Multidisciplinary Approach to Develop Energy Efficiency in the Barents Region

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Publication Series B. Reports

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of the editors and authors and can in no way be taken to reflect the views of the European Union.

Lapland University of Applied Sciences

Rovaniemi 2015

ISBN 978-952-316-090-3 (Stitched)
ISSN 2342-2483 (Printed publication)
ISBN 978-952-316-091-0 (Pdf)
ISSN 2342-2491 (Electronic publication)

Publications of Lapland UAS
Publication series B. Reports 12/2015

Financiers: Kolarctic ENPI CBC, Länsstyrelsen Norrbotten

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Translations: Lingoneer Oy
Layout & Cover: Antti-Jussi Yliharju
Original 3D and Vector Graphics: Antti-Jussi Yliharju
Printed by: Juvenes Print, Oulu 2015

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Preface

ENERU - Efficient Energy Management in the Barents Region (ENERU) is an international project funded by the Kolarctic ENPI CBC programme with the primary objective to strengthen cross-border co-operation in the energy management sector and to increase business co-operation between the South Kola region in Russia, Finnish Lapland and Norrbotten, Sweden.

This goal was pursued by establishing a multidisciplinary cross-border network, which joined energy sector experts, local energy companies, authorities, educational and research organisations and other relevant stakeholders. The aim of the network was to transfer the knowledge, methodology and practical know-how of efficient energy usage and renewable energy solutions within the region. The ENERU network involved Lapland University of Applied Sciences, Bionova, Micropolis and Education Consortium Lappia from Finland, Bothnian Arc and Piteå Municipality from Sweden, Institute of the Industrial Ecology Problems of the North of the kola and Cities of Kandalaksha and Kirovsk in Russia.

To identify potential for energy efficient management, the project experts studied current situation with energy consumption in the target regions, conducted energy audits in the pilot buildings in Russia and developed adjusted audit methodology based on international practices. Furthermore, there was produced analysis on current and potential use of renewable energy in South Kola region.

Received findings were used for development of the Action Plan aimed to support the continuation of the efficient energy management process in the programme region after the end of the project.

ENERU network supported business cooperation and provided European companies with the information on the market conditions and commercial possibilities in the energy efficiency sector in the Barents region. Within project's duration, the ENERU team organised several seminars, expert exchange and study visits enabling stakeholders to benchmark successful technologies in the energy sector.

This publication summarised the main results and findings of the ENERU project. The purpose is to share the findings and knowledge acquired within ENERU collaboration with all interested stakeholders to ease the future collaboration in the field.

The publication includes summaries of market surveys from partner countries, reports from measurement trips, and the reports on the renewable energy potential in the target region. Moreover, the publication includes articles by the project experts on current and future cooperation possibilities in the field of energy efficiency. Full versions of the included reports are available at www.eneru.eu.

The ENERU - Efficient Energy Management in the Barents Region project partners warmly thank all those who took part in the project and contributed to its successful implementation. Special thanks to the authors of the publication and the organisers of the measurement trips, seminars and trainings. The European Union's Kolarctic ENPI CBC program and the national financiers from the participating countries have made ENERU network activities and this publication possible - thank you all!

Milla Hirvaskari, Irina Gerashchenko

CHAPTER I
Introduction

Project Area

The target area of the ENERU project is the Barents region, which includes the northernmost parts of Sweden, Norway, Finland and Northwest Russia.

The region possess the unique nature with wide tundra areas in the north and extensive boreal forests zones in the south. The location mainly north of the Arctic Circle gives a period of exotic midnight sun and long and dark polar nights.

The Barents Region is extremely rich with vast natural resources and unique environmental values and thus, has great economic potential. It is one of few remaining areas with a relatively clean natural environment, which implies a high quality of life, but on the other hand, also entails a great responsibility. Despite low population density, the areas are influenced by several heavy industrial activities. The industry structure of the Barents Region is dominated by medium-sized and very large industries within the steel, forest, paper, ore and mineral branches and within the fishing, gas and oil branches. The energy sector also plays an increasingly important role in the economy of the region.

Energy efficiency in the Barents region is a long-term challenge posed by the unique and fragile nature of the region.

The abundant energy resources of the region enable to produce energy for the own needs. Barents region's countries utilize plenty of hydropower, local wood fuels, peat and waste liquor from the forest industry.

Sustainability and self-sufficiency are Barents region's commonly agreed energy vision. The R&D and investments are channeled into modern and competitive energy solutions, which also support means of livelihood and regional economy. Countries are sworn to utilize energy resources respecting the environment and the unique nature of the Barents region. It is also expected that energy production will be more and more diverse and be based on several different production technologies and fuels.

More renewable and low-emission energy production is still needed. At the same time, new technology solutions for energy efficiency have to be developed further. Barents region's large energy resources make it possible to increase production in the sustainable way and the northern conditions lay good basis for the development of new solutions and local know-how in energy efficiency.

Over the years of the R&D in the field of energy efficiency and the supply of renewable energy, the European countries of the Barents region acquired high-profile expertize in the matter.

Russia, on the other hand, has started systematic work on energy saving and energy efficiency in 2009 after the adoption of the Federal Law "On energy saving and energy efficiency improvements". Implementation of the new legal acts, among other issues, requires installation of modern energy measurement devices and conducting energy audits of public buildings.

Differences in energy efficiency practices among the Barents region countries unlock the possibilities for mutually benefitting cooperation. There is a need to strengthen and broaden multidisciplinary networks in the energy efficiency management and renewable energy sectors, to address existent differences and to increase awareness of sustainable energy management in the Barents region.

Barents info.org

http://www.barentsinfo.org/Content-by-Category/Environment--Nature. Accessed 25.4.2015

http://www.barentsinfo.org/Content-by-Category/Economy-and-Business. Accessed 25.4.2015

Rautajoki, T. 2015. Arctic Business Forum Yearbook 2015. Lapland Chamber of Commerce

LAPIN AMK
Lapland University of Applied Sciences
www.lapinamk.fi

Lapland University of Applied Sciences is the northernmost university of applied sciences in Finland and in the European Union. The institution offers a modern and international learning environment with good student services in all its educational units, which are located in the towns of Rovaniemi, Kemi and Tornio.

Students in the Construction and Civil Engineering Degree Programme at Lapland University of Applied Sciences can specialise in house building, infrastructure and mining technology or in technical building and energy services. Bachelors of Engineering graduating from the Construction and Civil Engineering Degree Programme design and realise buildings, roads and streets as well as water and waste management systems for the future. They can also work on specialist tasks in modern energy systems and technical building services. Building technology studies focus on managing Arctic conditions.

The construction industry has developed at a furious pace in recent years. The Government has set stringent energy-saving targets also for buildings and construction, which are taken into account in the curriculum. These include the energy efficiency of buildings, thermal conductivity (U values) as well as the revised ventilation calculation methods and limit values.

