 2000 to 4% in 2006. Among selected countries, Norway stands out with a share of energy venture capital investments that makes up more than 25% of the country's total investment activity.

Throughout the last 7 years, venture capital investors seem to have shifted their focus towards alternative energy, which today makes up approximately 40% of all VC investments in energy. Strikingly, this trend already shows up in exit statistics, where alternative energy companies constitute more than 40% of all exits.

From a national vantage point, Denmark is found to possess a range of strong competencies within the energy sector. Especially in the areas of wind energy and waste management is Denmark among the leading countries. But also the high level of energy know how translates into a remarkably high energy efficiency throughout the Danish energy sector. Further, the flexibility of the Danish workforce and the district heating infrastructure are noticeable Danish strong suits within the energy industry.

In spite of these strengths and the increasing share of venture capital going into energy in other countries, Danish energy start-ups continue to attract only a limited amount of venture capital. Energy investments constitute only 1.5% of all VC investments in 2005. The low level of investment has its roots in a sector that in decades has been characterised by regulation and monopolistic

behaviour. As a consequence, the deregulated market of today still suffers from a weak entrepreneurial culture and a very low level of start-ups, with a yearly average of only 2-3 energy starts-ups.

To build on current strengths and realize the full potential of the Danish energy industry Vaekstfonden finds that changes are needed in especially two areas:

- There should be more focus on entrepreneurs that provide innovative solutions based on existing energy technologies.
- Denmark should prioritize public research spending and improve funding conditions for projects in the demonstration phase.

If these suggestions are met, it is likely that Danish demand for venture capital will rise significantly in the forthcoming years. Three scenarios are developed spanning from a current venture capital demand of approximately 200 million DKK to a possible demand of 1300 million DKK. Currently, Danish venture capital funds that are dedicated to energy investments have 450 million DKK under management.

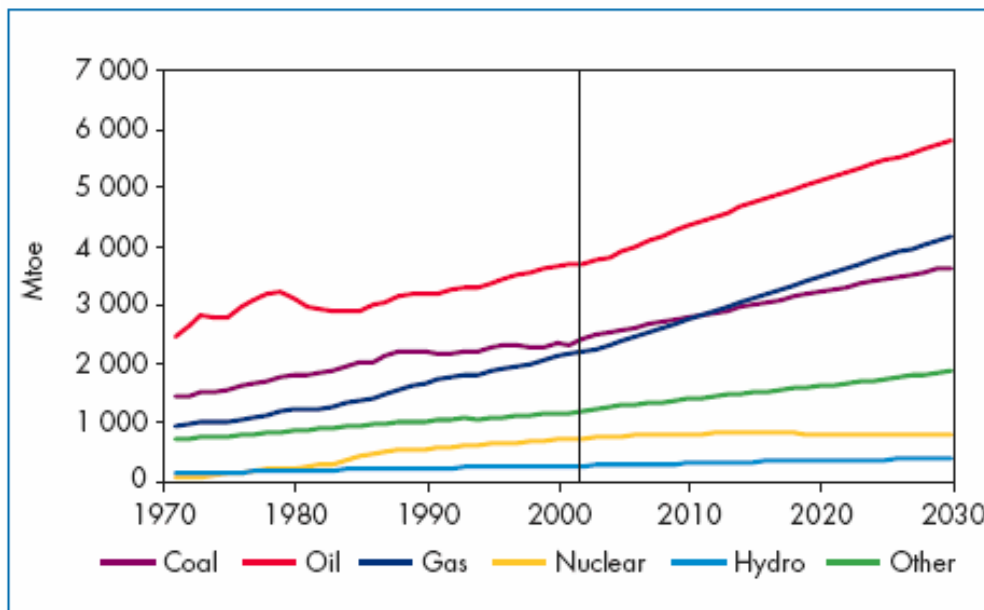
The findings in this report are based on qualitative as well as quantitative data. In all, 20 industry experts have been interviewed.

2. THE ENERGY MARKET

Since the late 1990's the price of coal has doubled, the price of oil has tripled, while the price of natural gas has quadrupled. Quantitative data show that the global demand will continue to rise, but also that some countries including Denmark have been able to keep energy consumption stable, while at the same time increasing GDP by more than 50%. This chapter briefly covers Danish energy strongholds based on quantitative data.

The combination of rising energy prices, negative externalities arising from fossil fuels, and the fact that fossil fuels are a limited resource has increased investors' attention on renewable energy solutions. Today biomass¹ accounts for 11% of global energy production, while water power and wind power generate 2% and 0,7% respectively. So far production prices for renewable energy sources have not been competitive, but in contrast to prices on fossil fuels, renewable energy sources continue to decrease in price. Yet the International Energy Agency estimates, that renewable energy sources will continue to make up only 14% of a growing global energy production by 2030, cf. figure 2.1:²

Figure: 2.1 Global energy consumption



Source: World Energy Outlook. Mtoe: Million Tons of Oil Equivalent

In Denmark, the share of green energy consumption is expected to be significantly higher. This is partly due to Denmark's success in maintaining the energy consumption at a relatively stable level over the last 25 years, while increasing GDP in the same period by more than 50%. In 2004, this meant that Denmark together with Japan had the lowest gross energy consumption compared to GDP.

