

# Challenges in Growth Entrepreneurship in the Finnish Energy Sector

Creating business through focused policymaking

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## Foreword

National responses to global environmental and economical challenges have been greatly focused on capturing the energy sector business potential. Finland, among other nations, is seeking technologic leadership through various public stimulus and support programs. The successful execution of these initiatives is fundamental for reaching the goals in energy sector innovation.

The development of policies enhancing innovation is especially challenging in the strategic energy sector. The underlying drivers of innovation and the economic performance – entrepreneurship and private capital – must be leveraged through the political barriers in the sector.

Energy sector innovation policy is highly intertwined into energy sector legislation. Public policies determining renewable energy market creation also frame the potential for attracting venture capital and intellectual resources to the industry. Finland has a reputable public R&D system, but it lacks focus in integrating different policymakers' efforts throughout the innovation cycle. Comparison to energy sector global successes implies that a more comprehensive view of policymaking is required in the future.

Recent political statements promoting Finland as a leading Cleantech nation seem to bypass the fact that Finland has only few global successes in the energy sector. They have not been born as a result of opportunistic public-private collaboration, which seems to be the prerequisite for developing proprietary technologic leadership. The lack of demonstrated public-private cooperation places Finnish growth companies in a challenging position in the era of tightening global competition and nationalistic policymaking.

This report consolidates the views of Finnish private business developers and energy sector consultants. They bring forward the message of business-oriented opportunism in policymaking in the changing energy sector environment.

I hope the analysis brings forward timely challenges in Finnish energy sector policy development. The recommendations proposed will have practical value only when applied in collaboration with the private sector business developers. I find that the results will have their place in bringing together the Finnish energy sector in any courageous efforts for developing the environmentally sound businesses and the Finnish economy.

I want to thank Juha-Pekka Hokkanen for composing the research, and professor Markku Maula for his views regarding international growth business development.

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## Introduction

As in any industry, growth entrepreneurship in the energy sector stems from the actions of individuals and organizations seeking new business opportunities. National investments into education and research transfer into growth businesses only when there are sufficient incentives to gather complementary assets for business development.

In the Energy sector, policymaking holds vast influence over market potential of the industry, and thus controls the propensity of the industry to attract and foster business development competences and private investments

According to Finnish energy sectors investors, the biggest challenges in business development relate to the predictability and pro-activeness of public policies fostering desired growth. Finland has adequate financial and technology assets in the early stage phases, but lacks the ability to transfer them to the market. Private business developers will deliver the diffusion of these assets.

The recent development of global green stimulus programs has demonstrated the great interdependence of energy sector market creation and innovation effort. The current national competition is foremost a public policy race on putting efficient stimuli in place for promoting new business development.

The formation of Innovation Systems is regarded as the core direct process for governments to promote entrepreneurship and the creation of technology based new companies. However, the individual policymakers often lack understanding of the policy effects on economical growth through new technologies. In the capital intensive energy industry, coordinating the effort of various government organizations is in the foremost importance for the Finnish nation. There are currently various and multilateral economic development initiatives planned to put forward in developing the energy sector. However, there is no focus on the exact challenges in the creation of new energy technology based growth companies, which can be regarded as the realization of successful innovation policies.

The objective of this report is to recognize the growth challenges in the current energy sector business environment. The report will furthermore recommend focus areas corresponding to the key challenges. The need for more efficient cooperation of public and private operators is seen as a key factor in the creation of energy sector growth companies, the energy industry development, and economic development of Finland.

The study also pursues to understand the current direction of the public policies affecting the energy sector. In order to propose valid policy directions, this study draws on an historical case examination of internationally competitive energy clusters. The Finnish business environment is examined through consolidating the views of the energy sector stakeholders in Finland. The report is a part of a M.Sc thesis research conducted for the Helsinki University of Technology department of Industrial Engineering and Management. It is published as part of Sitra's Energy programme's initiatives to enhance the energy sector growth in Finland.

## Finnish innovation system – Reflections for energy industry development

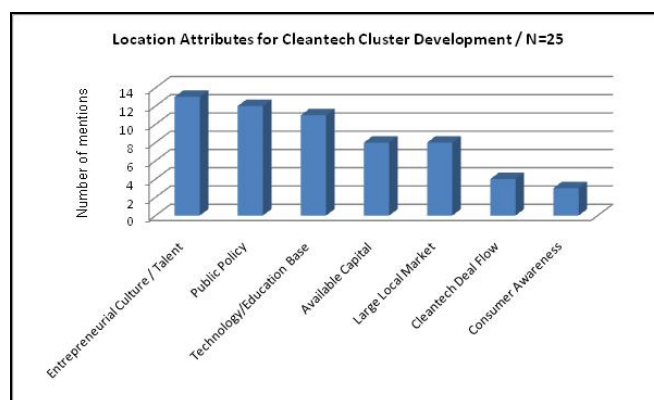
The Finnish innovation system has been widely studied for its ability to produce ICT-based new companies. There are also examples of successful developments in historically strong industries e.g. paper and electronics. The innovation system is strongly guided towards building commercial successes through a strong R&D effort allocated by the innovation system operators, mainly Tekes (the Finnish Funding Agency for Technology and Innovation).

R&D focused approach has limits in developing capital intensive companies. Limited home markets combined with low activity levels in private financing pose challenges for scaling up feasible technologies. The internationalization challenge has been on the agenda for years, but still lacking prominent internationally oriented small commercialization resources. The productiveness of R&D activities is also seen to suffer from low levels of entrepreneurship and private business acumen.

The business development obstacles of the Energy sector challenge the traditional view of Finnish innovation. The financial resources amounting up to 200MEUR in 2009 in Tekes' grants and loans do not create demand for capital intensive systems and business development competences. The lack of prominent technology companies will furthermore hinder the internationalization of such initiatives. This study proposes the following lack of business development resources as the main obstacle for energy sector long term growth business development.

Opportunities for business attract scarce resources for growth business development. Viable venture capital markets are generally considered the main source and catalyst for the diffusion of business acumen. The inflow of VC resources is furthermore seen as a positive sign for a nation's ability to produce commercially viable innovations.

A recent study by Burtis et al. (2006) maps U.S. venture capitalist incentives to invest into a location. The results illustrated in Figure 1 demonstrate great reliance towards the favorable public policies and entrepreneurial resources of the area.



