New energy policy for providing growth and employment

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1. Introduction

The energy and climate politics of Finland do not fully serve the benefit of the nation. Old energy policies are coming to an end. New energy policies help to grow the economy to the right direction by increasing employment and exports, decreasing imports and thus improving the competitiveness of our country. It leans on energy and resource efficient solutions, such as renewable energy sources and intelligent energy systems that are Finland's strengths. New energy policies also take care of Finland's future climate obligations.

The society affects the energy production and consumption in many ways. Means of influence are legislations, obligations, taxes and aids, but also urban planning, permits and infrastructure solutions that are all political decisions. Because of this, the possible imperfections of the energy system are not fixed by the markets. Notable changes to the energy system have and are still demanding active contribution from the political decision-makers.

The need for change in energy system arises from global trends. The price of the fossil fuels has increased and the price of replacing technologies has decreased. When targeting success within the world of strongly competitive and finite raw material energy resources, it is necessary for Finland to develop new and domestic energy production while we have to join many other countries with decoupling the economic growth from energy consumption. Another challenge is the unfavourable development of current account: we import goods that have gone up in price but the goods we export have gone down in price.

The global markets for renewable energy sources are in strong rise[1] as are the markets for energy efficiency improving solutions. The volume of the markets is annually several hundreds of billions and the growth is strong. Finland has very high education level and skilled workforce, through which we have a good basis for innovations and developing new energy solutions. [2][3] Know-how is very important in the new energy technology market. This is why the global rise of new energy technologies market could be a significant opportunity for Finland and for Finnish companies. When considering the energy system, this opportunity can be best made use of if the domestic markets can be utilized for trying out our own technologies and for gaining references.

The energy policies in Finland differ clearly from that of several other well succeeding countries', such as Sweden, Denmark, Austria and Germany. This should raise the discussion why we act differently, especially when our economy and the future of the country seem a lot darker than the future of the aforementioned countries. It seems that there is an understanding in Finland that the countries of comparison have come up with their energy policy solutions purely based on the environmental point of view. Even though the environmental point of view is one thing behind the solutions, it is clear that trade and economic politics are playing a major role in the energy policies of these comparison countries. For example, in 2012 Finland used imported energy products worth 8.5 billion euros (over 4% of GDP). [4] With the right political decisions, this annual demand worth of billions would be possible to direct towards Finland.

Even though the threat of a catastrophic climate change is very likely, thinking the effects of the decisions in the economic growth here and elsewhere often makes the most important political decisions. As the

[1] http://www.iea.org/textbase/npsum/mtrenew2013sum.pdf
[2] http://www.vatt.fi/policy-brief/2013-01
[3] http://stats.oecd.org/Index.aspx?DatasetCode=RGRADSTY
[4] The numbers are based on the numbers provided by the Bureau of Statistics (http://tilastokeskus.fi/til/ehk/2012/04/ehk_2012_04_2013-03-22_tie_001_fi.html), of which the increase in price caused by Neste Oil's processing activities in Finland has been eliminated.

climate change is partly caused by an unsustainable economic development, it would be important to simultaneously fix both economic and environmental problems and through this contribute to a change towards sustainable economics. This is why growth has been selected as one of the main perspectives of this report. Despite this point of view this report is not a statement for or against growth, but the reason for this point of view is to serve the political decision-makers in this current serious situation where wide societal and economic decisions have to be justified with growth arguments.

It is justified to ask if the energy politics of Finland is suffering from a lack of credibility. This lack of credibility is caused mainly by the inconsistency and unpredictability of the politics. Finland needs an energy policy that derives from domestic grounds and targets, not from the outside pressures; that takes the global trends into account and that is transparently argued and consistently formed. The energy policy's ground needs to be formed in a way that allows the comparison between different energy political solutions and that makes the energy politics consistent and predictable.

2. Background

Central Global Trends

There are three strong energy trends in the world. First trend arises from global population growth and the growing standards of living in the developing countries. The demand for energy grows constantly. The prices of energy resources have been rising for a long time. It's worth noticing that the time for easily accessible cheap oil is soon over and neither shale oil nor gas will bring long-term change in the situation.

Another strong trend is connected to the accelerated technological development. The price of new high technology based energy production and energy efficiency technologies will drop. Technological development includes all levels, from individual energy consumer to the whole energy system.

Third strong trend is associated with carbon dioxide emissions. The global carbon dioxide emissions of energy production grow, because 80% of energy is still produced by fossil fuels. It is clear that the need to reduce these emissions will grow, as the negative effects will manifest themselves more concretely.

Energy consumption and acquisition in Finland[5]

In 2012 Finland's energy consumption was 1.7 EJ (380TWh). The electricity consumption was 85 TWh. 70% of the energy consumed in Finland is bought from abroad.[6] It should be noted that the direct energy consumption does not tell the whole truth. Most of the energy gets consumed indirectly, in goods and services. For example, of the normal household energy usage, direct consumption is about 40% and indirect is about 60%. A large part of this indirect consumption is imported from outside the borders of Finland.