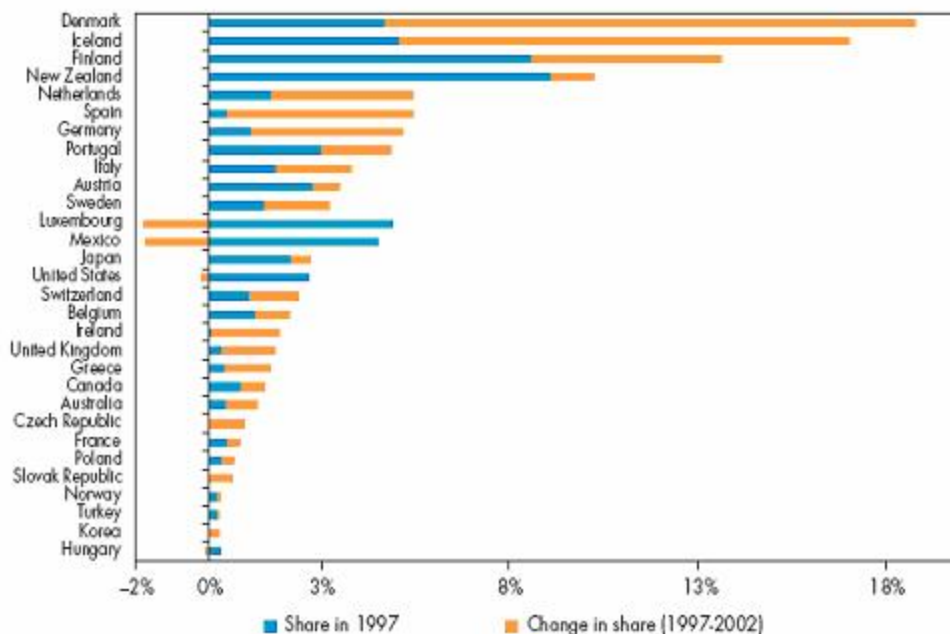
¹ Biomass is defined as organic materials derived from plants or animals. Biomass is an environmentally-friendly fuel that does not contribute to the greenhouse effect.

² Source: World Energy Outlook, IEA 2004

Since 1997, the low energy consumption and an increased production of oil and gas recovered from the North Sea have enabled Denmark to become self-sufficient in terms of energy production. But what really differentiates the Danish energy industry from its competitors is the ability to enhance efficiency in the energy production. Where the global average operating efficiency of transforming coal to power is approximately 32%, the best Danish power plants operate with an efficiency rate of approximately 47%. Also, the ability to produce both power and heating at the same time differentiates Danish energy production. While the share of combined power and heating production is approximately 53% in Denmark the nearest followers operate with a share around 35 %.

The quantitative data further indicate that Denmark is the leading nation measured in terms of power generated via wind or biomass. In 1997, wind power's and waste management's combined share of the total Danish power production was 6%, increasing to 21 % by 2002, cf. figure 2.2. By 2004, the share is 29%, of which wind power generates 18.5%.

Figure 2.2: Share of power generated by wind and biomass



Source: World Energy Outlook

In order to be self-sufficient in 2030, forward projections of the Danish resources of fossil fuels indicate, that Denmark will have to cover 40 % of the total consumption via green energy.

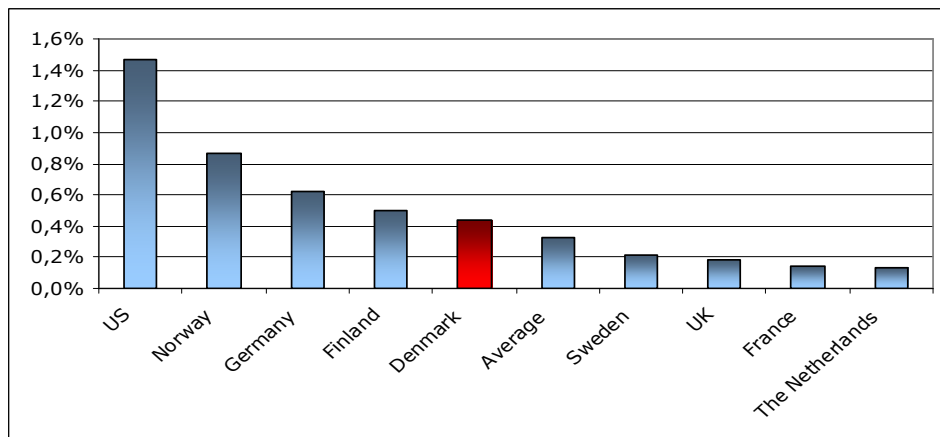
3. ENERGY COMPANIES AS INVESTMENT OPPORTUNITIES

The International Energy Agency expects that global investments in energy infrastructure will total \$ 16.000 billion towards 2030. Meanwhile, the US sector-specific industry association, Clean Edge, expects that the global market for 'Clean Energy' will grow from \$ 40 billion in 2005 to \$ 167 billion in 2015.

But what are the tendencies in the global venture market and what can we expect in the coming years? This chapter highlights the most important tendencies for venture capital investment in the energy industry.

So far, expectations about the future have not resulted in a growing share of energy start-ups at the global level. Only 0.27 % of all start-ups were energy companies in 2004 declining from 0.45 % in 2000.³ Figure 3.1 reveals, however, that there are large differences across countries.