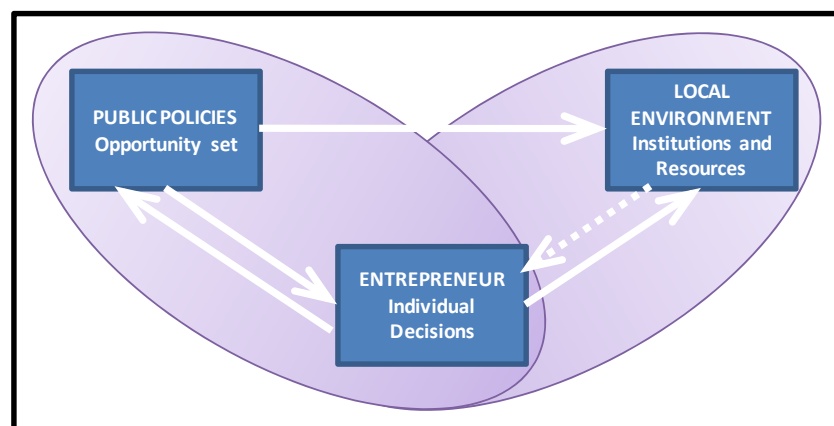
**Figure 1 Location attributes of VCs considering cleantech investment locations (Burtis 2008)**

The Finnish energy sector business development has historically resulted from mutually beneficial collaboration of industrial system providers and industry operators. In contrast, the U.S. business development is based on the prominent venture finance sector. In the study, The U.S. VCs find that the policy and local resources will affect most their decisions to invest in a location. The energy sector is a truly global market when it comes to technological development or the allocation of VC resources. The Finnish innovation system should thus not rely on past performance factors when planning energy sector policy initiatives. International comparison is the only way to remain competitive.

## Energy sector public policies and innovation

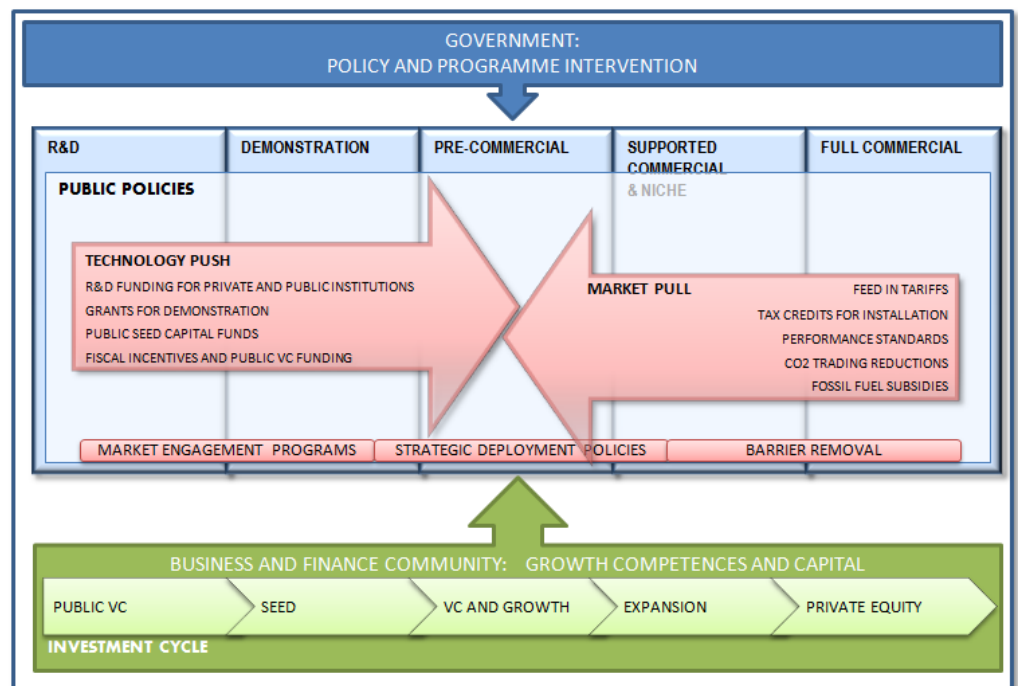
The VC investment into the Cleantech sector have grown fivefold in the last 4 years, to 6,5B\$ in 2008 (Cleantech Group, 2009). Global stimuli for financial crisis will turn to consolidated 450B\$ spending on green technologies globally.(Cleantech Group, 2009). National policies for reaping the benefits of energy sector turmoil are seen to follow innovative activities in technologies and services. Immediate benefits of technologic leadership is making nations to combine their strategic energy sector targets with policymaking across the innovation chain.

The multilateral causality between public policies and growth business development requires an extended framework for analyzing the key challenges underlying the energy sector development. The technologic development is often focused geographically, producing viable clusters and shared resources. The cluster analysis applied follows the effort to incorporate these interdependent relationships among entrepreneurs, government policy and the local environment (i.e. social and commercial institutions and physical and human capital resources). In a well-functioning entrepreneurial system, each component reinforces the other to promote firm, industry and cluster development. (Feldman 2005) The interaction is illustrated in Figure 2.



**Figure 2 The interdependence of policymaking, environment, and entrepreneurial decisions (Feldman 2005)**

The regulatory factors in the energy sector pose specific requirements for policy analysis. In recent Cleantech innovation policy research (see Burer, 2009) the connection between public policies and new businesses is seen as bipolar. The model in Figure 3 illustrates how both the technology development and the market pull for new businesses are accounted in the research. Private venture investment cycle developing the actual growth companies is modeled in parallel.

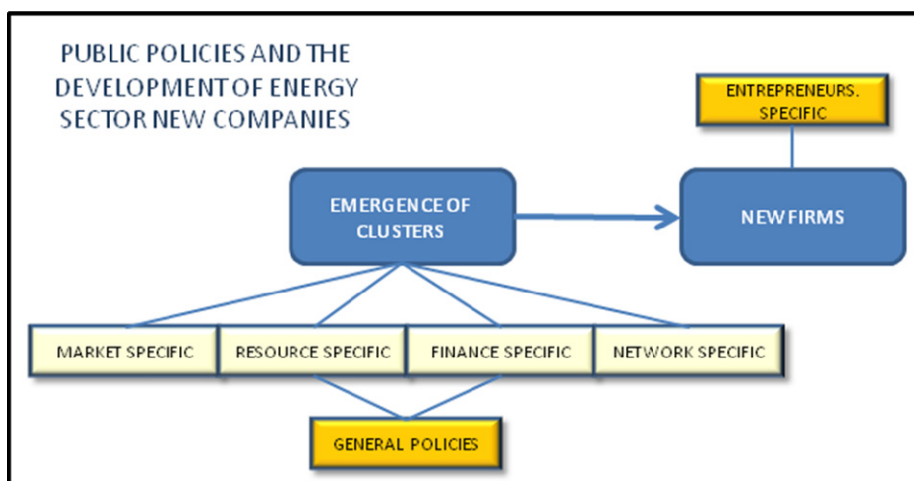


**Figure 3 Investment cycle and energy sector public policies**  
 Adapted from Grupp (2008) and Burer (2009)

### The policy focus of the report

The policies are further refined to structure the analysis. The research then uses the emergence of energy technology clusters as a unit of analysis. Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated organizations in a particular field linked. There is competition as well as cooperation. (Porter 1990)

Cluster-based approach illustrated in figure 4 is applied in the research. The policymaking areas are structured to model their effect on new business development.