One area of focus in the curriculum is the energy efficiency of buildings and the requirements set by new structures. In addition, the teaching method is based on problem-based learning, where the students during their studies increasingly familiarise themselves with real industry assignments and contents. The Arctic Civil Engineering (ACE) research group for construction and civil engineering is developing the sector in a number of research projects in collaboration with companies involved in the industry and other research institutes. The students can work within these projects in various learning tasks during the course of their studies.

BIONOVA consulting
www.bionova.fi

Bionova Ltd is an independent and privately-owned company founded in 2001. Its history includes a big number of projects in the field of energy efficiency, sustainable development and market research. Sustainability is a part of the core business and a potential profit opportunity to be seized and to be considered like any other long-term business investment. Bionova helps its clients to develop sustainable competitive

advantage and leverage environmental efficiency as part of their business and growth strategy.

The company's driving force is customer value creation. Bionova approaches problems from the customer's point of view and strives to understand and solve the customers' problems. In its work, the company seeks practical, scalable solutions and focus on measurable improvements. It defines issues from the point of view of end user value creation and tries to find new innovative solutions, which benefit its clients as well as the environment.

Bionova offers software solutions in order to make sustainability assessment easy for everyone. The company's environmental and life-cycle cloud software is sold under the 360optimi and Ecompter brands and is also privately labelled for its customers. In Finland, the Baltic states and Russia, it also sells CityPlanner Online.

MICROPOLIS

www.micropolis.fi

Regional development and marketing company Micropolis Oy is specialised in green technology and sustainable environmental development. Services include assisting companies, research institutes, municipalities and cities to prepare and implement national and international R&D projects and to acquire EU funding and grants.

Micropolis is located in the municipality of Ii, near the City of Oulu. Ii offers secure living, innovative and competitive business premises and relaxing leisure time opportunities in beautiful countryside surroundings along the shore of the Gulf of Bothnia.

With 10,000 residents, Ii has become a pioneering low-carbon society. Ii is part of a national Towards Carbon Neutral Municipalities (HINKU) programme that brings residents, experts and companies together to create and implement solutions to reduce greenhouse gas emissions. Significant renewable energy implications are being activated in the area, producing new business opportunities and competence for the whole of Northern Finland. The Ii region produces hydro, solar and geothermal and wind power as well as peat- and wood-based fuels. One of Finland's largest and tallest wind farms is located near the seashores of Ii.

Piteå

www.pitea.se

Piteå is a popular tourist town on the Swedish coast during the summer. For centuries, the basis for development has been forestry and, with its two paper mills and saw mills, it has been called the European Capital of Forestry. The leading forest product harbour in the Gulf of Bothnia is located here and has an important role in business development.

Today development and research in the area of renewable energy is the focus. Two companies are in the forefront, SunPine AB with renewable diesel made

of residues from forestry and Cleantech with the biofuel BioDME. Lindbäcks bygg is a leading building company for multistorey buildings with a focus on sustainability and renewable energy. A wind park is also under construction and according to the plan; it will be the biggest in Europe.

Piteå, with 41,500 inhabitants has increased its population by 1,200 since the turn of the millennium.

AMMATTIOPISTO LAPPIA
Omaa luokkaansa

www.kkylappia.fi

Vocational College Lappia is an educational institution, located in Tornio in Western Lapland and offering upper secondary-level professional education for students in five sectors - service, technology, culture, welfare and nature.

Vocational College Lappia strengthens the local and regional competence and welfare of the local population. The location of the college is well exploited in its activities - pristine nature, services, high-tech industries and opportunities offered by the business and tourism sectors.

Vocational College Lappia offers educational services for both students and respected professionals willing to develop their professional competence in their own field and improve their performance in an international environment.

Basic vocational studies aim at providing students with the appropriate knowledge and skills for vocational expertise. Besides developing vocational skills, they help students to become balanced and matured individuals and to prepare them for further studies.

Teaching is mainly organised at college premise, but the educational process also includes supervised on-the-job training.

Vocational College Lappia takes part in project activities both at a national and international level (e.g. Leonardo, Comenius, Grundtvig).

Bothnian Arc

www.bothnianarc.net

BothnianArc
Perämerenkaari - Bottenviksbågen

The Bothnian Arc is a coastal zone along the Gulf of Bothnia in the northernmost part of the Baltic Sea. The area covers seven Swedish municipalities (Haparanda, Kalix, Luleå, Boden, Älvsbyn, Piteå and Skellefteå) as well as four Finnish sub-regional areas (Kemi-Tornio, Oulu Arc, Oulu and Ylivieska), one city (Raahe) and one regional council (Central Ostrobothnia).

About 710,000 people live in the region.

The main vision of the Bothnian Arc is to become the most functional and integrated border region in Northern Europe – with strong economic growth, high-quality social welfare and a sustainable, clean environment.

Key focus areas include increasing

regional co-operation and activating various parties, lobbying, enhancing co-operation between companies and organisations, strategic development activities, marketing and raising awareness of the Bothnian Arc.

The Bothnian Arc encourages and activates various parties to collaborate across borders by building networks and creating new projects.

Institute of the Industrial Ecology Problems of the North, Kola Science Center, Russian Academy of Sciences (INEP KSC RAS)

www.inep.ksc.ru

The INEP is a Federal State Institution of Science, part of the Kola Scientific Center of the Russian Academy of Sciences. It was established in 1989 as the country's first multi-disciplinary Ecological Research Institute. INEP's mission is research for the sustainable development of the Arctic region. The main directions of the work include:

- Development of a research basis for the environmental optimisation of nature management in the industrial regions of the North.
- Development of environmental technologies for the production and processing of mineral and hydrocarbon resources, including practical solutions in the field of energy management and energy efficiency.

Main partners in the energy-related field: Center of physic-technical problems of the North KSC RAS (Apatity), Northern chamber of commerce and industries (Murmansk), Noncommercial partnership Technopark –Apatity, Murmansk regional innovative business incubator (Apatity).

Kandalaksha City Administration

www.kandalaksha-admin.ru

Kandalaksha municipality is located in the south of the Murmansk region, on the northern part of the Kola Peninsula. In the west, the region borders with Finland and, in the east, it borders Kandalaksha Bay in the White Sea. The city is a big transportation hub: it is on the highway between St Petersburg and Murmansk, a railway and commercial seaport.

The aluminum plant is a municipal enterprise and one of the most essential employers along with the railway station.

In 2010, Kandalaksha started the implementation of a municipal programme for energy saving and energy efficiency 2016. The programme is being implemented in accordance with federal law "On energy saving and improvement of energy efficiency".

The main goal of the programme is to achieve rational and sparing use of energy resources based on the introduction of legal, organisational, technical decisions in the field of energy efficiency. The

objectives of the programme include the application of energy-saving technologies in modernisation, reconstruction and capital repairs of budgetary property and housing stock; the improvement of the energy efficiency of buildings and houses; the improvement of thermal efficiency and electricity supply systems.