Figure 3.1: Percentage of energy start-ups in all start-ups

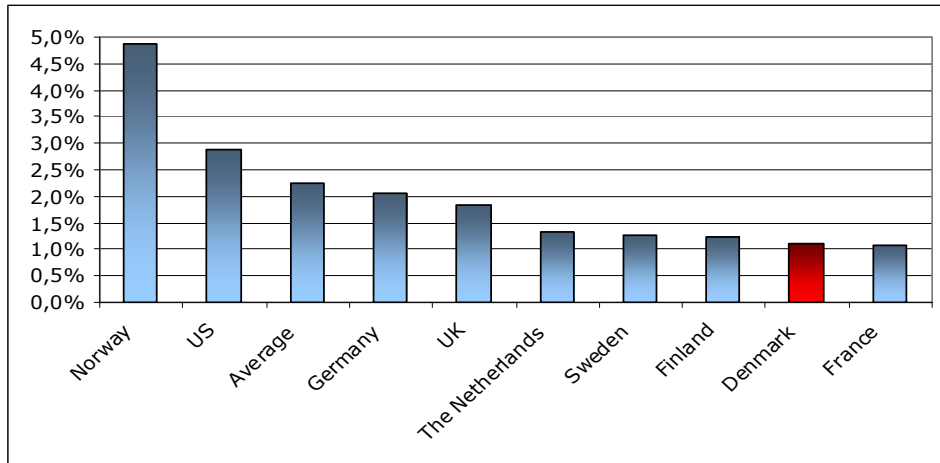


Source: Bureau van Dijk

Norway, which has the second highest energy start-up share, simultaneously shows a mature market for trading in energy companies. Thus, energy companies constitute nearly 5 % of all mergers and acquisitions (M&A's) and initial public offerings (IPO) in Norway in 2000-2006.

³ Source: Bureau van Dijk

Figure 3.2: Share of energy related M&A's and IPO's by country

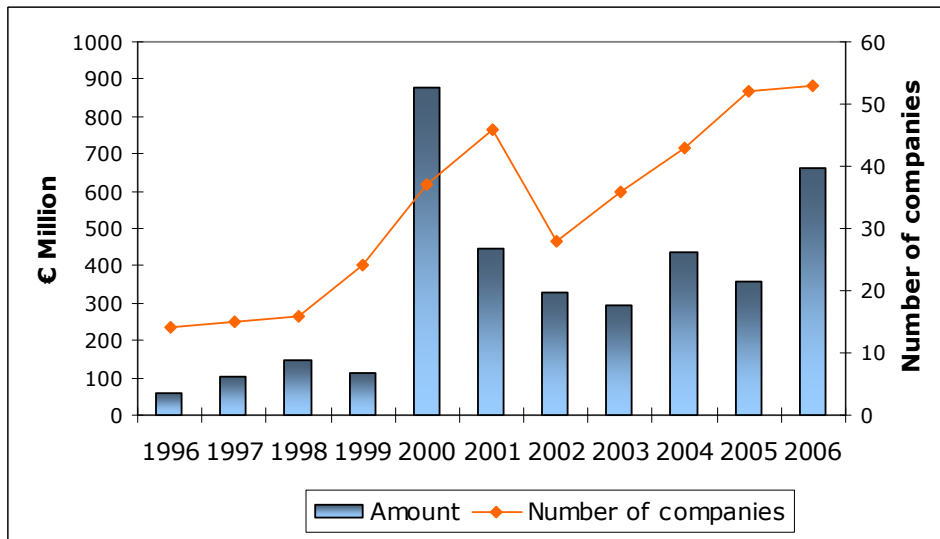


Source: Bureau van Dijk⁴

More venture capital to energy companies

Venture capital funds have since 2000 been seriously committed to energy companies. Triggered by a 50 % increase in energy prices, the venture capital investment level increased tenfold from 1999 to 2000, cf. figure 3.3.

Figure 3.3: Venture backed energy companies

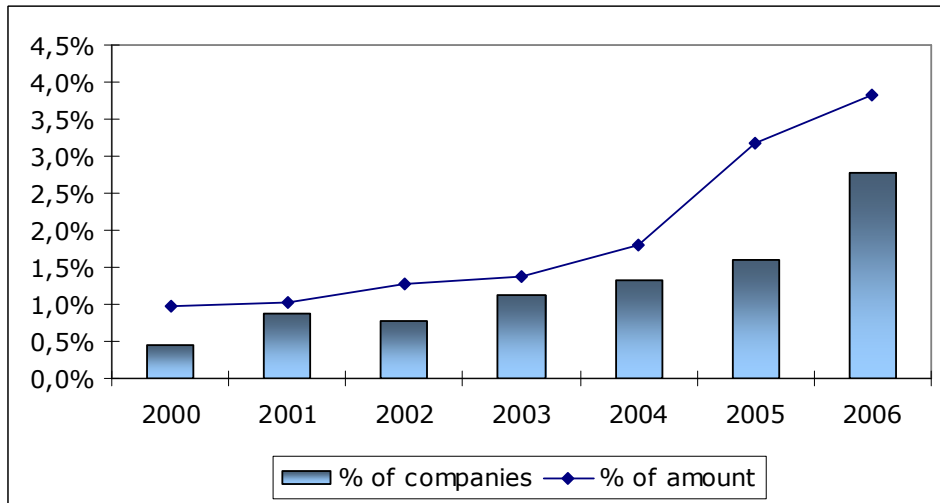


Source: VentureSource

The positive development also shows up in the share of investments for energy companies in total venture capital activity. Hence, the energy companies' share of total venture capital investments constitutes nearly 4 % in 2006, cf. figure 3.4.