**Figure 4 The framework of public policies affecting energy sector cluster formation and new business development**

The policy focus is on new business development within the policy areas. The key policies analyzed in the study are presented in Table 1.

**Table 1 Key policies discussed in the report**

MARKET SPECIFIC	RESOURCE SPECIFIC	FINANCE SPECIFIC	NETWORK SPECIFIC	GENERAL POLICIES	ENTREPREN. SPECIFIC
<ul style="list-style-type: none"> <li>•Feed-In Tariffs and investment subsidies</li> <li>•Standards and limits</li> <li>•Public direct spending</li> </ul>	<ul style="list-style-type: none"> <li>•Education and research policies</li> <li>•Promotion of business development resources</li> <li>•Public R&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>•Public-Private networking</li> <li>•Industry outreach of public operators</li> <li>•Complimentary asset promotion</li> </ul>	<ul style="list-style-type: none"> <li>•Legislation promoting private risk investments</li> <li>•Public VC capital</li> </ul>	<ul style="list-style-type: none"> <li>•Commitment to international agreements</li> <li>•National target settings in the energy sector</li> </ul>	<ul style="list-style-type: none"> <li>•Changes in insolvency laws</li> <li>•Entrepreneurial education</li> </ul>

## Public policy development in two global Cleantech clusters

The literature discussing development of two global energy sector clusters was reviewed for the report. Focus was on the main components that relate to the present situation of the Finnish energy sector development. The cases for Denmark, Germany were analyzed by the effects of public R&D programs and market-creating incentives.



### **Danish wind industry**

The foundation of the export oriented wind power industry in Denmark was laid in the 1970's when the oil crisis created public interest for using Denmark's natural resources for alternative energy production. First projects then began privately through innovative individuals. Following the first public capital grants in early 80's the energy producers took interest on large scale turbine development. The development later exploded when tariff-based incentives were introduced in central Europe. Nowadays the market share of Danish wind producers is 40% globally, amounting to 3MEUR in turnover and over 20,000 employed in Denmark.

Public planning for wind energy initiatives reached various levels of society, enhancing the public commitment for the sector. The policy planning was conducted with respects to the industry manufacturers as well as end users. On the R&D side, public resources were mainly directed towards basic research, while private resources were focusing on turbine development.

The basis of Danish public policies is a widely applicable feed-in tariff for wind energy production. The literature proposes that the previous regulatory framework was formed in a "battle of institutions". (Jacobsson et al., 2007)

The parliaments and public opinion together had a prominent role in debating over the costs and benefits for proposed initiatives.

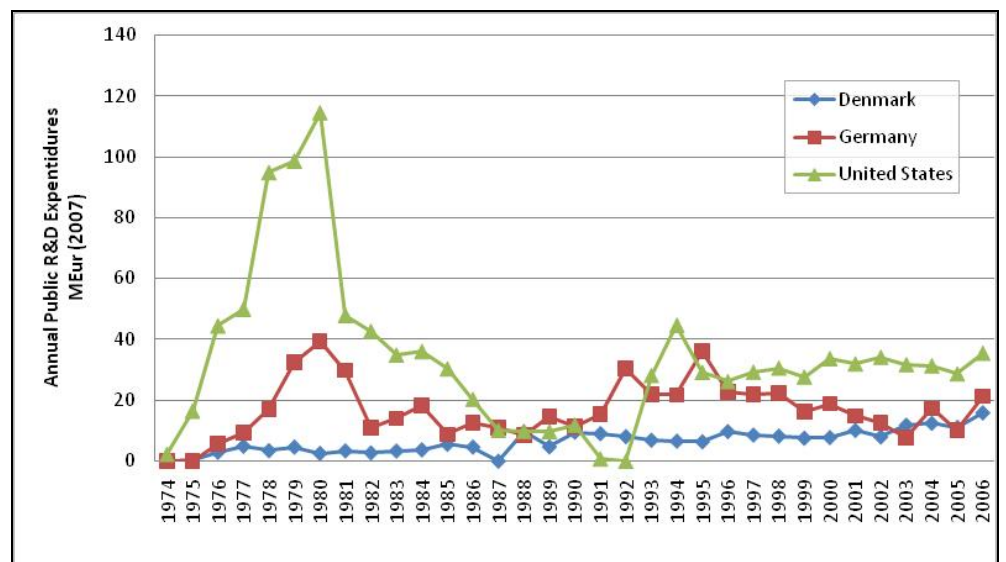
### **German solar industry**

German solar industry also has its roots in the public planning following the 1970's energy crisis. The deviation from nuclear power created demand for alternative generation methods. The first concrete policies, the passage for the "1,000 roofs program" in 1991, aimed for gaining experience with solar installations and making new housing compatible with renewable electricity generation needs. The policy was later refined with feed-in tariffs fixed for 20 years beyond the installation date. The tariff, providing investment certainty for firms and individuals, has been a part Germany's energy policy since 1991 and continues still. (Solarwirtschaft, 2009)

Through the government's market-launch policy, a modern and forward-looking industry was able to develop. Over forty major companies have developed so far producing solar power components at all stages of the production chain. With 30GW power installed nationally, the solar power sector employs over 30,000 people in Germany, achieving a turnover of 1.7 billion EUR in 2004. (Solarwirtschaft, 2009) The policy development is generally regarded as an successful example of a cluster emergence without specific natural resources or capabilities. (Cleantech investors forum, 2009)

## Public R&D expenditure

Public R&D investments work as an important stimulus for private investments in early stage development of technologies. Their importance is often diminished as the private sector financing develops or the technologic risks decrease. Also, the privately funded R&D in manufacturing industries is found to yield a substantial premium over the rates of return from government funding. (David, 2000) For Finland, the question of R&D subsidies is specifically important, while the national innovation system has historically relied on publicly driven R&D systems. In the course of the research, we took a view on the key wind energy public R&D allocation in the prominent nations.