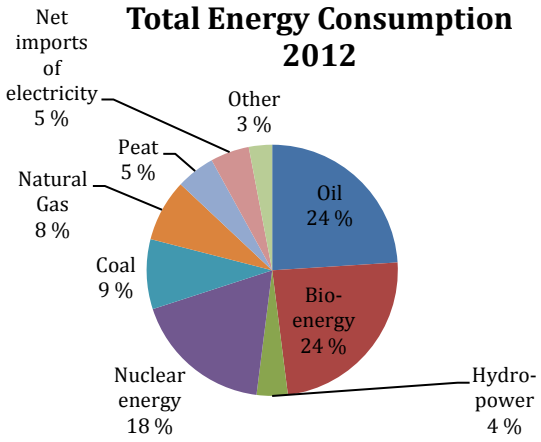
A major part of Finland's directly consumed energy is used in manufacturing, heating buildings and in transportation. The biggest energy products are wooden fuels, oil, nuclear energy, coal, natural gas, peat and waterpower.

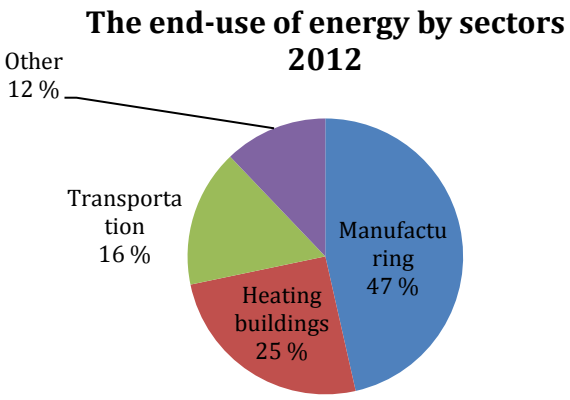
The Finnish economy is very energy intensive. Half of the energy and electricity is being consumed within heavy industries, whose competitiveness is very sensitive when it comes to production inputs such as the labor, resources and the price of energy. This also means that the premises for improving energy efficiency in Finland are good. In recent years, our economy has actually become more energy intensive and the compensations for the energy inputs have grown faster than the economic production. 6% of economic production goes into energy inputs.

Renewable energy sources produce over 30% of all energy in Finland. Compared to the EU average, the high share is explained by large forest resources and long tradition of utilizing them. The renewable energy in Finland comes mainly from waste liquor of the forest industry, burning wood and hydropower. Other renewable energy sources are marginal compared to these.

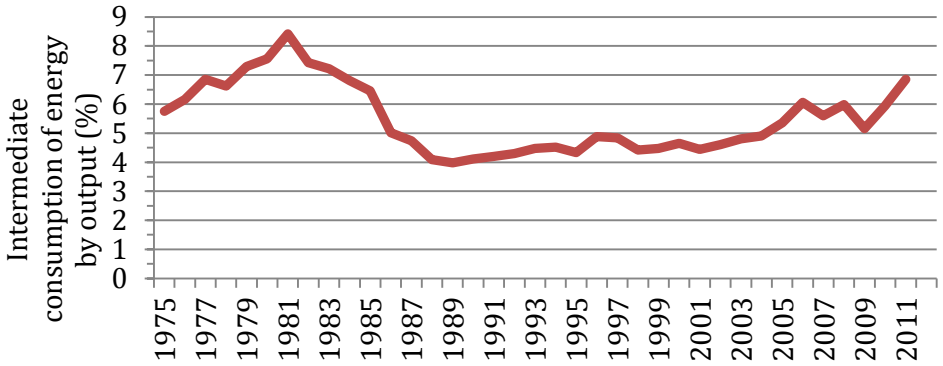
[5] http://www.stat.fi/til/ehk/2012/ehk_2012_2013-12-12_tie_001_fi.html
[6] http://www.ek.fi/ek/fi/energia_ym/energia/energiantuotanto.php

GRAPH 1 TOTAL ENERGY CONSUMPTION AND THE END USE[7][8]