⁴ Note: These shares are based on an yearly average from 2000-2006

Figure 3.4: Energy companies' share of all venture capital investment

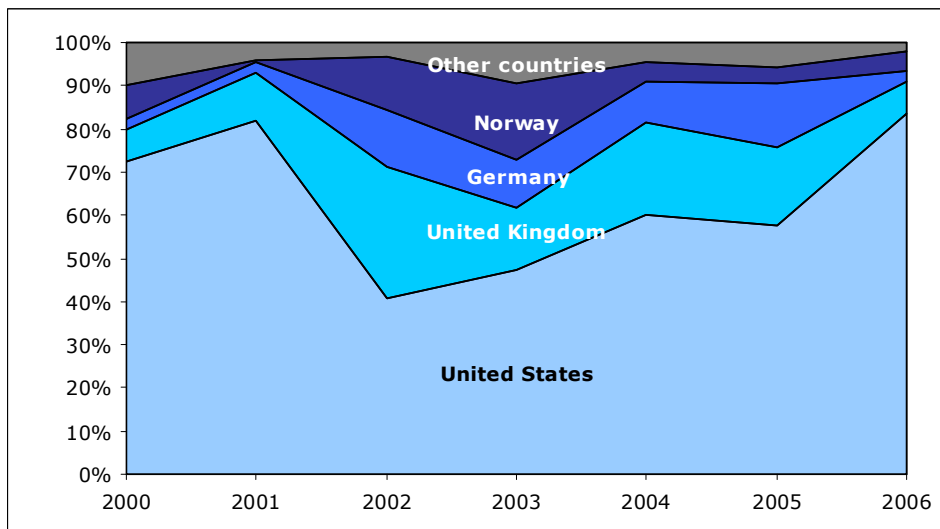


Source: VentureSource

US and Norway take the lead

In 2006, the US market attracted more than 80% of the World's venture capital investments in energy. In particular, the deregulated energy markets in Massachusetts, California and Texas attracted a substantial proportion of all VC investments. It is also noteworthy that Norway despite the country's modest size, has been able to attract 7% of global venture capital investments in energy 2000-2006, cf. figure 3.5:

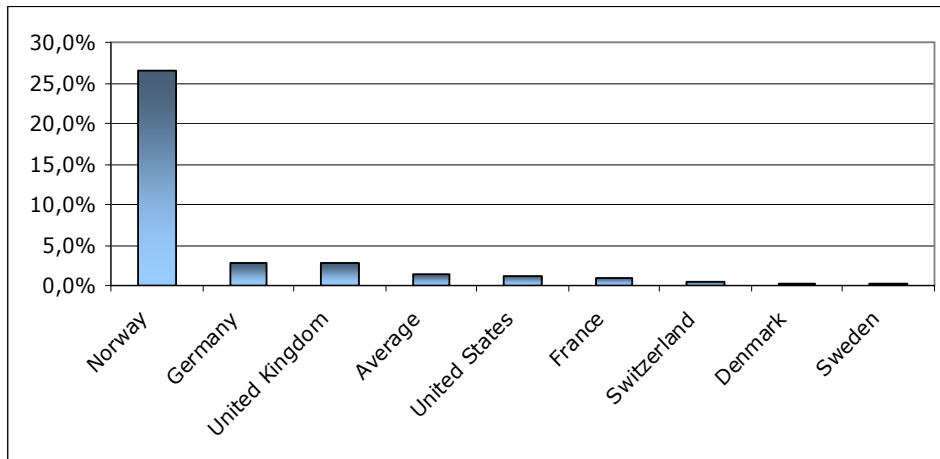
Figure 3.5: Invested venture capital in energy distributed by country



Source: VentureSource

The importance of the energy industry in Norway is stressed by the share of venture capital investments in energy. More than 25 % of all Norwegian VC investment has been placed in energy companies. Meanwhile, the country with the second highest share, Germany, only has a share of 3%, cf. figure 3.6. Denmark lacks behind with a share of less than 1%.

Figure 3.6: Share of venture capital allocated to energy



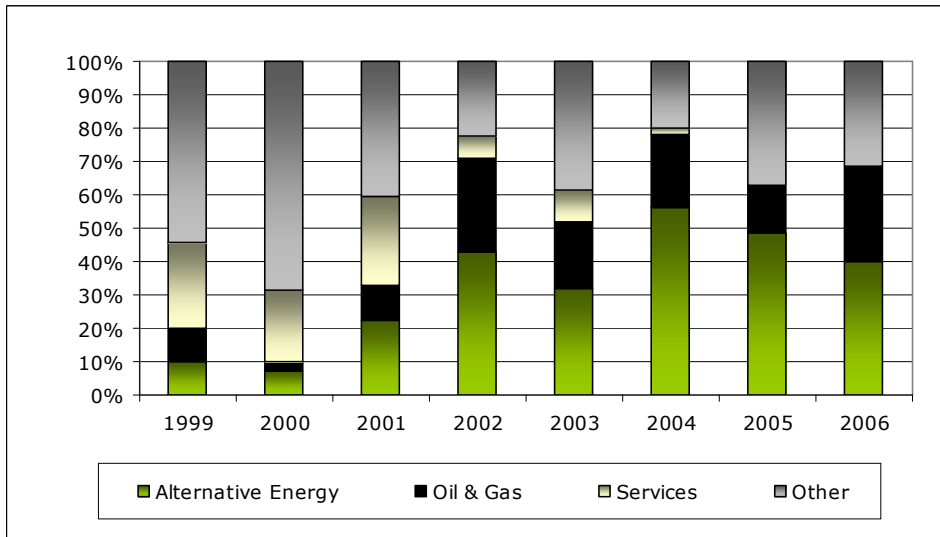
Source: VentureSource

Note: The shares are calculated as a yearly average from 2000-2006.