**Figure 4 Public R&D expenditure into wind energy 1975-2007, in MEUR (IEA 2009)**

The case nations do not show great reliance on public R&D in the course of the industry development. Furthermore, the case literature describes the main focus of public support being on the demand side of innovation cycle. In the cases of Germany and Denmark, the public R&D expenditure has remained stable in relation to the growth of the industry. As illustrated in figure 4, the Danish expenditure was only 60% more in 2007, as in 1990. At the same time R&D in wind had doubled in Germany. In Denmark, the expenditure has remained in around 18% of all energy sector public R&D expenditure from 1990, while in Germany the Wind energy accounts approximately for about 5% of total expenditure.

The relatively low growth in the public R&D expenditure implies proactive public commitment into the successful sector. The market-based incentives have worked as the main incentive for the industry development, attaining business development and R&D resources, while the role of public R&D has been important in the starting phase of the industry. The high levels of public R&D into one sector (18% in Denmark) correspond to a high public commitment into the development of the industry.

### Introduction of market creating mechanisms

New technology based businesses often have the difficulty to compete with industry incumbent firms. Especially in the energy sector, the gap in the cost structure of new technologies will hinder the diffusion to market. The review finds that especially in the capital intensive industries, it is important create protected spaces for new technologies. (Andersson and Jacobsson, 2000)

The government plays a crucial role in bridging the markets, through change of legislation and because it can act as a "launching customer". (Alkemade, 2005)

The market creation mechanisms in the examined cases were foremost focused on creating strong financial incentives for the respective technologies. The cost effectiveness of the introduced tariffs is debatable, but their ability to create industry growth is eminent. The core findings in policymaking process relate to political awareness preceding the legislation, and the ability to sustain the market incentives through political turmoil. The market creating mechanisms were also introduced early in comparison to global initiatives.

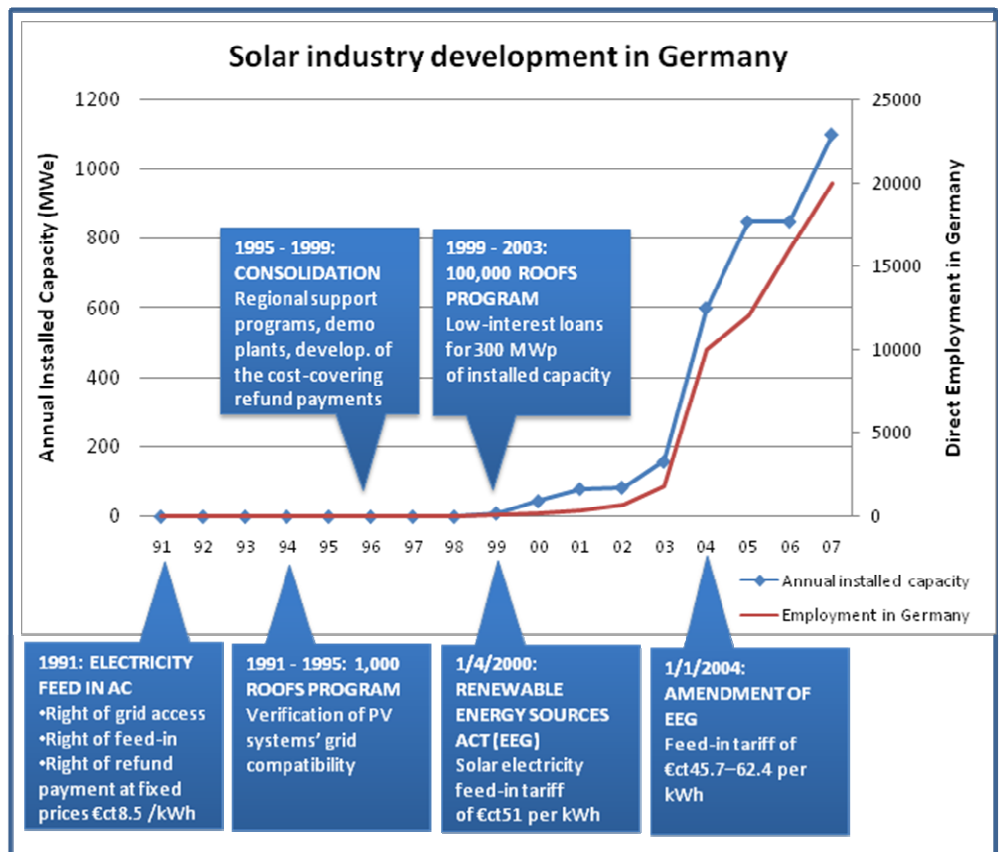


Figure 5 The market creation policies and the development of the German solar industry (Solarwirtschaft 2009)

The German key policies presented in Figure 5 present the relatively compact development of the industry. Starting directly with the feed-in act in early 90's the industry took 10 years to create distinct results in employment. The consistency and the aggressiveness of the tariffs in Germany promoted private venturing into the market, and thus created a resource base to build the industry on. (Cleantech conference, 2009)

In Denmark, the employment effects of the market creating policies were recognized in the early 90's: The main driver before that had been public research activities, and the prominent energy acts of the nation. The growth was fueled by export-oriented industries, and Denmark merely worked as an R&D base when considering the scale of the production development. The literature implies that the ambitious and clear objectives in renewable energy were a crucial factor for the wellbeing of the industry. They tied up the public, politicians and the industry into the development effort. The industry development is presented in Figure 6.