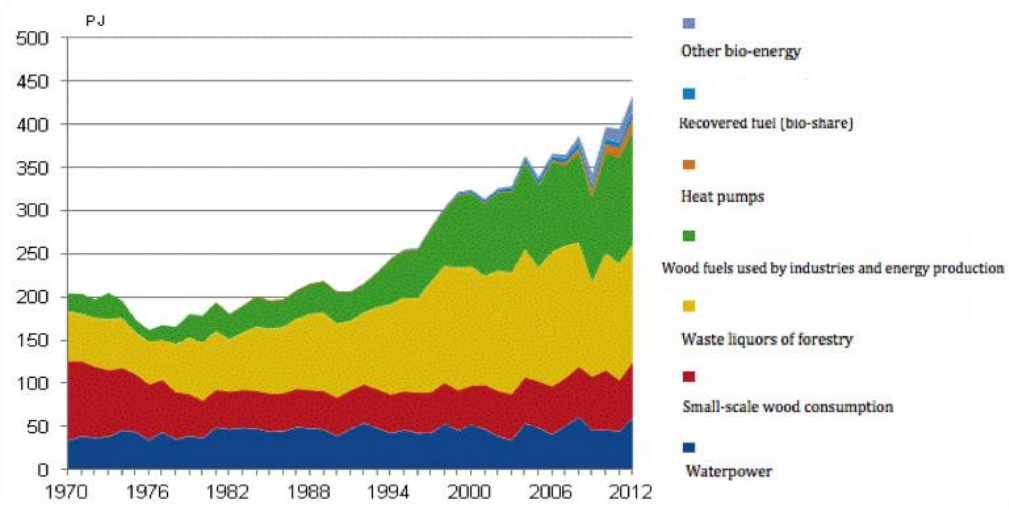




GRAPH 2 ENERGY-INTENSITIVITY OF THE ECONOMY 1975-2011.[9]



GRAPH 3 RENEVABLE ENERGY SOURCES CONSUMPTION IN FINLAND[10]



[7] http://www.stat.fi/til/ehk/2012/ehk_2012_2013-12-12_kuv_001_fi.html
[8] http://www.stat.fi/til/ehk/2012/04/ehk_2012_04_2013-03-22_kuv_014_fi.html
[9] Bureau of Statistics, Antti Pasanen, Markku Räty, 2014
[10] http://www.stat.fi/til/ehk/2012/ehk_2012_2013-12-12_kuv_004_fi.html

3. International Development

Next will be inspected the energy political targets and development of countries that are interesting to our case. Sweden and Denmark have been selected as examples because they are within the same size as Finland and part of Nordic countries. Germany and Austria have been elected from euro-countries because of their economic prosperity.

Finland[11]

Present

- Current account -1.78% of GDP
- Unemployment, November 2013 8.4%[12]
- The share of renewable energy within the whole energy consumption 31.8% (2011)[13]

Targets

- Minimum goals of EU, but 20% bio fuel target in transportation by 2020
- Renewable energy 38% of end consumption by 2020
- Increased electricity consumption 16% from 2010 (88 TWh) to 2030 (102 TWh)

Sweden[14]

Present

- Current account +5.98% of GDP[15]
- Unemployment, November 2013 8.0%
- The share of renewable energy within the whole energy consumption 46.8% (2011)

Targets

- 40% decrease in greenhouse gases from 1990 levels by 2020
- Minimum 50% of renewable energy from total consumption by 2020
- 20% improvement to energy efficiency by 2020 (from 2008 level)
- Total energy consumption increases only 4% by 2030
- Fossil fuel –free transportation by 2030

Denmark[16][17]

Present

- Current account +5.57% of GDP
- Unemployment, November 2013 6,9%
- The share of renewable energy within the whole energy consumption 23.1% (2011)
- 240 companies in wind power industry, 29000 jobs

Targets

- 50% of electricity is produced by wind by 2020
- 7.6% decrease in energy consumption from 2010 to 2020
- Detached from fossil fuels by 2050

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[11] http://www.tem.fi/files/36730/Energia-_ja_ilmastostrategia_2013_SUOMENKIELINEN.pdf

[12] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Unemployment_statistics#Further_Eurostat_information

[13] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Energy_from_renewable_sources

[14] http://www.government.se/sb/d/16022

[15] Source IMF

[16] http://denmark.dk/en/green-living/strategies-and-policies/

[17] www.ukerc.ac.uk/support/tiki-download_file.php?fileId=3082

Austria[18]

Present

- Current account +1.78% of GDP
- Unemployment, November 2013 4.8%
- The share of renewable energy within the whole energy consumption 30.9% (2011)

Targets

- 34% renewable energy from total consumption by 2020
- 20% decrease in greenhouse gases from 1990 level by 2020
- 20% increase to energy efficiency, 10% in buildings, 5% in transportation by 2020
- Creating/securing 80000 jobs within building renovation and in development of energy system and creating 31000 new jobs for developing public transportation

Germany[19][20]

Present

- Current account +6.95% of GDP
- Unemployment, November 2013 5.2%
- The share of renewable energy within the whole energy consumption 12.3% (2011)
- 390000 new jobs created within renewable energy