More investments in alternative energy

The venture capital investors' increasing interest in energy has led to a broader composition of the investment activity. Especially, investments in alternative energy have since 2001 witnessed significant growth. Encompassing diverse areas such as sun energy, fuel cells and wind power, the share of alternative energy peaked in 2004, constituting 55% of the global energy venture capital investments.

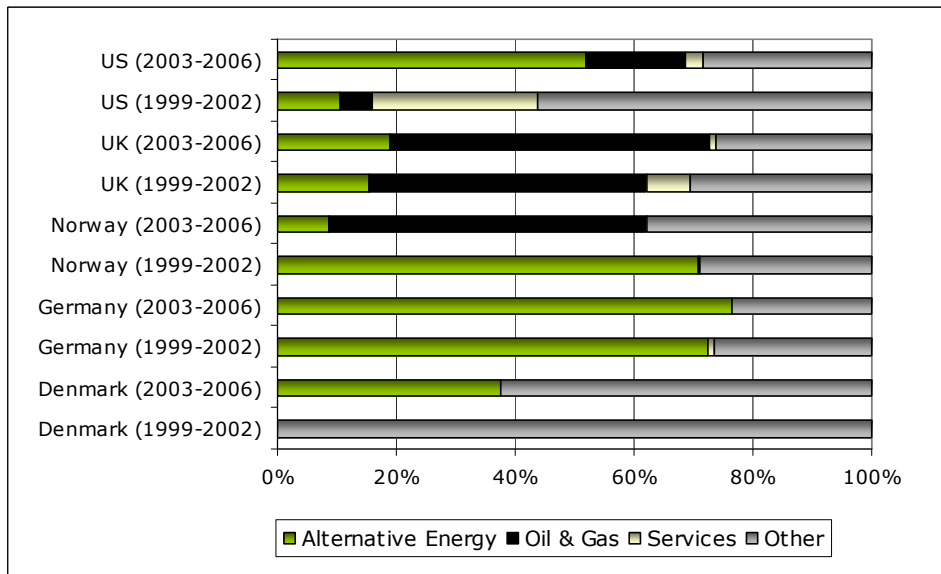
Figure 3.7: Global venture capital investment, by energy segments



Source: VentureSource

These international trends again hide large differences among countries. Interestingly, Germany is the only market that predominantly invests in alternative energy, among the selected countries from 1999 to 2006. Denmark experiences the largest progress from 0 % in 1999-2002 to nearly 40 % in 2003-2006.

Figure 3.8: Energy investments, selected countries, by segment

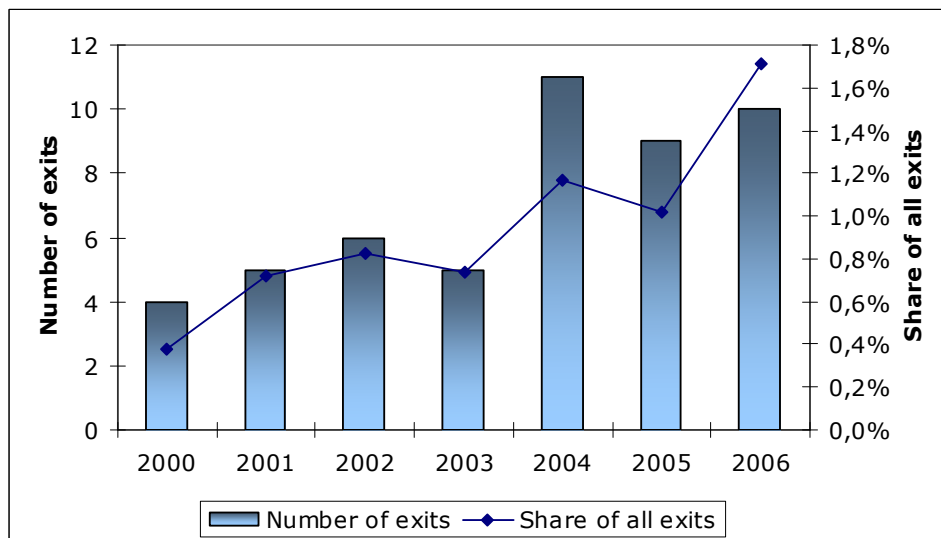


Source: VentureSource

The exit potential starts to show

The enhanced interest from venture capitalists to invest in the energy industry is beginning to show in the exit activity. Thus, the yearly number of exits has doubled from 2003 to 2004. The share of energy-related exits measured in terms of all exits constituted 0.6-0.8% in 2000-2003, rising to a share of 1.3-1.7% in 2004-2006, see figure 3.9:

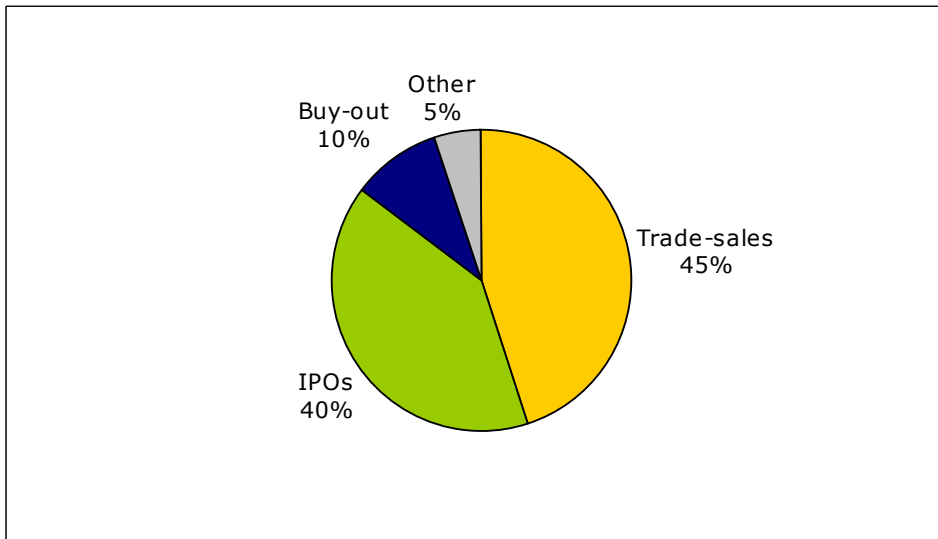
Figure 3.9: Venture backed energy exits measured in terms of all exits



Source: VentureSource

With an average investment horizon of 4-6 years, the relationship between venture capital investments and exits suggests that investors have been able to create value in the companies they have invested in. The energy industry received approximately 0.6% off all the venture capital in 2000-2004, which laid the foundation for an exit share twice as high in 2005-2006. The distribution of exits is shown below:

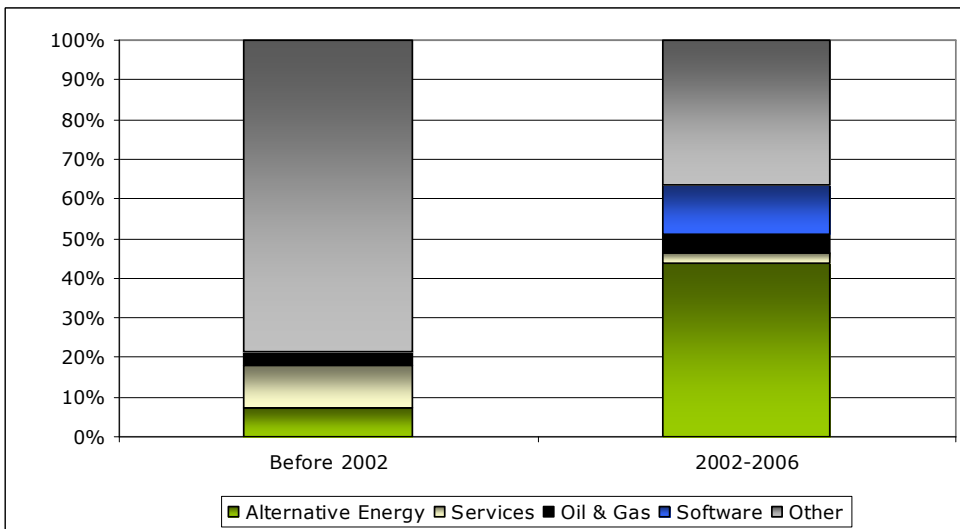
Figure 3.10: Energy exits by exit route



Source: VentureSource

The increasing venture capital investments in alternative energy are also visible in the development of exits distributed by energy segment, see figure 3.11.

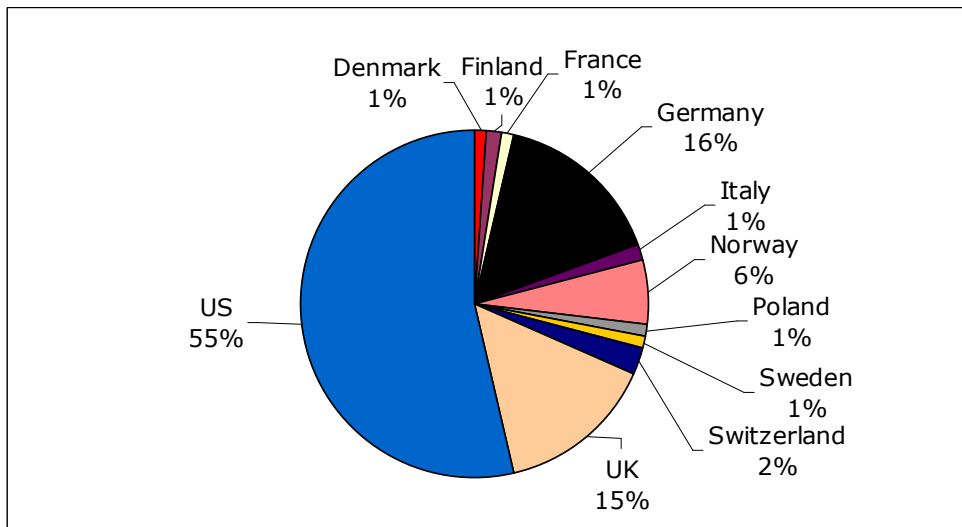
Figure 3.11: Energy exits distributed by energy segments