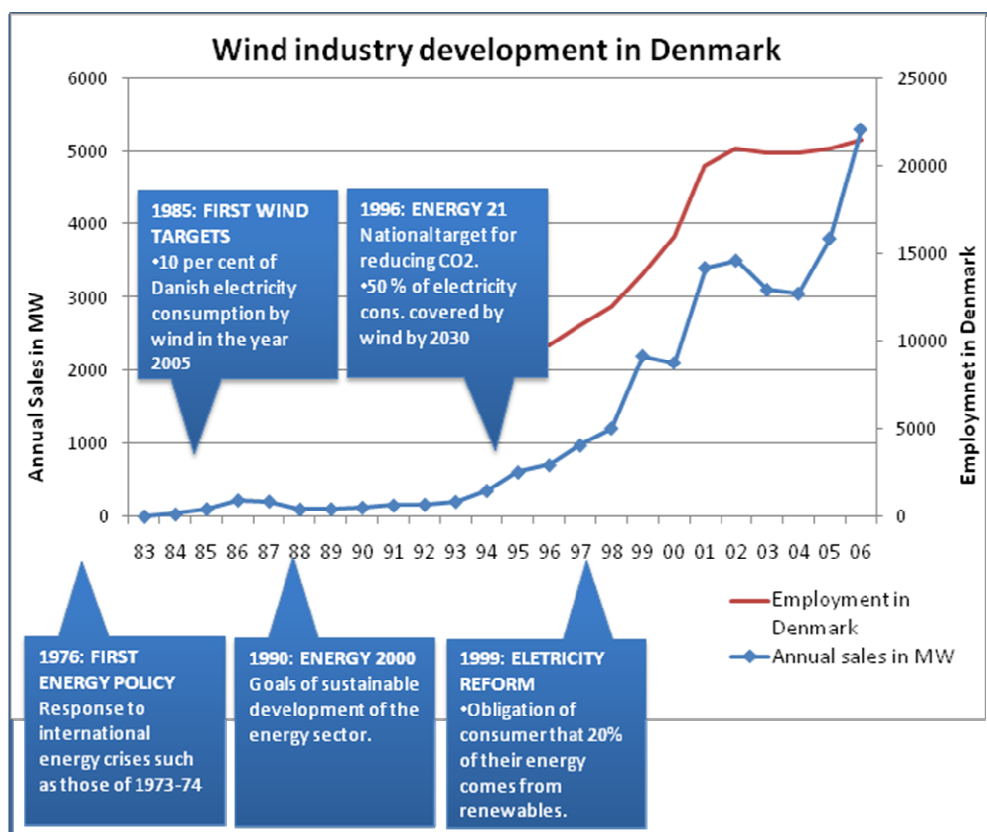


Figure 6 The development of the Danish wind industry (Krohn 2002, Danish Wind energy association 2009)

## Results

The review concluded findings on the implied importance of market creation mechanisms as the core instrument for cluster development. In both cases, strong market-based incentives had been put forward 5-10 years earlier than the other global clusters had. The cluster development also showed relatively low increases in public R&D spending: Focus on both cases were in securing the basic research of the energy sector development.

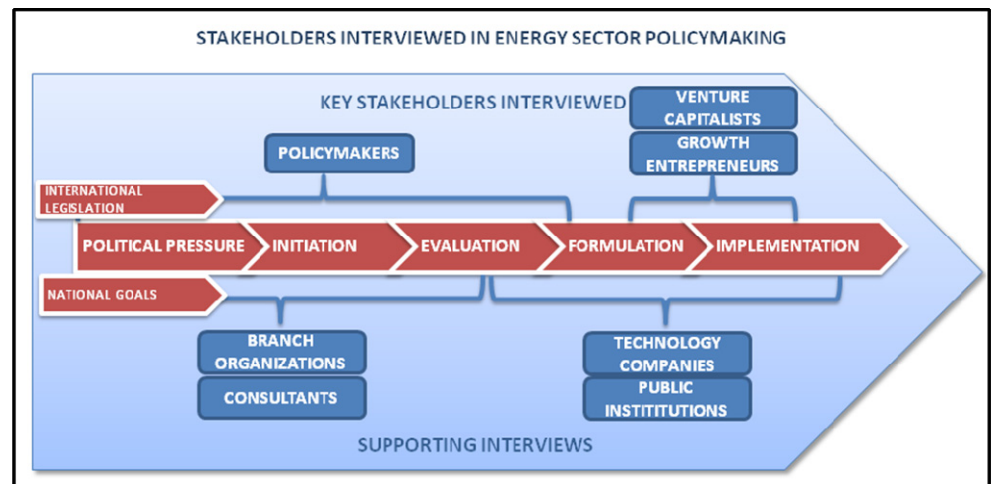
The results have implications for the policymaking in Finland. Firstly, the creation of an international, vertically integrated cluster requires market-creating incentives. The cases show that the reasonable competence base in complementary assets, such as prominent researchers, and business developers took over ten years to develop. The focus of policymaking was on securing reliable infrastructure for investments into the sector.

Secondly, the review revealed that the technologic focus was negatively correlated with the home market size. In smaller markets, the public policies and public R&D were further focused to support a certain technology or industry. R&D programs were present in all of the cases, but the review offered few indications about their importance for the cluster development.

Thirdly, stimulating private investments was seen as a crucial factor for development of the clusters. This supports academic findings that policies increasing VC funding imply increases in entrepreneurial activity in an industry.

## The Finnish energy industry stakeholders views

Over 30 stakeholder interviews were concluded to provide up-to-date input for understanding the Finnish Energy Sector stakeholders' views regarding the challenges in growth entrepreneurship. The qualitative study aimed at creating an understanding of the positions of the stakeholders, as well as their perceptions of the research question. An extensive stakeholder mapping was concluded in the initial phase to find out which are the responsible parties and organizations affecting the design of the Finnish Innovation System and Energy Policies.



**Figure 7 The Stakeholder groups interviewed for the Study: The effectiveness in policy development**

Three direct stakeholders important for the study were used for the analysis (Policy makers, Venture Capitalists, Growth Entrepreneurs) with five stakeholder groups indirectly affecting the Innovation environment (Consultants, Technology companies, Branch organizations, Public institutions). The stakeholders and their effect in policymaking are illustrated in figure 7.

## Methodology

The qualitative study was based on inductive theme building over specific questions about the challenges in the Finnish energy growth businesses. Preliminary research was conducted to determine the stakeholder's position to the study problem. The content was analyzed by finding mutual themes for the:

1. Main challenges in energy sector growth entrepreneurship
2. Main challenges in energy sector public policy design
3. Feasible ways to initiate and design more effective policies.

The interviews were furthermore focused on the specific area of the Interviewee (e.g. VC-Finance, Policy Maker - Markets) through semistructured theme discussion on how to best overcome the challenges through the public interventions. Inductive content analysis was used to construct specific themes regarding the discussion, and further, the case-research methodology was used to extend the results to the spectrum of the study. (Eisenhardt 1989)

All interviews began by examining the interviewee, or interviewee organization's position towards the research setting, and the research problem. Though the notes

about the general position were not used in the analysis, they were applied in understanding significant deviations within an interviewed stakeholder group.

## Results

The interview material was structured according to the cluster emergence framework of the study. The data was inductively analyzed and perceived key challenges for cluster creation were themed and analyzed. Stakeholder bias was limited by cross-referring the data with secondary materials in the Finnish energy sector public policies. The key findings are consolidated in tables corresponding each policy category.

### Market-related policies

The investors and entrepreneurs saw the lack of tariff-based incentives as an efficient instrument to intermediate new technology diffusion. Although the views were much inclined towards their own technologic field, the tariff-based investments ability to attract business development and research capabilities was seen as a major influence in any cluster development

Investment subsidies were seen as useful, but rather bureaucratic means for developing the industry. The lack of transparency and unexpected outcomes of subsidy application were also seen as a major hurdle by business developers. The public investments were also seen insufficient for large demonstration projects.

The policymakers saw mainly operational challenges in reaching strict CO<sub>2</sub> reductions. There was no clear perceived challenges related market creation mechanisms in innovation.