Targets

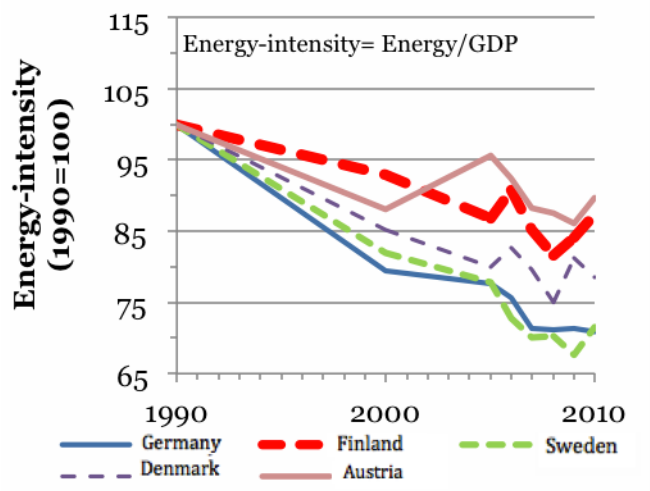
- 40% decrease in greenhouse gases (from 1990 level)
- 20% decrease in energy consumption from 2008 to 2020
- 2% improvement in energy efficiency in a year
- 35% renewable energy from total consumption of electricity by 2020
- Importing fossil fuels will decrease by 22 billion euros in a year
- By 2020 the total of 500000 jobs, by 2030 the total of 800000 within the sector of renewable energy
- 2030 GDP 20 billion more and public debt 180 billion less than without these actions

Comparisons

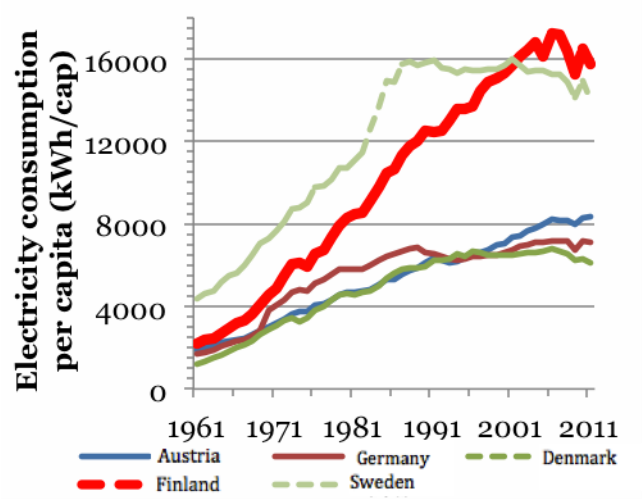
Next graphs will show how the countries of comparison have evolved within energy efficiency and in the consumption of renewable energy in the last decades.

[18] http://www.en.bmwfj.gv.at/Energy/Energystrategyandpolicy/Seiten/default.aspx
[19] http://www.bmwi.de/EN/Topics/energy.html
[20] http://www.germany.info/Vertretung/usa/en/06__Foreign__Policy__State/02__Foreign__Policy/05__KeyPoints/ClimateEnergy__Key.html

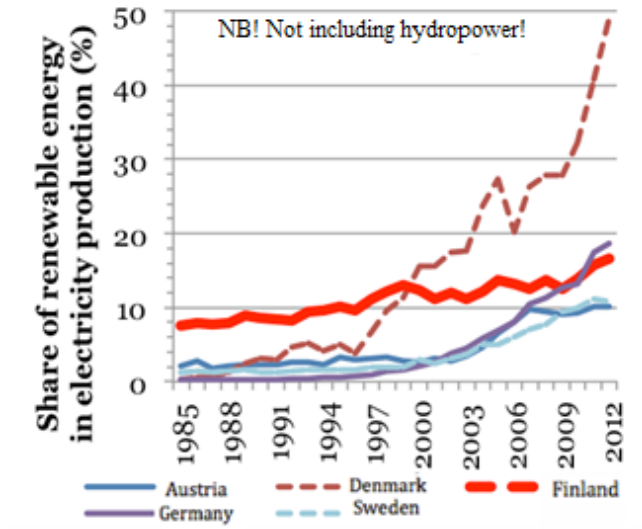
GRAPH 4 THE DEVELOPMENT OF ENERGY-INTENSITY. HOW ENERGY EFFICIENT THE ECONOMY IS.



GRAPH 5 ELECTRICITY CONSUMPTION PER CAPITA. THE DEVELOPMENT OF ELECTRICITY CONSUMPTION



Graph 6 The share of renewable energy. Showing how new renewable energy sources are utilised



It is clear in the pictures that the development of the countries of comparison differs from that of Finland. The energy dependency has stayed the strongest in Finland and electricity consumption has grown strongly until the beginning of 2008 recession, exceeding even Sweden's level. The economic growth and increased electricity consumption have developed hand in hand and the development for increased energy efficiency has been neglected.

The share of renewable electricity in Finland has traditionally been on a high level. Within the last couple of decades the development has been stagnated unlike in the countries of comparison. In these countries, the political decisions have changed the direction towards new energy technologies such as divided energy system and new production technologies (wind-power and solar energy). Especially large division to these countries happened in the beginning on 2000's, when Finland decided on building three new nuclear power plants. The turn to nuclear energy in Finland has been as rapid as the turn to renewable energy in Germany.