Kirovsk City Administration

www.kirovsk.ru

The municipality of Kirovsk is a mining city geographically located in the centre of the Kola Peninsula, in the southern part of the Khibiny Mountains on the shores of Lake Big Woodjavr.

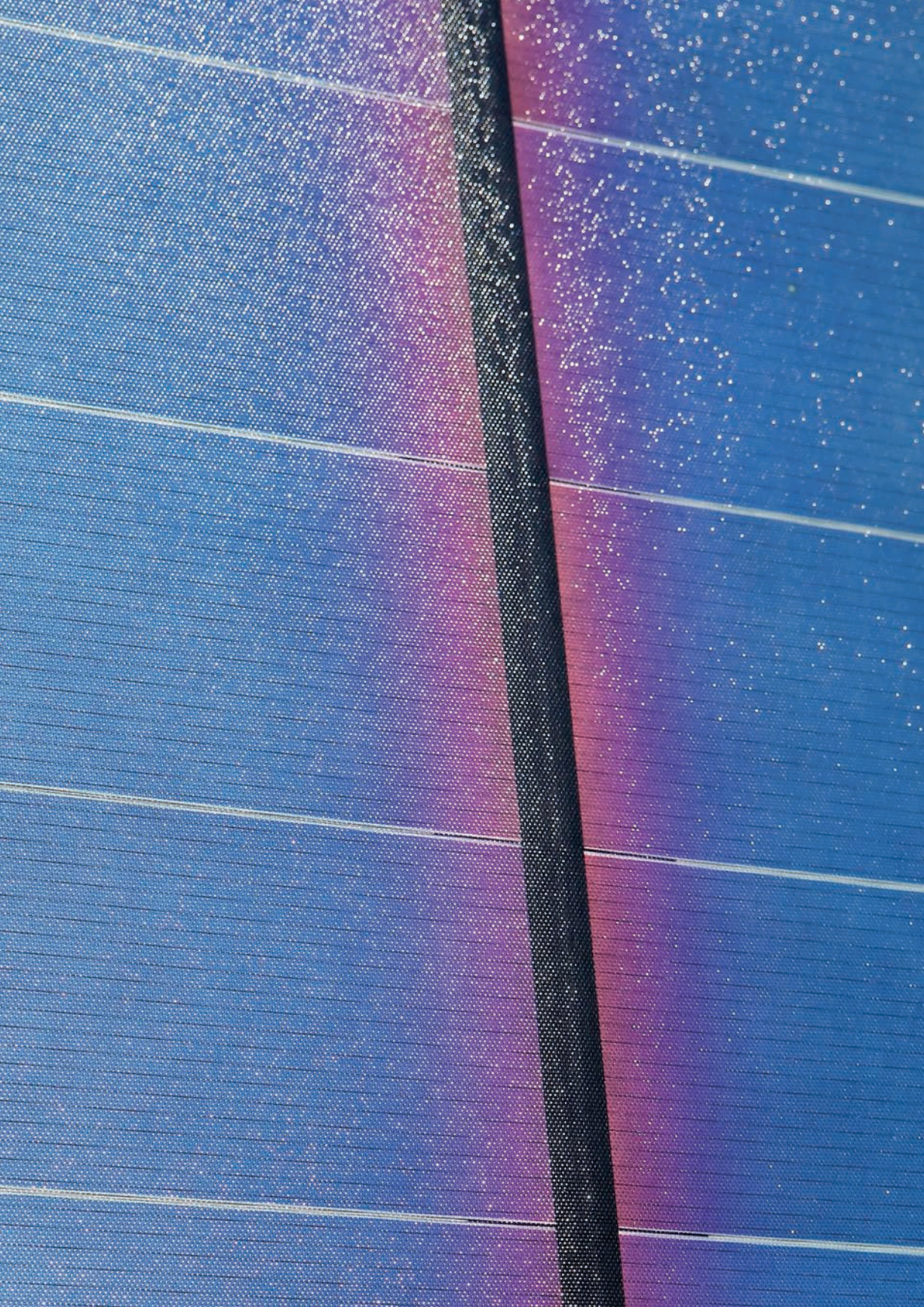
Kirovsk is a mining city built around the rich apatite deposits of the Khibiny Mountains. The largest enterprise in Kirovsk is the chemical company "Apatite" – a mining and processing plant engaged in the production of phosphate raw materials. This is a powerful industrial giant, which is among the 100 largest companies in Russia.

The industry in the city is represented by manufacturing industries and enterprises operating in the distribution of electricity, gas and water.

In 2010, Kirovsk municipality started the implementation of the municipal programme for energy saving and energy efficiency 2016. The programme is being implemented in accordance with federal law "On energy saving and improvement of energy efficiency".

The main goal of the programme is to achieve rational and sparing use of energy resources based on the introduction of legal, organisational, technical decisions in the field of energy efficiency. Activities implemented within the programme include the modernisation and reconstruction of budgetary organisations, the conducting of energy audits, the streamlining of customers of energy resources, the improvement in energy efficiency of communal infrastructure, housing stock and municipal educational organisations.

Photo: Ari Andersin / Vastavalo.fi



CHAPTER II
Business Opportunities in the Barents Energy Field

Business Opportunities in the Barents Energy Field

Energy management and energy saving is a growing industry in Northern Finland. The Russian market presents large business potential as energy management services and products have not yet been implemented on a large scale. In Northwest Russia, the manufacturing and mining industries have a strong presence. The cities of the region have been born around these industries. Manufacturing and mining as industries provide major projects for companies operating in the energy and environment sector as well as enormous market potential, for example, for solutions in controlling and optimising production.

However, energy management and savings solutions in buildings as an industry is more fragmented and there are a lot of small- and medium-sized enterprises (SMEs) in the industry. SMEs often have too few resources to expand their business to the international market. In addition, they are often poorly known in the region. There could be more co-operation opportunities between the companies of the industry.

This chapter presents the results of the survey, conducted within the framework of the ENERU project in order to provide information on how the development action related to Russian export could be enhanced and how the cross-border co-operation activities between the countries could be increased from the point of view of the region's companies.

The aim of the survey was to study the companies in the area of the Finnish and Swedish sides of Bothnia Arc that offer solutions for energy management and energy saving in buildings. Manufacturers, device vendors, technology experts and service providers, i.e. planners and consultants of the industry were taken into account when studying the companies. In addition, the Profile Book provides information about companies' experiences of and views on entering the Russian market.

Although the target area of the ENERU project is the South of the Kola Peninsula (Northwest Russia), in this chapter Russia as a market is seen more widely including areas of Moscow and St Petersburg.

Experiences and Views of Finnish Companies Operating in Bothnian Arc

Sofia Husso, Kristiina Nurmenniemi

This section introduces a summary of the Profile Book, produced based on the survey and in-depth interviews with twelve Finnish companies, which operate in the environment and energy sector in the region of the Bothnian Arc [1].

The purpose of the profile book is to provide information on Finnish companies that have had previous experience in doing business in Russia or are interested in exploring Russian business opportunities. Furthermore, the book evaluates the attractiveness of the Russian energy and environment markets and their possible market entry challenges.