**Table 2 Market specific factors described by the interviewees**

MARKET SPECIFIC FACTORS	
Core Challenges	Proposed solutions
Lack of reliable market-based tariff schemes	Focused public schemes in pre-market demonstration
The cost of market base incentives	Political choices to promote only key industries
The financial limitations of investment subsidies	Proactiveness, focus on future with market incentives
Incoherent structure of the Finnish energy industry	Less regulation in mature technologies
Market intervention related inefficiencies	Evaluation of incentives ability for employment

## Resource-related policies

The business managers and private business developers promoted two distinct factors with positive influence on business development in general: Competent labor force, and sector specific networks of export-oriented businesses. The clusters that form around these factors were seen to foster new business development. The policies that promote other heavy industries, for example forest or metals, were described crucial for energy technology development.

**Table 3 Resource specific factors described by the interviewees**

RESOURCE SPECIFIC FACTORS	
Core Challenges	Proposed solutions
Ensuring basic research	Focused programs based on Tekes programmes
Future development of extra-energy clusters	Entrepreneurial academic team building
International sales and marketing competences	Opportunism in University consolidation
International exposure and R&D contacts	Cross-border business dev. And venturing
Teambuilding competences for business development	High public stakes on potential winning teams

## Finance-related policies

All of the interviewees stated that currently financing is not the greatest challenge in the early growth venturing. Challenges posed by the business managers refer to large demonstration projects and to immediate liquidity challenges for the growth entrepreneurs. Moreover, the VCs and some government entities describe that the current offering of risk capital might lead to inefficient investments. All of the interviewees describe the Tekes led Finnish Innovation system as a useful entity, especially in considering of R&D grants for high-technology companies.

The current private early stage venture capital in the Finnish energy sector is sufficient. The VCs describe international exposure a prerequisite successful venturing. The academia further supports findings that the historical low VC-venturing activity is related to lack of venture non-financial value added components in business development, not than the lack of risk capital per se.



**Table 4 Finance specific factors described by the interviewees**

FINANCE SPECIFIC FACTORS	
Core Challenges	Proposed solutions
Financing of large demonstration projects	Proactive public finance in chosen technologies
Stimulating Cross-border Venture Capital	Attractive taxation for international VC
Inefficiencies in public support infrastructure	Stimulation of national Business Angel activity
R&D grant dispersal into too small pieces	Focusing Tekes R&D programs towards business
Inefficiencies in capital allocation (too much available)	

### Network-related policies

According to the interviewees, there were always possibilities in network development among business entities, especially internationally. Public operators were more inclined towards increasing the information input for decision-making. The network-building activities across the energy-sector operators were seen as interesting for the public organizations, but less appealing from the point of view of the entrepreneurs. All parties agreed on possible benefits of increased and focused collaboration regarding innovation in the energy sector.

For the policy makers network challenges were mostly related in organizing the internal decision-making procedures efficiently. Collaboration towards other policymaking institutions was seen cumbersome. According to all policymakers the main obstacle towards development or demonstrating new networking possibilities, was the lack of upper level political pressure, and the absence of approved collaboration models and informal networks.

**Table 5 Network specific factors described by the interviewees**

NETWORK SPECIFIC FACTORS	
Core Challenges	Proposed solutions
Future of Finland's industrial clusters	Direct public-private collaboration
Internal policymaking unclearities	Informal contact promotion within public institutions
Lack of business development voice in policymaking	Activation of Entrepreneurs and VCs
No collaboration in Energy sector innovation efforts	Responsibility clearance in new business emergence
Loss of focus and initiative in energy sector operations	Public-private teams for policymaking

## General policies

Entrepreneurship researchers interviewed found that commitment to a certain environmental policy and the following raise in awareness, might very well lead to the development of entrepreneurial activity. The academia also proposed that such initiatives are needed, but their effect to energy-sector entrepreneurship might realize after a relatively long period of time.

The business managers stated that companies' general environmental norms and policies are greatly reflections of the society they base their business on. The norms further influence the actual operations by monitoring and incentive schemes. The business VCs and entrepreneurs concurred on the effects on daily business, but remained sceptic about their ability to enhance new business creation without financial incentives.

**Table 6 General factors described by the interviewees**

GENERAL POLICIES	
Core Challenges	Proposed solutions
Lack of public proactiveness in high-tech energy sector	Communication of growth business targets in sectors
Follower of EU legislation – Not on forefront	Public policy leadership in chosen technologies
Small home market - No focus for certain sectors	Attracting foreign competences on focus sectors
Public-private joint promotion	Increase collaboration in the policy planning
Policies directed for heavy industry survival	Courageous New business development focus

## Entrepreneurship policies

The interviewees concluded the challenges in entrepreneurship were foremost related to national attitude and culture and secondly to the lack of deep enough exposure to a variety of business challenges.

According to the academia, the aspects of the Finnish entrepreneurship culture are widely recognized and studied. Factors such as national identity, appreciation towards work accomplishments, or the structure of basic education were stated during the interviews. The VCs supported the academic research by empirical findings about the low level of growth seeking entrepreneurs, and statements about the need for entrepreneurial guidance for academic community.

The VCs also identified that the competence spectrum of the potential entrepreneur was not often sufficient for growth business development. The strive for building and acquiring competences through teams, or partnerships was the main obstacle for developing feasible ideas.

**Table 7 Entrepreneurship specific factors described by the interviewees**

ENTREPRENEURSHIP POLICIES	
Core Challenges	Proposed solutions
Low entrepreneurship culture in Finland	Entrepreneurship culture training
Spin-off mentality and lacking public support	Financial incentives for Spin-Off activities
Taxation and incentives not directed for new ventures	Activation of energy energy sector entrepreneurs
Researches have no skills for business development	Climate change promotion for activating citizens
Lack of international exposure and contacts	Promotion of academic exchanges

## Challenges in the Finnish energy sector business development

Five public policy areas were discovered in the analysis as the current challenges for new business development in the energy sector. The findings relate to the policymaking procedures, as well as to the coherence and market applicability of new initiatives.

The Energy sector in Finland does not lack early-stage growth financing. The key challenges relate to business development resources, especially in internationalization. The direct financial needs for later stage demonstration projects are a major hurdle for bringing new technologies commercial phase. The legislative environment in Finland is considered risk averse and incoherent in pursuing business opportunities, with inter-ministry discussions blocking feasible new initiatives. The described challenges and their applicability with key stakeholders are illustrated in figure 8.



**Figure 8 Themed challenges in energy sector growth business development. Number of hits per category**

The research further supports findings in the evaluation of the national innovation system, where the public support infrastructure is regarded excessively complex to access and administer. Recognized risk-averse culture in new business development, and entrepreneurship cultural factors seem to also apply in the energy sector new business emergence.