Differences between countries in energy production and consumption are caused by the different ways of thinking behind the energy policies. Modern energy policy is seen as competitive advantage and as a source of economic growth and employment in the countries of comparison, whereas in Finland modern energy policy is traditionally seen as competitive disadvantage that increases costs. It should be noted that the current account of the countries of comparison is positive, whereas in Finland it is negative. The unemployment rate is also lower in these countries than in Finland.

4. Finland's energy possibilities

The designed practices and enactments made during cheap energy resources and expensive replacing technology are no longer economically sensible even in short term in the time of increased energy prices and decreasing technology prices. In the mid-term and long-term consequences we can talk about remarkable opportunities for the political economy.

Possibilities for political economy

Finland has suffered from economic downhill since 2008.[21] One of the central reasons for this downhill is the weak demand and weakening competitiveness. ***Finland spent 8.5 billion euros in 2012 (over 4% of GDP) by consuming imported energy products.***[22] The number is on about the same level as the Treasury's estimate of Finland's public economy 's long-term sustainability gap is in relation to the GDP.[23] This means that Finland has annual demand worth of 8.5 billion euros, caused by information silo in energy policy, regulation, taxation, aid and infrastructure, is at the moment fulfilled by imported energy and technology. In addition, we will be importing energy technology worth billions of euros as part of the present energy policy. Right energy policy could direct this annual billion-euro demand back to Finland by 2020 with 20%, by 2035 with 50% and by 2050 with up to 100%. Besides the direct economy strengthening impact the demand jab would also have notable dynamic impact.

When done right, these actions would affect the gross domestic product positively simultaneously in two ways: they would increase investments and employment and decrease importing at the same time. Third impact to gross domestic product would be indirect, when the competitiveness of Finnish companies would improve within rapidly growing energy efficiency and new energy markets.

Possibilities for public economy

The central target of energy policy is to create economic growth, which would radiate positively all around the society, including public economy. By changing the energy system, it becomes possible to positively impact on, in addition to economic growth, several interesting public economy sectors, such as demand for employment and current account. Most of the changes can be made from the public economy's point of view cost neutrally by developing regulations and by redirecting taxation and aid.

At the moment the state annually supports the energy consumption of corporations directly and indirectly with total of 2.7 billion euros.[24] Most of these aids make the transfer towards modern energy systems more difficult. One central way to change the energy system is the reassessment and possible redirecting of these aids. It is possible that some of these aids could be abandoned with the new energy policy, which would help the public economy.

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[21] http://verkkojulkaisut.vm.fi/zine/23/cover

[22] The numbers are based on the numbers published by the Bureaus of Statistics (http://tilastokeskus.fi/til/ehk/2012/04/ehk_2012_04_2013-03-22_tie_001_fi.html), of which the increase in price caused by Neste Oil's processing activities in Finland has been eliminated.

[23] http://www.vm.fi/vm/fi/04_julkaisut_ja_asiakirjat/01_julkaisut/02_taloudelliset_katsaukset/20130531Julkis/TS_raportti_Vartia.pdf

[24] The government's revenue and expenditure evaluation 2012

Possibilities for companies

Finland has a strong group of companies that are investing in energy efficiency and in new energy resources, even though it is weakening within international comparison. The money that at the moment is sliding abroad through the energy product imports could be directed in Finland through these companies. In addition to Finland's own consumption, these companies would gain a significant opportunity on a globally strongly growing sector if the domestic markets would support the access for the international markets.

Energy intensive industries energy costs should not rise. Energy intensive industries' competitiveness needs to be improved by improving its energy efficiency. Thus the energy costs would decrease and competitiveness on international markets would improve. Cheap energy alone is not a solution for competitiveness, but efficient use of energy and other inputs, which are the keys for bringing down the costs.

Employment possibilities

Finland has 300,000 unemployed job seekers at the moment. In addition, there is a notable number of people employed with different governmental aids and people outside the labour force. [25] Unemployment has stayed on a high level for a prolonged period of time. Rightly executed energy policy could create tens of thousands jobs rapidly.

International examples show that by 2020, Finland could create 30,000 jobs with the right energy policy. Jobs would be created first and foremost in energy efficiency ventures, as well as in the renewable energy production.

By 2030 it would be possible to create 50,000 new jobs in Finland. In addition to energy efficiency ventures, new jobs would be created around the new forms of energy between 2020 and 2030. By 2050 it would be possible to create overall 90,000 jobs. Most of these jobs would by then have been created to companies whose main markets are outside of Finland.

Untapped resources

Finland has a vast amount of untapped possibilities both within energy efficiency improvement and within domestic energy sources. In addition to these, there is a great possibility of increased elasticity of demand with the help of intelligent electric grid.