Most of the interviewed companies had already established some customer base in Russia or were in the planning phase of expanding their business into Russia. The companies were attracted by the proximity of the Russian market, the potential of high volumes and market demand for smart and modern energy solutions and products. The companies faced three main challenges; the security of doing business, lack of networking and public relations skills and practical issues.

In the conclusion, possible methods are presented on how Fenno-Russian co-operation and business activity could be developed.

Methodology

Survey

All the companies that provide solutions in energy management and saving in buildings in the region of the Bothnian Arc were identified. Each company's offering was also described. The company list was gathered jointly by regional development company Business Oulu, Micropolis Oy, the Center for Environment and Energy (CEE) and the Rovaniemi University of Applied Sciences. A total of 132 companies were identified. An internet-based questionnaire was then sent to all companies, getting a response rate of 10 percent. The total time for answering was 18 days (27.5.–13.6.). A week before the end of the response time (6.6.2014), a reminder message was sent to those companies that had not yet responded to the survey.

Interviews

After the survey, the 12 most potential companies where selected for in-depth interviews about their views and experiences of doing business in Russia. These companies were selected out of total 132 Finnish companies operating in energy management services or products within the Bothnian Arc area.

[1] *The coastal zone around the Gulf of Bothnia, located at the northernmost end of the Baltic Sea with a total population of 700,000 people*

All 12 companies were willing to participate in the interview process. This can be interpreted as meaning that the subject was considered important among the representatives of the companies. Most of the companies were interviewed by telephone; three companies were interviewed face-to-face. The interviews lasted a minimum of 10 minutes and a maximum of more than an hour.

The interviews took place in April - July 2014.

Finnish Company Profiles

This section presents the profiles of the 12 Finnish companies.

Cad Sä Oy

www.cadsa.fi Oulu

Cad Sä Oy provides electrical and lighting design and safety education on electrical power. The company has no previous experience of doing business in Russia.

Cleworks Oy

www.cleworks.fi Oulu

CleWorks is fresh start-up from Oulu established in 2012. It has developed a device and service solution for flexible electricity consumption markets. It is focused on private and business customers that use electricity for heating. In the Internet of Things (IoT) solution, the latest electricity market prices and local weather forecast are checked, and a 24hr electricity purchase plan is made automatically. Each point of electricity consumption is then programmed to use the cheapest hours, which leads to money being saved. In addition, this solution allows the full remote control of heating and cooling from any device with an internet connection. The company has not yet entered the Russian market.

Cyberlightning Oy

www.cyberlightning.com Oulu

Cyberlightning Ltd is a leading 3D internet company with next-generation controlling and monitoring solutions for the Internet of Things (IoT) networks in the Smart City context. The company is paving the way for the next generation of open standards and the open source-based future Internet. Cyberlightning's CyberVille™ software platform is mainly aimed at energy sector system integrators, utilities and solution providers with empowering features for operations in logistics, power plants, smart grid and home area applications. CyberVille™ Technology is also horizontally scalable through other IoT/big data verticals, such as traffic, infrastructure and health. Currently the company is not operating in Russia.

Fidelix Oy

www.fidelix.fi Vantaa/Oulu

Integrated building management systems are essential for improving the energy efficiency and life cycle of buildings. Fidelix FX-Net is a freely scalable technical monitoring and control system for buildings of all sizes. FX-Net represents a new generation of systems designed to meet the needs of modern construction and advanced building technology. The FX-Net networked system can be used for several applications such as the control of heating, ventilation and/or air conditioning, energy and water consumption measurement, burglar alarms, access control, video surveillance systems and fire security. The company has export product packages to Russia and also has a dealer in Russia.

Keisari Pelletti Oy

www.keisaripelletti.fi Kannus

Keisari Pelletti Oy supplies customers with small heating plants that use wooden pellets as fuel. These plants can generate from 200 KW up to 1.5 MW. The plants are ready-to-go containers, which are extremely easy to install and use. The finished units are transported by truck. The photos show a 1.2 MW heating plant located in a dairy. The plant has two wooden pellet burners. Currently the company is not operating in Russia.

Oulun Lämpökaivonporaus Oy

www.oulunlampokaivonporaus.fi Ii

Oulun Lämpökaivonporaus Oy offers solutions for drilling geothermal wells and installing geothermal systems. Currently the company has no business activities in Russia.

Solved – The Cleantech Company

www.solved.fi Oulu

Solved is an online cleantech advisory service that tackles the world's environmental and energy challenges. Solved offers a unique digital platform with top experts all around the world. The first projects took place in Central Europe, Russia and the Nordic Countries in 2013. This "Born global" startup is for industrial and energy companies, municipalities and real estate and resort developers. Solved's expert pool is expanding fast and currently consists of a team of up to 300 world-class experts from various fields representing 40 different countries.

Talomat Oy

www.talomat.fi Oulu

Talomat Oy is a provider of low-voltage LED lighting (12VDC) control technology and building automation. Currently the company is not operating in Russia.

Valopaa Oy

www.valopaa.com Oulu

Valopaa Ltd is an LED lighting company based in Oulu, Finland. It develops and produces LED luminaires, intelligent lighting control systems and lighting technology for demanding environments. It has concentrated on lighting solutions, which require high energy efficiency,

a long lifetime and easy maintenance. Its products are the most cost-efficient choice over a long lifetime in terms of investment, operational and maintenance.

Thousands of Valopaa solutions have been implemented around the world. The products are cost-effectively illuminating many roads, streets, parks, outdoor areas, bridges, underpasses, sports and recreational areas, industrial sites and petrol stations. Valopaa has delivered lighting projects to Russia and has partners in St Petersburg and Moscow.

Volter Oy

www.volter.fi Kempele

Volter Oy manufactures small combined heat and power plants (CHP) that uses wood chips to provide all the electricity and heat required for an entire small housing estate. This technique replaces one litre of oil with approximately two kilogrammes of dry wood. The waste heat from the process can be used for example in hydronic underfloor heating or preheating domestic water. The power plants can also be connected to the main power grid. The company has no business in Russia yet.

Team-Control Oy

www.team-control.fi Merijärvi

Team-Control Oy offers a control system for buildings, which is easy to use and can be customised according to customer requirements. Monitoring district heating, geothermal heating, underfloor heating, air conditioning and security can be embedded in the system. For example, TiiMi Security includes a burglar, fire and flood alarm as well as a diversified power control system. The company has done business in Russia with a partner.

Planora Oy

www.planora.fi Kempele

Planora Oy is an energy design company with extensive knowledge and experience within the entire energy field, including energy production, distribution and consumption, industrial planning, project management and consulting activities. Planora's specific knowledge is energy and all kinds of design related to energy production and distribution. These fields of design include the design of district and local heating plants, hydraulic and thermal calculation and dimensioning, as well as project management services. Planora also provides a web-based service for energy companies. The service, called Iisi-Netti, is a unique way of taking control over daily activities, such as network management and maintenance.