### Key challenges

The interview findings are here refined into five distinct areas of public policy development, which the Finnish stakeholders find most challenging.

### The lack of policy pro-activeness supporting renewable energy technology and innovation

Finland was the last country in Europe to apply market-based incentives for renewable energy technologies. In globally successful energy sector clusters, the public policies have predominantly supported the demonstration of risky energy sector technologies. The report finds that all of the stakeholders argue the Finnish

energy sector policymaking lacks pro-activeness, especially with the market-based initiatives.

Growth entrepreneurs and investors in the energy sector describe the undeveloped home markets and challenges with pilot projects as a national competitive disadvantage. Even though the interviewees did not find consensus on market based initiatives cost effectiveness in business development in Finnish markets, most saw that in the innovation effort, the public resources are not enough focused into industries with accumulated global comparative advantage.

The consultants described the policymaking risk aversion the main challenge for proactive behavior. The consultants also felt that the overall political process preceding energy sector legislation did not concentrate on creating successful global businesses, but more in dividing the public resources into relatively small pieces. The challenges with divided financial resources were especially valid with large pilot projects.

The policymakers found little co-operational effort with the private stakeholders in preparing nationally important energy sector legislations. This was present especially in the planning and execution of demand-based initiatives for energy sector.

In Finland, the energy sector legislative work concentrates in meeting the CO<sub>2</sub> levels agreed in the Kyoto Protocol. The policymakers found that the discussion towards other public institutions and business developers for innovation aspects was widely scarce, and did not include specific processes for ensuring national business development initiatives. Referring to the success-cases analyzed, it can be argued that Finland does not possess the required focused and proactive policy making environment where risky technologies are put forward.

### The organization of Finnish industry branch organizations for promoting new energy technology growth businesses

The branch organizations of the Finnish industries are under one confederation, Confederation of Finnish industries (EK) representing the entire private sector, both industry and services, and companies of all sizes. The energy sector projects require close collaboration of new technology producers and their utility customers. While the concentrated approach is regarded beneficial for effective public dialogue of whole industries, growth companies promoting new technologies have little room for lobbying from inside a strong branch organization. Only the initiatives that are aligned with the general strategy of Federation of Finnish Technologies (TT), and Finnish Energy Industries (ET) will have strong position in the promotional efforts.

The growth entrepreneurs describe the present situation challenging for direct exposure in policymaking and preceding public dialogue. Their prospective customers within the Finnish ET, as well as in leading Finnish industries (e.g. metals or paper) have strong incentives for high capacity and low production cost technologies, which compete for the limited public investment schemes. The organization was furthermore described beneficial focused new project initiatives, but hindering in changing the status quo of Finnish energy infrastructure.

The investors and entrepreneurs were also not motivated to bring forward strong statements about their own technologies, as it might damage business relationships within the confederation. This report concludes that the centralized organization unilaterally pre-empted the efforts for new technology business development in the pilot phase. The public pressure should be focused towards mobilizing the organization as a whole behind the new technologies.

### The lack of business development opportunism in the energy sector public policy preparation

International energy sector clusters have emerged in environments where public policies have created positive signals for business development. The well-round Finnish public R&D infrastructure is unable to overcome the barriers of energy sector business development by itself. The report finds that the lack of business-minded opportunism in the legislative preparation hinders the development of growth companies.

The consultants find that Finnish policymaking in general is less concentrated, and more risk averse in responding to possible nationally beneficial business opportunities. In comparison to other EU countries, Finland historically follows more strictly the legislative framework provided the EU, and thus has less flexibility for guarding national interest for example in energy sector policymaking.

The policymakers do not see the business development challenges so directly, partly because of the responsibility division of the parties included. In the ministry of employment and the economy (TEM), The Energy Department focuses on the energy sector legislation, Innovation department in innovation policy, and TEKES in the division of R&D funding. The interviewed parties find that while there are many initiatives focusing on energy technology sectors, increased collaboration with private parties might lead to better results in innovation.

The energy sector business developers are few in number, and those interviewed for this report find public cooperation interesting, but not highly beneficial. Other public innovation system stakeholders find the collaboration relevant, but also describe possible challenges in the organization of such forums. This report recognizes the following lack of opportunistic business leadership in policymaking as a source of comparative disadvantage for Finnish energy industry business development.

### The lack of collaboration in energy sector legislation within the policymaker organizations

The energy sector legislative initiatives are intertwined, having an effect in wide areas of national development. Especially the core initiatives for business development, demand-based incentives, require coordination of three to five intra-ministry

departments. The policymakers interviewed find the dialogue between the various policymaking organizations less inclined towards business development.

The energy sector policymakers interviewed for the study were informed about the possible legislative instruments that could be put to place for reaching the energy efficiency targets, but had little knowledge on their effects in new business development. The innovation policymakers had also only few ideas, and little research material on the energy sector initiative effects in business development. Both parties described TEKES as the main organization handling business development, and regarded closer collaboration beneficial. The ongoing organizational restructuring of the Ministry of Employment and the economy apparently had negative effects on the collaboration, especially regarding the crucial energy sector legislation. The consultants found such intra-ministry dialogue challenges probably hindering for the development of feasible incentives for new business development.

The Investors found historical reasons in the post-war strategic development of the Finnish heavy industry to be the main source of consensus seeking behavior in energy sector legislation. Finland has no history in tying up the industrial policy and energy policy with regards to growth business development, and thus the policies planned for status quo will fail to address the innovation effort of the government.

### Challenges in early-stage growth business support policies and infrastructure

The levels of entrepreneurship in Finland, especially in higher education are historically low in international comparison. The previous efforts for increasing entrepreneurship have created public support infrastructure for growth business development, while the amount of private VC and prominent business developers has remained relatively low. In the energy sector the need for entrepreneurial commitment is especially high, while private business development resources remain generally scarce.

The investors and academia interviewed conclude the risk averse attitudes and Finnish business culture as main challenges to overcome. The main challenges described in relation to growth business legislature are the public policies directly affecting individual's propensity to start and nurture risky ventures. Main driver here is the change of personal insolvency laws lowering the transaction costs for potential spin-off entrepreneurs. The interviewees also support recent effort for the policymakers to reduce the tax burden on business angels and prominent business developers. The current taxation on venture capital investments is also seen not to incentivize new fund creation. On the cultural level, the academia puts weigh on cultural aspects of entrepreneurship that are highly recognized and discussed in the Finnish society.