A study in 2007 showed[26] that by 2020 it is possible to improve the electric efficiency by 15 TWh/a (18% of 2012 consumption) and primary energy consumption by 52 TWh/a (14% of 2012 consumption). The costs would be 18 €/MWh in electricity and 23 €/MWh in heating. Savings would be achieved by renovations and introduction of new technologies in properties and industries.

In addition to current renewable production, in 2020 renewable energy sources could produce electricity 18 TWh (21% of 2012 consumption) and primary energy 40 TWh (11% of 2012 consumption) for the cost of 35€/MWh in electricity and 27€/MWh in heating. Rapidly introduced resources consist mainly of wood and agriculture based bio energy, wind power and heat pumps, but within long-term also solar energy.

Finland has 570,000 electrically heated properties.[27], By the application of simple and intelligent structures, the energy usage of these properties can be evened out in real-time. The increased elasticity of demand decreases the need of peak, adjustment and reserve -power and thus decreases the energy costs.

[25] http://www.tem.fi/files/38397/MARRAS13.pdf
[26] http://www.sciencedirect.com/science/article/pii/S0360544207001041, Lund 2007
[27] http://www.stat.fi/til/rakke/2012/rakke_2012_2013-05-24_tau_003_fi.html

5. The criteria for new energy policy

To make energy policy credible, it needs to be objective, transparent and consistent. Individual decisions need to be comparable with each other. For example, the relationships between different forms of energy taxations and aids, the rationality of current regulations, benefits, disadvantages and costs of different options need to be justified with calculations, and it needs to be shown with alternative scenario calculations that the practiced policy is beneficial for the society.

The criteria of the new energy policy are meant to be utilized as a framework in the political decision-making considering energy. The criteria are meant to be applied in preparing solutions considering energy production, consumption, energy and resource efficiency, energy taxation, aid, obligations and regulations.

When applying the new criteria, the whole life-cycle of the systems needs to be taken into consideration, from the technology that is used to the effects of the technology during and after the use.

Old criteria

Two criteria have directed the Finnish decision-making in energy policy since 1970's oil crisis: the **price** of energy and the **availability** of energy. Through the climate change one important criterion has emerged, the **carbon dioxide emissions**. In addition to factual criteria expressed publicly, various societal targets have influenced on the decisions. The problem arises from the fact that they are not consistently expressed.

New criteria

In the new energy policy, energy is viewed from the perspective of the **overall benefit of the society**, to maximise the benefits of energy with all of its effects. In this context, **growth and employment** are highlighted in the current political environment and economic situation.

Energy policy based on **growth and employment** needs to have the following central criteria:

1. Utilising the characteristic resources of Finland, i.e. the domesticity of energy solutions

It needs to be valued when making decisions how well the element in question can benefit the resources that are characteristic to Finland. These resources are for example high technological know-how, wood and agriculture based bio raw materials, regional renewable energy in different forms, good potential for wind power and large land area compared to the population. In addition, smoothly working social constructions are also a characteristic strength of that enable wide coordinated solutions.

The domesticity of energy solutions impacts directly to employment and growth, current account, exporting energy technology and the competitiveness of companies.

2. Availability and certainty of energy

It needs to be valued when making decisions how the element or technology in question effects on the availability and certainty of energy supply. When making these valuations, production and consumption needs to be considered as a whole. Modern technology solutions such as intelligent electricity grids enable strong elasticity of demand that changes the role of energy production in valuing availability and certainty.

This kind of evaluation needs to be done in all levels when looking at the foreign influences on the evaluation of energy efficiency. It is clear that consumption of domestic and regional energy sources and the savings achieved by energy efficiency significantly improve energy security, availability and certainty.

3. Emissions of energy production

Energy policy based on the new criteria and domestic solutions will reduce the emissions on its own. By practicing the new energy policy, obligations from outside will not become a problem.

First and foremost Finland needs to practice a policy that follows its own views, when it comes to emissions. When the emission impacts of the energy policy beneficial to Finland are clear they can be compared to the obligations imposed by the international community and make necessary changes in the policy to meet these obligations.

4. Energy costs

The total cost of the energy consumption is essential for the industrial and national economic competitiveness, as well as for the household energy bill. It is influenced by the price of energy, efficiency of the utilisation of energy and energy taxation. This is why the total cost of the services produced with energy, such as heating, lighting or production, is more essential than just the energy price per kWh.

The energy costs imposed on industries and households impact on the benefit of the nation in different ways. Increased price decreases the international competitiveness of industries that consume a lot of energy, unless the energy consumption is made more efficient simultaneously. Increasing energy price on households is likely to increase the adoption of domestic energy efficiency solutions, which increases employment and the markets for companies operating in Finland.

6. Proceedings

An energy system cannot be restructured by merely replacing the old with the new. The best possible overall solution includes a great deal of integrated answers relating to energy production, efficiency, consumption, infrastructure, and energy systems.