The CEO of Planora is also Managing Director of the Finnish Russian Energy Club. The Energy Club was established between Finland's Ministry of Employment and the Economy and the Russian Ministry of Energy to enhance co-operation in the fields of energy efficiency and renewable energy sources.

Experiences of Doing Business in Russia

In this chapter, the companies' experiences of doing business in Russia are described. In the first section, the possible current business activities of the companies in Russia are described. In the second section, the factors that make Russia an attractive market for the companies operating in energy and environment sector are described. In the third section, challenges in the Russia market faced by companies are presented. Finally in conclusion, possible solutions and further proposals are presented based on the collected data.

Operating in the Russian market

Five of the 12 interviewed companies said that they have done or are currently doing business in Russia. Some had already been doing business there for several years. Five companies stated that major city regions such as Moscow and St Petersburg are their most targeted areas in Russia.

Currently seven companies did not have business activities in Russia but they had considered the possibility of starting. One company had done a preliminary market study and two companies had negotiated with a Russian customer or Russian export partner.

Some of them were currently preparing for the possibility of doing business in Russia by figuring out things related to bureaucracy, applying for an export licence for their products or building an operating system for their products in Russia.

Attractiveness of the Russian market

All the interviewed companies perceived Russian as an attractive market area for their business. The high volume and proximity of the market and the undeveloped market for technology were highlighted when asked about the factors affecting to the attractiveness of the market. The other mentioned factors were the rise in energy prices, liquidity and labour mobility as well as the ability of Russians and Finns to get along with each other. The factors reducing the attractiveness of the market are described in the next chapter "Challenges".

The majority of the interviewees referred to the high volume of the market when asked about the reasons for the attractiveness of the Russian market. Russian interest in trying new solutions and in the Finnish technology was also seen as a volume-increasing factor. According to the collected data, the market volume and business potential behind the Russia border is not yet fully recognised in Finland. Better knowledge of the region would make it easier for the companies to offer their services to the Russian market.

The interviewed companies felt that Russia is still in the development phase in solutions related to energy management and saving. The companies felt that there is much untouched market in Russia, for example, in control and automation systems. There are no district

heating systems in Russia, so local systems are needed, which increases the demand for small power plants and technology related to them. The export of technology solutions to the Russian market was also seen as more profitable than export to the European market, where the market is already more advanced in technology. Europe was also considered to have higher saturation in the market and tighter competition between companies.

The companies' interest in visiting a company in the Murmansk region also reflects the attractiveness of the Russian market. Eight of the 12 companies were in principle interested in visiting the market area, if the content and timing of the visit was appropriate to their business.

Challenges

The companies were asked about the challenges that have held them back in expanding their business to the Russian market. Three distinct themes emerged from the collected data. The themes were **1) security 2) networking and public relations** and **3) practical issues**.

Security. By 'security', companies meant legal risks related to their business (for example compliance with agreements and formation of agreements). Companies were also worried about keeping their equipment in Russia and unexpected events and changes in the business environment.

Networking and public relations. The importance of local knowledge and networks in the local community were found to be crucial factors for successful business in the market. However, few companies had strong previous experience of doing business in Russia. In particular, companies lacked local partners that could generate sales and take things forward across the border. However, finding reliable partners in the market was seen as challenging by the companies.

As a significant challenge, the companies also mentioned the lack of co-operation between Finnish actors in developing joint product packages. Due to lack of collaboration, the different stakeholders of industry lack a broader understanding of the entire energy sector: an understanding of how the different activities in the energy sector and operating entities depend on each other. In the absence of understanding, the development of joint product packages was seen as very challenging. The interviewed companies felt that lack of understanding of the energy sector among the actors could also be explained by lack of qualified instructors in the industry.

Doing business in Russia was seen as a result of long-term performance in a market, which requires local networks and strong presence in the market. However, as most of the interviewed companies were SMEs, a small marketing budget was seen as a limiting factor for stronger presence, visibility and networking activities in the market.

The third of the themes that emerged was **practical issues**. In particular, in the case of physical products, border formalities (such as customs, visas and

permits) were seen as a major challenge. A weakening rouble and unpredictability in the foreign exchange rate were also considered to be a challenge when thinking about technical contract issues and Russian purchasing power in general.

Although several of the interviewed companies have knowledge of the Russian-language in their organisation, they perceived the language as a possible barrier when thinking about expanding to the market. Business representatives also said that they did not know well enough Russia standards and standards related to product safety regulation. It was felt that standards cause too much bureaucracy for SMEs. The diversity of the sales arguments and marketing adapted to local conditions was also considered to be challenging. Companies wondered, for example, if Russians are more interested in ecological solutions or should the spearhead of the sales be safety or habitability? The challenges are presented in the figure below.

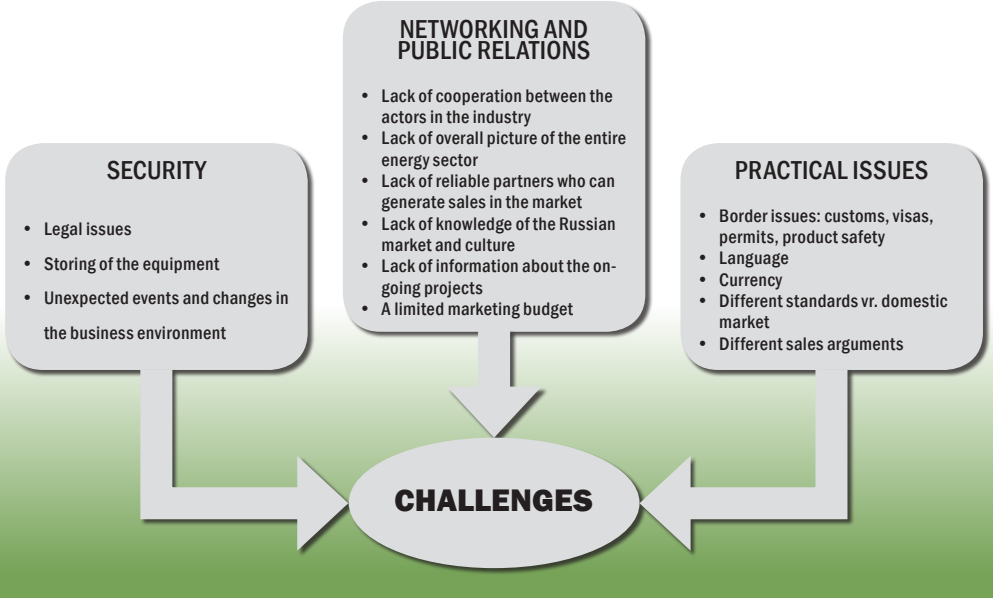


Figure 1. Challenges experienced by the interviewed companies

Possible solutions to the perceived challenges

The companies were asked to describe possible solutions to the challenges, which have held them back in expanding their business to the Russian market. The solutions are presented under three themes described below which were **1) security 2) networking and public relations** and **3) practical issues.**

Security. Larger companies provide a safety buffer for SMEs. Thus, the opportunity to offer solutions as part of a joint product package with the larger players was seen as a significant risk-decreasing factor for SMEs operating in Russia. If the counterparty does not comply with the agreement, bigger players have more bargaining power behind them. Finding out about the backgrounds of possible partners was also seen as an important risk-decreasing factor in order to operate in the market.