Source: VentureSource

In 2000-2006, US energy companies have received more than half of the global venture capital investments in energy. These heavy investments also show up in the exit numbers, where US energy companies account for approximately 55%, cf. figure 3.12:

Figure 3.12: Energy exits distributed by country

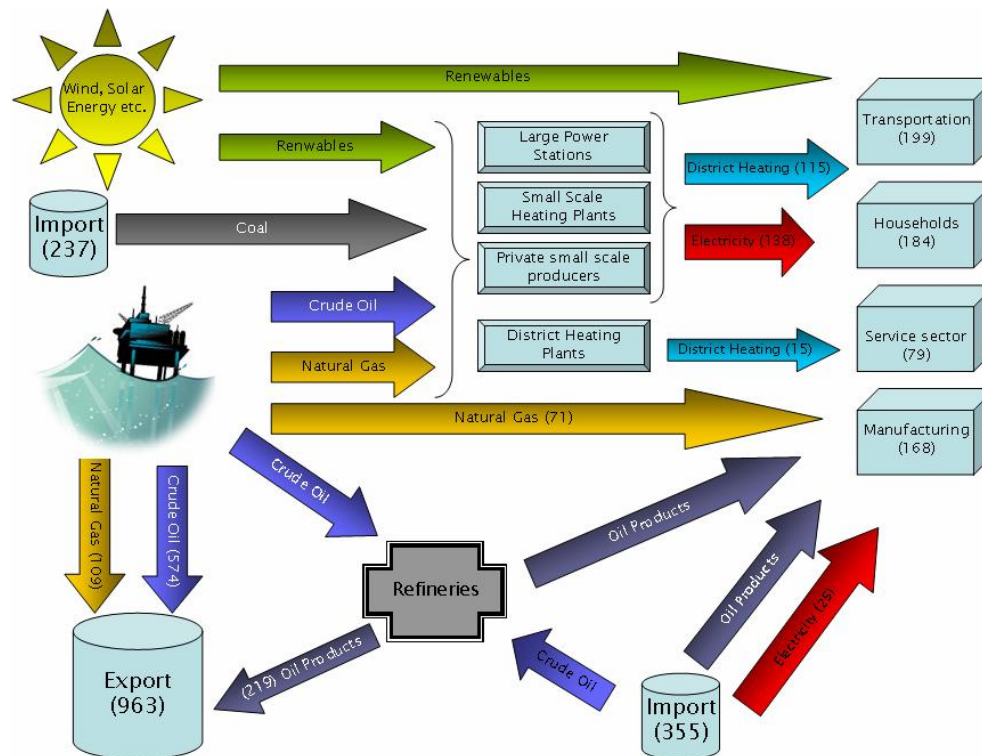


Source: VentureSource

4. THE VALUE CHAIN OF THE DANISH ENERGY INDUSTRY

In order to evaluate investment opportunities in the Danish energy industry it is relevant to examine, how the industry is structured. Therefore, Vaekstfonden has divided the value chain of the danish energy industry in to four stages. As can be seen in figure 4.1, the stages span from raw material extraction to production, transmission and consumption:

Figure 4.1: The value chain of the Danish energy industry



Source: Vaekstfonden

In all, 20 industry experts were interviewed about the composition and dynamics of the Danish energy sector. Insights from a minimum of 3 industry experts have been assigned to each of the stages in the value chain. Following is a brief description of what the different stages encompass.

Raw material extraction

This stage encompasses the process before the actual production of the energy. As an example it is increasingly expensive to locate and extract oil from the North Sea. Likewise coal, gas and waste suitable for energy production can be costly to provide.

Energy production

Energy production encompasses the process, where energy sources are transformed into heat and power.

Transmission and distribution

Energy transmission and distribution is in this report defined as the infrastructure that enables the producers of energy to sell energy to consumers.

Consumption

The last stage in the value chain is consumption. This stage encompasses products and services that geographically are placed near the consumers. As an example, decentralized energy production via solar power systems is part of the consumption stage.

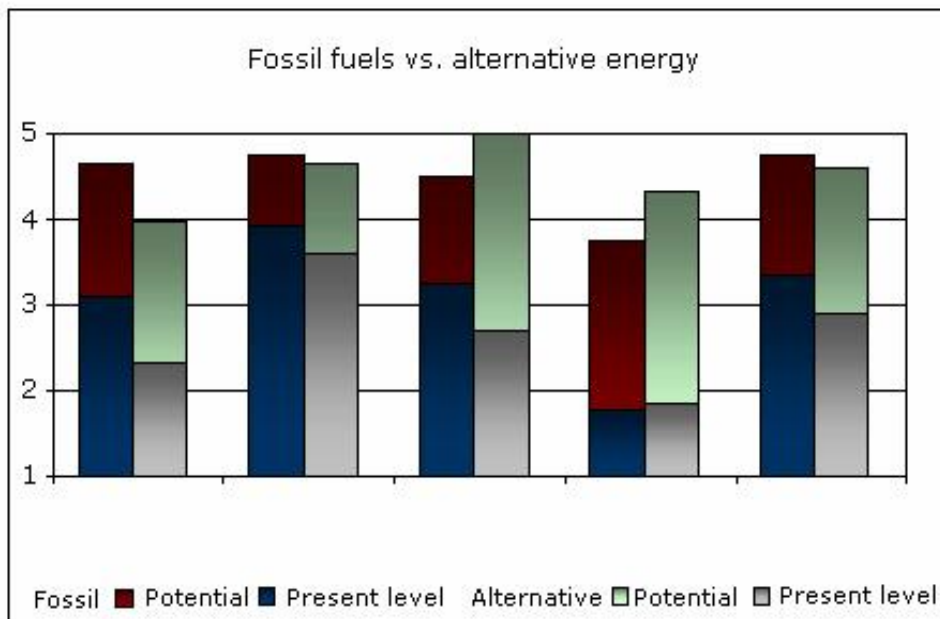
5. EVALUATION OF THE DANISH ENERGY INDUSTRY