The business developers find the organization of public support adequate, but ill guided for high-growth entrepreneurs. Energy sector VCs support the introduction of public programs where companies are prepared for private investments from the

beginning, rather than nurtured for the programs intentions itself. Presence of business angels is seen as a prominent intermediate to be included.

The report concludes the cultural aspects as a core challenge in increasing the probability of feasible corporate spin-offs and research-based energy sector companies. The current market environment allows public policymakers to extend communication to promote success stories, and speed up the direct policies for increasing entrepreneurship in the sector.

## Recommendations for policies and the preceding interaction process

The recommendations for policymaking are based on the core challenges of the Finnish energy sector growth business development. The findings on international success cases are here refined and fitted for the prevailing organization of the Finnish innovation system.

### Concentrated approach on technological pilots

The internationally successful nations have adapted concentrated policy packages in the development of national clusters. The smaller the home market, the more concentrated the concrete policies have been in promoting a technology. The recent stimulus capital into green technologies has furthermore increased the direction for focusing public resources.

The business developers find public support adequate in early-stage development but describe great challenges in promoting large scale pilot projects. There is also wide consensus that the Finnish public support infrastructure divides business development resources into relatively small pieces, in contrast to the need of energy sector growth companies.

Policy support, for example through investment subsidies, is a major enabler of first reference plants. The probability of internationalization can be greatly enhanced by a concentrated public-private effort in pre-commercial phases. The Finnish policymakers should thus take strong initiative in promoting new technology demonstration with the private operators in the chosen focus areas.

The possible challenges in the political processes and energy sector internal barriers should be taken into account when preparing energy sector initiatives. The enabler of a technologically focused approach is a strong political will and an focus on the business possibilities of the chosen industries.



## Focus on the combined possibilities of environmental effects and business development potential

In the international cases, the policymaking had a dual purpose from the beginning: Secure energy sector strategic targets, and reach global business leadership in the prospective industry. The Finnish policymaking focuses currently only on the first aspect.

Interviews with prominent energy sector consultants describe Finnish policymaking more risk averse, and less opportunity driven in comparison to other EU countries' activities. Furthermore, VCs and entrepreneurs consider predictable and proactive policymaking as a signal for favorable investment environment. The result for the lack of opportunism is thus incoherent and slow reactions with new business development initiatives in the private sector.

Finnish policymakers should include courageous sector development targets in energy policy initiatives. The understanding of the implications for innovative growth will greatly worsen, unless opportunity driven approach is not used in the preparation of legislation.

## Intra-ministry collaboration and responsibility clarification

The international success-cases demonstrate a recognizable political will for promoting initiatives in business creation. The direction is based on a favorable public opinion for new energy technologies. The policymaking for innovation, energy strategy and national finance are combined to benefit the national goals as a whole.

Interviewed Finnish policymakers state that the energy sector innovation initiatives are not clarified with other ministries, and there is little understanding on the business development potentials of the industry. The lack of collaboration and shared political responsibility for energy sector new business development will undermine the effort for creating viable national clusters.

Collaboration between the public institutions responsible for policy planning (e.g. Ministries of Finance, the Economy and Employment and the Ministry of Environment) and execution (TEKES, Avera) for should be increased and the responsibilities concerning industry development clarified.

## Development of market creating incentives

Finnish business developers require a public policy scheme overcoming the challenges in pilot project finance, but not interfering with the free market development. Tariff-based incentives are seen to be most beneficial for the industry development.

Attracting research talent and business development capabilities is seen to develop mainly through strong incentives in market generation.

The findings suggest that Finland will need to initiate new market based incentives in order to reach the baseline CO<sub>2</sub> reductions cost-effectively. Meanwhile, the investment subsidies will remain the main instrument with short term innovation value. The research suggests that the investment subsidies do not support innovative business growth effectively. In the long term only predictable schemes can bear results in sustained innovation.

In the short-term, the support for new technologies should be politically prepared and executed through public-private pilot ventures. In choosing pilot projects, Finland should courageously aim for industries with historical competences or potential for deep value chain development.

### Simplification of public support infrastructure

The international comparison of Finnish national innovation system suggests that the public support infrastructure is excessively bureaucratic and multilateral creating inefficiencies in new business development. With references to the recent R&D spending, the energy sector requires a streamlined environment for businesses to apply for business development resources. As Finland lacks prominent private VC operators in energy sector, the considerations for the early stage support should be re-evaluated. Resources could be shifted from the R&D activities into market creating activities, which are seen to increase the new business development potential more effectively.

### Ensuring strong base for basic research and entrepreneurial training

International energy sector cases imply a 10-15 year time-span for cluster emergence. The development of specific resources in R&D and business development will not happen overnight. The research resources will have to be focused within the energy sector to have effect in innovation.

Finnish business developers and venture capitalists consider the foundation of qualified labor force as the main criteria for decisions in new business development investments. Spin-off activity from qualified institutions and companies is seen essential for new business deal-flow. Promoting entrepreneurial activities should be included in the consideration of energy sector innovation: Cultural barriers take long to overcome.

Finland should continue to evaluate and focus the energy sector academic programs, and especially aim in developing entrepreneurial skills. Changes and focusing of the university system pose great opportunities in consolidating energy sector entrepreneurial resources.

Building programs for national R&D should be made in collaboration with the internationally recognized academia and business development experts. The increasing collaboration with the private sector operators through The Energy and Environment Strategic Centre for Science, Technology and Innovation (CLEEN) is seen beneficial. The collaboration in R&D should be backed up with a supporting policy package expanding support into the pre-commercial phases of business development.

### Taxation of private venturing and incentives for entrepreneurial development

Private equity investments are the lifeline of energy industry financing. The report suggests the further tax reductions aimed at the overall increase of VC and angel investing will be beneficial for growth business development. Personal insolvency laws should be evaluated in the effort of increasing spin-off activity.

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## Appendices

### Appendix 1: General interview structure and key questions

The goal of the research is to

1. Determine the key challenges in energy sector growth business development
2. Determine the public policies that most effectively respond to the current challenges

The research applies case methodology through

1. A case research on two international clusters in energy sector
2. Finnish stakeholder interviews on the concurrent challenges

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Based on the preliminary research, your organization is thought to be one of the main stakeholder in Finnish Energy sector policy planning.

What are from your point-of view the biggest challenges in the Finnish innovation system with regards to growth entrepreneurship in Finland?

- Financing
- Research
- Entrepreneurship
- Resources
- Policy planning

(Discussion on the focus point of the interviewee)

How do you see public planning best responses to the described challenges?

- Through increased collaboration of stakeholders
- Through design of concrete policies and procedures
- Through better planning and execution

What would be the most efficient way to organize the preparation of efficient policies?

- Which stakeholders
- Which cooperation model
- What challenges in practical operations