Networking and public relations. The companies highlighted the importance of relationships, co-operation and networking. Companies felt that more co-operation between Finnish actors is needed in order to build joint product packages in the industry. When co-operation between different actors increases, they have the opportunity to form a wider understanding of the whole energy sector, its activities and dependence between the different stakeholders. The interviewees also felt that awareness of the entire energy sector should be increased by education.

According to the collected data, networking events were perceived as an effective channel to exchange contact information with possible collaborators. The desire to make visits to trade fairs and matchmaking events in Russia were mentioned many times during the interviews by the companies. At the trade fairs and matchmaking events, companies have an opportunity to meet customers and potential partners already operating in the market. The companies met Finnish companies already operating in the Russian construction industry as well as local companies, HPAC companies, energy-intensive industries and so-called middlemen who bring different parties together as interesting possible partners for them. In addition to networking events, companies also mentioned a need for a service that would maintain a register of possible leads and would also provide information about ongoing projects.

Companies felt that things are difficult to co-ordinate from Finland but highlighted the importance of interaction before the start of actual business activities in the market. According to companies, the opportunity to interact with the possible customers operating in Russia before starting business activities in the market enhances co-operation between the parties. Through the interaction, the company have a possibility to present a preliminary solution to a customer when visiting the market for the first time.

Companies also mentioned the importance of maintaining relations with local authorities in the area. Projects could promote formation of so-called "friendship at the top level" between the

territories. It was felt that relations with the regional authorities have a significant impact on both business success or failure in the Russian market.

Practical issues. Companies' representatives expressed the need for a service for funding and language issues. As standards and sales arguments in Russia are different to the domestic market, companies also highlighted the importance of sharing best practices with the actors already operating in the market. In the domestic market, the selling point may be savings in energy management while in Russia it might be a comfort that sells.

In addition, the interviewees discussed about import duties and bureaucracy. Companies mentioned the possibility of transferring final production to Russia in order to reduce import duties. Bureaucracy cannot directly be affected but by providing companies with support and current information about bureaucracy, they do not have to operate with a lack of knowledge. In the figure below, possible solutions for the challenges perceived by companies are presented.

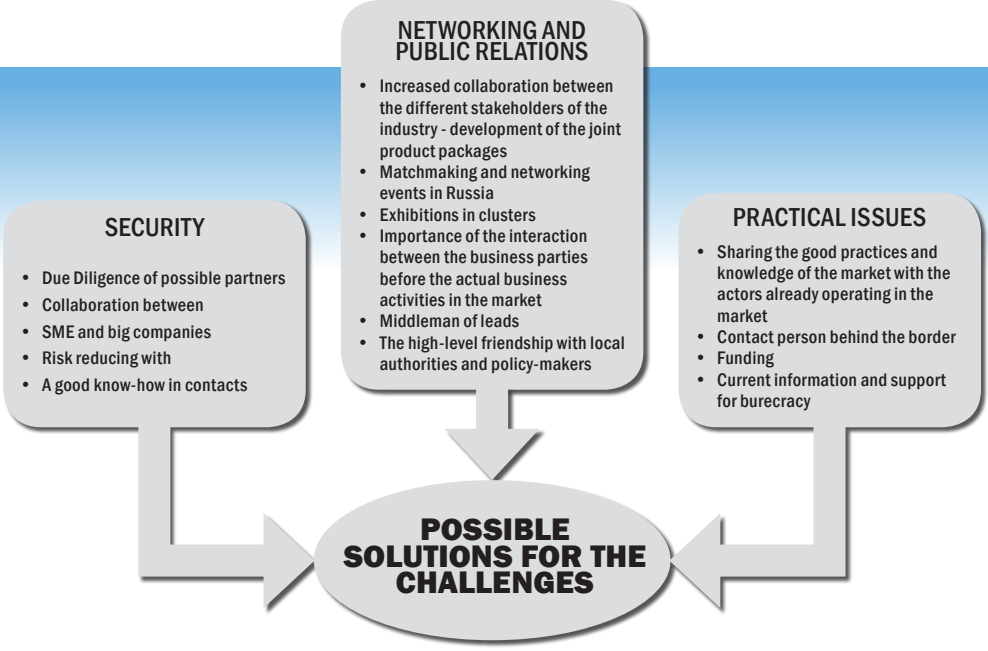


Figure 2. Possible solutions for the challenges perceived by companies.

Conclusion and further proposals

SMEs often have few resources to expand their business to the international market and the risks that they experience in expanding to the Russian market are greater than for larger companies. In the interviews, business representatives highlighted the importance of co-operation: it is easier and less risky for SMEs to expand business abroad as a part of joint product packages.

Although companies saw risks and challenges in expanding to the Russian market, in principle, all of the interviewed were interested in doing business in the market. The companies were attracted by many opportunities there: high volumes and an as-yet undeveloped market for technology in the energy sector. Companies also felt that the market is currently offering opportunities for smart and modern solutions, which will naturally be necessary during the renovation of old and new techniques in building a new building service.

The list below represents how the Fenno-Russian co-operation between the countries can be increased from the point of view of the companies of the region. The proposals are divided into the three themes presented before. These themes are safety, public relations, networks, and practical issues.

Safety

- Offering support for companies to find reliable partners from the market
- Enabling co-operation between SMEs and large companies
- Reducing companies' perceived risks through technical contract expertise

Practical issues

- Facilitating companies' access to funding
- Providing companies with opportunities to share good practices and experience with companies already operating in the Russian market
- Helping companies to process their offering to fit the local market
- Providing correct and timely information about bureaucracy

Public relations and networking

- Increasing co-operation between different actors in the energy sector > increased awareness of the energy sector > development of joint product packages of the industry
- Providing opportunities for personal contacts and interaction between the possible customer and the company already before the actual activities in the market (e.g. visits to the market)
- Providing a service for companies, which gives current information about ongoing projects in Russia and maintains a register of leads
- Offering companies the possibility to network with Russian actors
- Offering companies the possibility to participate in a joint exhibition in Russia
- Promoting the formation of relationships between the regional authorities of the territories

Experiences and Views of Swedish Companies

Rebecca Thulesson

This section presents the results of the market survey conducted on the Swedish side of the Bothnian Arc region, which consists of the municipalities of Haparanda, Kalix, Boden, Luleå, Älvsbyn, Piteå, and Skellefteå.

The purpose of the study was to map out businesses in the energy and environment field, chart the interest in trading with Russia, and draw up business profiles and analysis of potential companies that might be interested in the Russian market.