Inspection of taxation and aid

Any necessary taxations and aids have to be derived transparently from an expanded set of criteria and they have to support the strategic goals. These values must be set to a level that benefits the common good of the nation. Using a transparent and logical set of commitment, taxation and support policies, much needed sustainability can be brought in to energy politics. By effectively allocated taxations and aids, new investments can be encouraged which in return support employability and growth.

Minister of Energy

The main issue in energy politics is the lack of coherency. The face value of energy politics must be raised to the same level in politics, as energy is represented in the national economic system. Because of the long cyclical nature of energy based investments, political commitment is paramount. The collective decisions, which influence energy systems, should be collected under the jurisdiction of a one minister.

A limber regulatory-system

The development of energy systems if often met with bottlenecks. The most common bottlenecks are over-regulation, complicated bureaucracy and ineffective officials. The regulatory-system must be developed in a fashion that can be applied to all sizes of actors, with speed and ease. The time spent on regulatory processes must be minimized. It should be possible to execute the potentially most promising project with a swift timetable. This would also require the accurate inspection of the benefits and disadvantages of the planned project processes, in addition to environmental factors.

Opening up the Energy Markets

Energy markets must be made available to different sizes and types of energy-based competition. Small-scale production has to be given the opportunity to enter the markets by removing the lower entry threshold, as well as enabling the net metering for their needs.

Towards selling the services

The regulatory system requires changes that help the energy market to develop from its current outdated system of selling energy and energy related appliances, towards more efficient ensemble of providing energy based services.

Intelligent electric grids and elasticity of demand

The need for intelligent electric-grids is real. Since the beginning of 2014 all of the AMR-meters in use at subscriber locations have the possibility to enable large-scale elasticity of demand that needs to be utilized. Some examples of mass demand services of elasticity of demand are: the redirection of electric

power due to price fluctuations, balance sheet management and the load usage in adjustment and reserve markets. If elasticity is added to the system, it would enable to level out the system creating a more energy efficient whole as peak, adjustment, and reserve-power are no longer required in the same scale. The use of an intelligent electric grid also enables the consumption of energy produced by various methods.

Aid must be related to energy efficiency and quality

Energy usage and production is supported by the society annually to the tune of 2.7 Billion Euros. Energy-efficiency and the application of domestic renewable energy should be preconditions to aid provided by the society. The regulations for such aids must be based on energy political criteria. Any benefits to national economy derived from such aids need to be presented in a clear and transparent fashion.

The need to improve the energy efficiency of existing building stock

The criteria for the energy-efficiency for existing building stock needs to be derived from the common criteria held in energy politics. The application of sufficient control methods enables to meet the goals set out by the existing criteria. Thus necessary renovations will be accomplished and the intelligent energy systems get to be utilized.

Efficient utilization of forest growth and agricultural side revenues

Regulations and incentives need to be developed in a way that enables the better utilization of yearly forest growth, agricultural side revenues, and the re-usability of waste, than at present. Upon moving to a bio-economy it is important to make sure that raw materials are utilized in an advanced refining environment.

Energy-efficiency of the transportation infrastructure

A large portion of the total consumption of energy is used in transportation. When designing a transportation system, the transportation's effects to the energy system have to be taken into consideration. The continuous improvement of energy efficiency is an important element in this. Rail transportation is an important part of improving energy efficiency and diminishing any unnecessary emissions. The energy policy criteria must be applied also in developing the transportation system.

The share of bio fuels in transportation needs to be increased

One of the most efficient ways of increasing domesticity of consumed energy in Finland is to increase the use of the share of the bio fuels. Bio-share includes raw material outside food chain, such as processed waste, wood and agricultural branch currents. The mixing ratio demand needs to be transparently connected from the criteria directing energy policy.

Prevention of Energy-poverty

Modern energy politics creates the growth to the economy, which affects all branches of society. The basis for this is the assumption that everyone gets to enjoy the benefits, and nobody is forced to pay an unreasonable price. An energy policy that aims towards energy efficiency is most beneficial to those that have the capabilities and resources to invest in the improvement of energy efficiency. For this reason the conditions for energy companies involved in the improvement of energy efficiency, for example in properties, must be improved in a way that would allow such companies to use their energy efficiency

projects as bonds for bank loans. This enables the less financially endowed to participate in energy efficiency and enjoy the benefits it brings.

ATTACHMENT: Background of the report

We wish that the report will start an active and fact-based public discussion about the possibilities and future of energy policy and through this, make the energy policy serve the benefit of the nation.

This report is a public speech, which springs from the observations of researchers of various fields, of the notion that the present energy policy does not serve the national benefit as a whole. The new energy policy thinking demonstrated in this report, when implemented, would lead to the economic and employment growth and to many other positive phenomena in the society. Through the new energy policy, preventing the climate change would become a great opportunity to our country instead of a threat.