The industry experts' evaluation of the Danish energy industry indicates that a more focused distribution of public research money is needed in order to support the creation of more energy start-ups. But to succeed, entrepreneurs also would benefit from shifting focus from developing new technologies towards designing more innovative projects based on combining existing technologies. To some extent, the current limited dealflow from the Danish energy sector is a result of not focusing on existing technologies.

In order to create consistent results, industry experts were asked to evaluate selected factors in two dimensions according to their potential impact as well as the current impact. A 1-5 scale is used, where 5 is the highest score.

The expert evaluation shows, that there is a sizeable funding gap within the Danish energy industry, cf. figure 5.1. Several experts declare, that this problem is connected to inadequate public funding for R&D, which results in a situation, where promising public research is often stopped at an early stage, due to lack of funds.

Figure 5.1: Impact of factors fossil fuels vs. alternative energy



Source: Vaekstfonden

SWOT

To give a basis for assessing investment opportunities going forward, Vaekstfonden has condensed all insights from experts into a SWOT analysis.

Table 5.1: SWOT analysis of the Danish energy industry

<p>STRENGTHS</p> <ul style="list-style-type: none"> ▪ High energy efficiency ▪ Wind power ▪ District Heating ▪ Waste management ▪ Flexible workforce ▪ Know-how 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> ▪ Funding gap between public research and the market ▪ Size of the Danish market ▪ Lack of entrepreneurs ▪ Low degree of knowledge sharing among knowledge institutions
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> ▪ Large scale investment program from DONG Energy ▪ Fuel cells ▪ Energi efficiency ▪ Bio ethanol ▪ Exports 	<p>THREATS</p> <ul style="list-style-type: none"> ▪ Universities do not stimulate entrepreneurship ▪ Belief in prior strenghts ▪ Political dependence

Source: *Vaekstfonden*

As can be seen from the SWOT evaluation, there is great diversity in the Danish strengths within the energy sector. Yet the experts expect that more innovative companies will arise in the areas such as offshore wind turbines and waste management. Further, most experts stress the fact that companies already operating in the industry will have to be more focused on their core business, suggesting that investments opportunities might occur as a result of spin-outs from large energy companies.

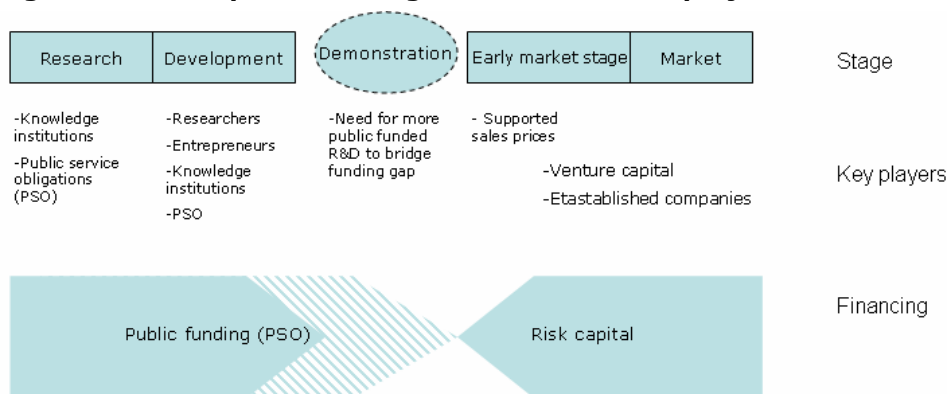
6. ATTRACTING VENTURE CAPITAL TO ENERGY COMPANIES

The analysis indicates that Denmark has a wide range of strong points within the energy sector. Yet changes are needed to further commercialize technology opportunities. In order to exploit the full potential of the Danish energy industry, the above findings suggest that Denmark:

1. Focus more on entrepreneurship based on combining existing technologies rather than expecting to be able to compete worldwide on R&D across a broad range of technologies
2. Prioritize public R&D funding on fewer technology areas to allow more funding to be available for the critical demonstration stages, which is typically too early for venture capital investors to engage in.

Why public funded demonstration projects is considered to have such a big role, is shown below:

Figure 6.1: More public funding for demonstration projects



Source: Vaekstfonden

If these suggestions are implemented, the likelihood increases of significantly raising total dealflow from the Danish energy sector. Three scenarios show, what VC investor could expect in terms of dealflow from the Danish energy market going forward:

Table 6.1: Danish VC investments in new or existing technologies

Yearly dealflow	Optimizing existing technology	New technology	Aggregated capital requirement Million/DKK.
Presently 2-3 new companies	20%	80%	160 - 240
10 new companies	50%	50%	600 - 700
20 new companies	50%	50%	1.200 - 1.400

Source: Vaekstfonden

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