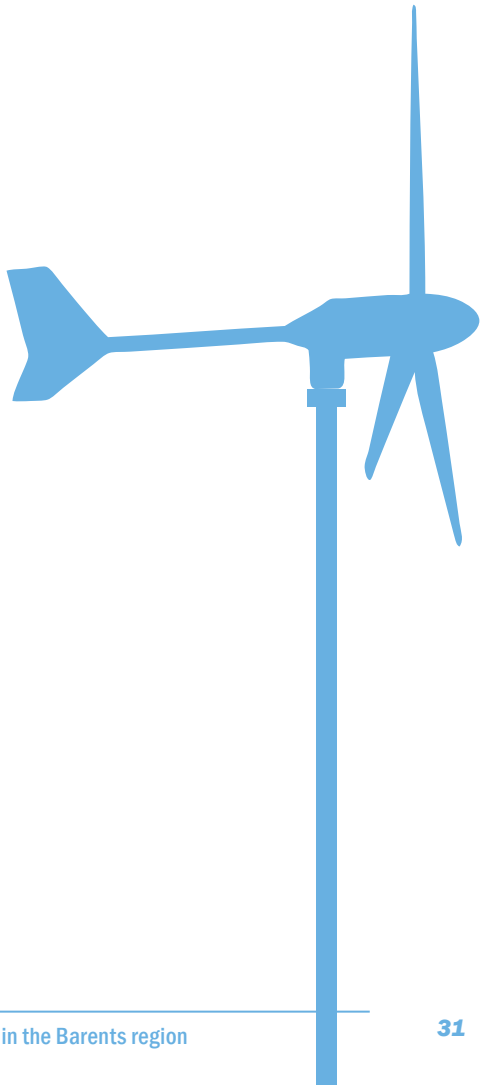
Methodology

Region- and Activity Mapping

The mapping of businesses in the Bothnian Arc region was conducted by an Internet search of current municipalities, along with energy-related search terms in the Eniro catalogue, www.eniro.se, and through a search engine for energy services (NENET), www.nenet.se/energitjanster.

The search terms used were: Energy, Energy efficiency, Energy declaration, Power distribution grid, Solar power, Wind power, Bio-fuel, Earth heating, Geothermal heating, Heating equipment, Cold, Heat recycling, Heat pump, Supplemental insulation, and Windows.

A total of 183 companies in the energy and environmental business were located.



Marketing Mapping, Russian Trade Mapping

Of the 183 companies, ten appeared to be of more interest and were contacted for a personal telephone interview.

Based on the answers, a number of development needs as well as obstacles in trading with Russia could be identified. Please refer to Part 3: Development Needs.

Company profiles were completed of the six companies, which answered that they were interested in the Russian market. Please refer to Part 4: Company Profiles.

Development Needs

One question for the companies was "What would facilitate/which obstacles exist in regards to trading with Russia?" The answers pointed to what is needed in order to support trading with Russia. Some of the areas in need of development are:

- Contact person or company's own distributor on-site in Russia
- Adaptation of Swedish products to enable use in the Russian climate
- Adaptation of Swedish products/ services to harmonise with Russian standards
- Greater or smaller buying power of Russian customers – product demand and willingness to pay
- Corruption and political instability
- Freight costs and distance
- Language and money

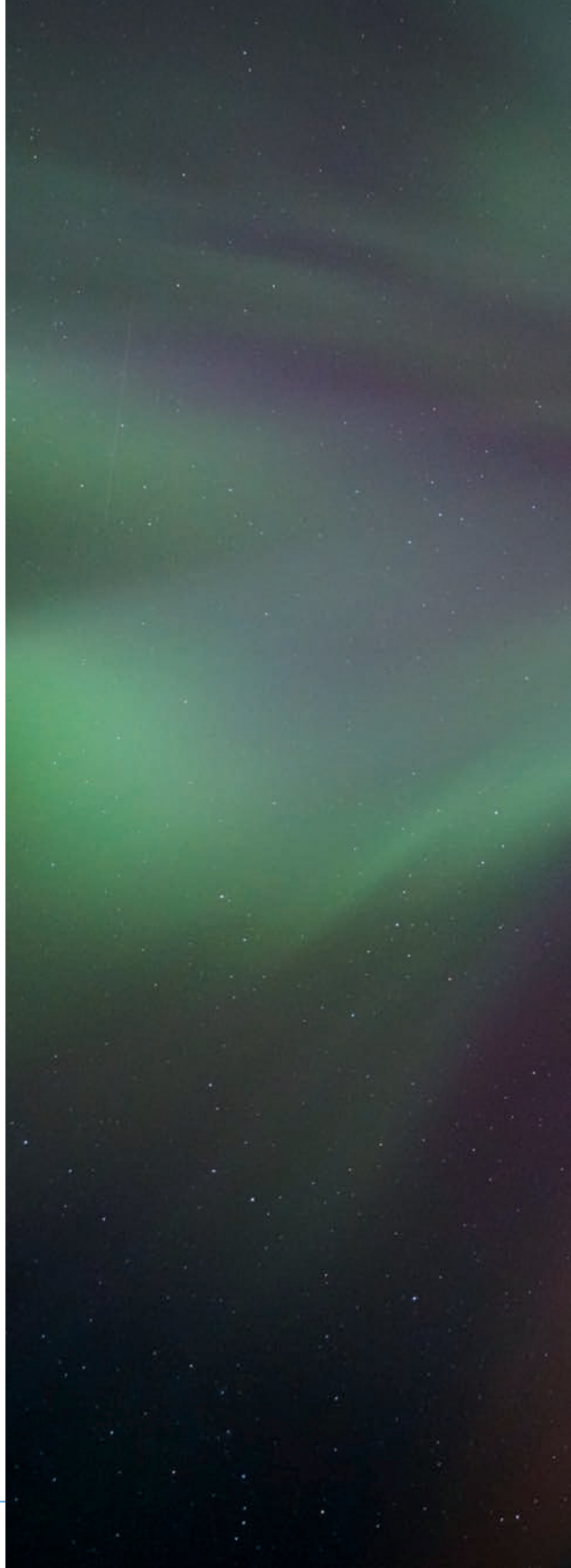


Photo: Veli-Pekka Hentilä / Vastavalo.fi

Six of the interviewed companies were interested in operations on the Russian market. These companies are presented below along with a profile.

Abelko Innovation

www.abelco.se Luleå

This company supplies products for regulating and governing heat distribution, ventilation, and energy-saving power. Abelko's headquarters are in Luleå. It has previous experience of the Russian market through a business partner and also used to ship products to Yekateringburg.

Abelko would like to obtain a Russian retailer and contact person, as it is currently lacking this.

One obstacle, identified by the company, is mainly the politically unstable market, which has resulted in prioritising business with other countries, for example the Czech Republic. In addition, the amounts of paperwork along with bureaucracy present an impediment.

Analysis: The company is interested in co-operation with other businesses to reach the Russian market; it has experience of export and partner co-operation.