This venture started from the discussions between Professor Peter Lund and Mr. Oskari Nokso-Koivisto that took place in summer 2013. It became clear in these discussions that academic world provides plenty of new perspectives for the energy policy, which should be included in the wider discussions. This was the foundation for the research of the criteria of energy policy. To support this work, a group of professors was gathered from various fields of expertise, which have worked in this venture without compensation. The work of Mr. Oskari Nokso-Koivisto has been funded by a group of companies and organisations interested in the venture.

The report has been produced as a group work in four different meetings and in email correspondence between these meetings. The secretary of the team has been Mr. Oskari Nokso-Koivisto, who has received funding for his work from the following companies; Caverion, Pro, Taaleritehdas, TEK and St1.

The participants of the professor team were:

D.Sc. Minna Halme is a Professor of responsible business in Aalto University. She has worked within responsible business since 1990 in Finland, in the Institute of International Environmental Economics in University of Lund in Sweden, and in the Georgetown University in the United Stated of America. Her research areas are responsible business, business innovations that increase socially and ecologically sustainable development, and the social impact of corporate responsibility.

Ph.D. Janne I. Hukkinen is a Professor of environmental politics in the University of Helsinki. Hukkinen is a member of the Finnish Society of Sciences and Letters and an advisor for the Energy Council of the Supreme Administrative Court. His research is focused on the politics, strategy and cognitive evaluation of sustainable development. He received his doctorate from the University of California I Berkeley in 1990.

Ph.D. Jouko Korppi-Tommola is Emeritus Professor of physical chemistry in the University of Jyväskylä (2013). He is Vice-Dean, the head of the Nanoscience Center, founder of the teaching and research program in renewable energy. Visiting professor abroad. Special fields of interest; laser technology, solar energy and renewable energy forms in general. He has published 120 referred articles and held over 300 lectures or scientific presentations. Millenium Distinction Award 2011. Received his doctorate from the University of Helsinki.

D.Sc. M.Sc.(Tech.) Lassi Linnanen is a Professor of environmental economics and management in the Lappeenranta University of Technology. In addition to wide international research and teaching posts, he has been an entrepreneur in cleantech-industry, held chair in boards of several start-up companies, and been the advisor for companies and public sector on four continents. His current research is focused on managing systematic change.

D.Sc. Matti Liski is a Professor of Economics in the Aalto University. He teaches and researches the questions within environmental economics, resource economics and energy economics. His group researches for example the consumers' energy technology choices, investments and pricing in electricity markets, intelligent electric grids and the modeling of coal pricing. Prominent international honorary office positions in scientific communities.

D.Sc. Raimo Lovio is a Professor of environment and innovation management and the head of the Management department in the Aalto University. Lovio's special field is the innovations and commercialization of new energy technologies. Lately he has written about bio fuels, heat pumps, solar energy industry and more widely about Finland's possibilities within the cleantech-sector. He the president of the Suomen Lähienergialiitto Society.

D.Sc. (Tech.) Peter Lund is a Professor of Engineering Physics and Advanced Energy Systems in the Aalto University and Visiting Professor in Wuhan, P.R. of China. Within the field of future energy for 35 years. Several international senior Specialist roles, including steering groups for European energy programs, former chair of Energy Advisory Group for EU, the chair of European Academy of Sciences for energy cooperation, advisor for EIT. He has coordinated national research for new energy technology, the chair of Research Council for energy and environmental Strategic Centres for Science, Technology and Innovation. 500 publications, he has supervised 30 doctorates, editor in three scientific journals. M.Sc. (Tech.) in nuclear technology and reactor physics ('80), D.Sc. (Tech.) in new energy technology ('84), London Business School ('89).

D.Sc. Jyrki Luukkanen is Director of Research in the questions for energy, environment and development in The Finland Futures Research Centre in University of Turku. He has been directing several national and international research and educational projects. In the recent years these projects have focused, besides Europe, on South-East Asia (Laos, Cambodia, Thailand and Myanmar), China, East-Africa (Tanzania and Kenya) and to Caribbean (Barbados, Jamaica and Cuba). Luukkanen was a committee member of the Academy of Finland for bio and environmental sciences in 2004-2006 and 2007-2009.

D.Sc. Jarmo Partanen is a Professor of electricity markets and electric grids in the Lappeenranta University of Technology. Partanen is also the director of the department of Energy in Lappeenranta University of Technology that employs 200 personnel and that researches and teaches energy technology, economics and sustainability. Partanen was a committee member in the Academy of Finland for environmental sciences and technology research in 2007-2009. His research group's fields of research were connected to development of intelligent electric grids, elasticity of demand and regulation of electric markets.

Ph.D. Markku Wilenius is a Senior Specialist in The Finland Futures Research Centre in University of Turku. He received his doctorate in climate policy in 1997 and he has been a Professor for long in the Future Studies in the Turku University of Polytechnics. He was the director of strategic research for German finance giant Allianz in 2007-2009. In his latest researches he has focused in the long waves of economy and cooperated with Finland's forestry and finance industry. He was recently appointed as the advisor for research and innovation department for the European Commission.