BoRö-pannan

www.boroe.com Kalix

This company offers sales and installation of products such as accumulator tanks for boilers, as well as sun catchers. Its headquarters is located in Kalix. BoRö exports some of its products to countries in Europe, but has not done any business with Russian customers yet.

BoRö feels that a partner in Russia that is familiar with the market would meet one of their development needs. Another need would be to review products and prices in order to adjust them to Russian conditions.

One obstacle identified is money transactions. In that instance, the company sees swap-trading as an alternative.

Analysis: The company is interested in co-operation with other businesses to reach the Russian market. It would consider creating products specially adapted for this purpose.

Combi Heat Värmeprodukter AB

www.combiheat.se Haparanda

Combi Heat Värmeprodukter AB is a Haparanda-based company, which produces fire wood, pellets, boilers and heaters. It does some exporting to Finland and beyond Scandinavia, but is yet to export to Russia.

It says that its development needs could be met by increasing its financial preconditions in order to establish itself in foreign markets. It would also seek assistance in order to adapt technology and products that would be applicable to Russia.

As the products sold by this company are relatively high-priced quality products, the purchasing power of the Russian market is identified as a possible hindrance.

Analysis: The company is interested in co-operation with other businesses to reach the Russian market. It would need assistance in order to achieve this.

Norrbottens Bergtjänst AB

www.bergtjanst.se Piteå

This company, located in Piteå, provides services such as water well drilling, energy drilling, and installation of the same (e.g. geothermal heating and energy wells). In the past, it was in the process of establishing a Russian contact person but it fellthrough.

The company reports that its development need is to obtain more knowledge of Russian trade terms.

Difficulties mostly consist of lack of time and resources, which also were the reason that things did not work out the last time efforts were made to establish contacts in Russia.

Analysis: The company might be interested in cooperating with other businesses to reach markets in Russia; it would depend upon the amount of time and resources needed.

SCA Energy Norrbränsle

www.sca.com/sv/bionorr Piteå

A company in Piteå that does business in shavings, bark, chippings, briquettes, pellets, etc. It has previously imported from the Baltic states but does not have any direct connection with the Russian market, neither for import nor export purposes.

It reports its development need as being able to optimise freight costs, for example by sea. SCA identified business obstacles as not always having a surplus of products, as well as concern for compromised quality when these products are transported over great distance. (Currently though, there is a surplus of a product that is suitable for export.)

Analysis: The company is interested in co-operation with other businesses to reach the Russian market. Potential co-operation would also mean that several businesses could split shipping costs.

Snowpower AB

www.snowpower.se Luleå

This Luleå-based company works with storage of solar and waste heat, as well as seasonal storage of both heat and cold. It has previous experience of doing business in Russia, but its buyer is no longer available. There are complete product descriptions in place, as well as contacts to re-establish business in Russia.

The company feels it would need to obtain a Russian partner to run a test project for marketing. A co-operation agreement with a Russian actor to aid with estimates and building costs would be desirable.

Corruption is identified as an impediment, as well as the fact that Snowpower AB would not want to be the sole owner of a project in Russia, but rather be a business partner.

Analysis: The company is interested in co-operation with other businesses to reach the Russian market. It already has experience, product descriptions in Russian, and a contact person who is seeking out business opportunities for the company.

Experiences and Views of the Russian Companies

Tatyana Fedorey, Nadezhda Kimasheva, Ksenia Pankina

This section presents the results of a market study, conducted to investigate the market for energy efficiency in the Murmansk region and companies in this market related to their opportunities for international co-operation.

There are two ways for foreign companies to gain access to the Russian market. Foreign companies that decide to do business in Russia should establish their own company in accordance with RF legislation. Another alternative is to have a co-operation agreement with an already existing Russian company and fulfil its tasks through it.

If a foreign company deals with energy efficiency services and would like to do business in Russia, the algorithm of its actions in this direction should be the following:

- Choosing a form of legal entity to be registered, preparing documents and its submission to the accrediting body for the accreditation/registration process.
- Registration with a Tax Authority
- Registration with non-budgetary funds: the Pension Fund, the Social Insurance Fund, Compulsory Medical Insurance Fund, the Federal State Statistics Service.
- Stamp production
- Opening a bank account and appropriate notification of the tax authority regarding bank information.
- Obtaining a permit to become a member of a self-regulatory organisation (SRO) of energy auditors.
- Hiring staff in the company and starting to work.

When foreign nationals are hired in Russia, there are some mandatory provisions in Russian law relating to the employment of foreign citizens in the Russian Federation. Every foreign citizen must obtain a work permit before starting to work in Russia, and a working visa (if a visa is required). Depending on circumstances, foreign nationals may be employed under standard procedure (which usually takes at least 3 months from the date of the submission of the required documents), or under the procedure for hiring foreign nationals - qualified specialists (shorter procedure). Each of these procedures has its own peculiarities.

Employers must comply with the rules of life safety, rules for processing of personal data and take mandatory local regulations, which must be available to all employees under the signature prior to their employment.

Employers are urged to adopt local regulations on labour. Such acts should

contain the rules of the hiring and firing of staff, basic rights and duties of employers and employees, disciplinary action (these provisions generally reproduce the Labour code), the date of payment of wages, hours of work and rest, rules about bonuses, sick leave, compensation of expenses, dress code, restrictions on smoking, restrictions on the use of office equipment for personal needs, and other issues that are important from the point of view of the employer. The employer must bring these rules to the attention of every employee, and each employee must confirm that he/she has read them with his/her signature.

A survey of business opportunities in the energy efficiency-related market in the Murmansk region

Legislation

Rules of operation in the market of services in the field of improving energy efficiency set for foreign companies do not differ in any way from operation conditions for Russian companies, except regarding running energy surveys.

The only entities entitled to run energy surveying activity are those that are members of self-controlled companies in the sphere of energy surveying. Establishing and operating self-controlled companies in the field of energy surveying should be exercised in compliance with the requirements of this Federal Law and the Federal Law No.315-FZ dated 1 December 2007 "On self-regulating organisations"). FZ-261, Chapter 4, sheet 15, item 4.

Admission into membership of a self-regulating organisation in the region can be granted to a legal entity, including a foreign legal entity (in a form of branch registered in RF) that meets the appropriate requirements as set out in this Federal Law, and additional requirements set in compliance with this Federal Law on a self-regulating enterprise in the field of energy surveying. (FZ-261, Chapter 4, sheet 18, Item 6.). See the above-mentioned rules of admission in SRO: I, point 6.

There is a regional programme in energy efficiency adopted by the Murmansk region Government "Long-term target-oriented programme - Energy-Saving and improving Energy efficiency in the Murmansk Region" for the period 2010-2015 and for the period up to 2020.

The base of the power grid of the Murmansk Region comprises 17 hydro-power plants of the "Kolsky" branch OAO "TGK-1", 3 block stations, 2 heat and power plants - OAO Murmansk "Heat and Power plant" and Apatity heat and power plant, "Kolsky" OAO "TGK-1", a branch of the "Concern Rosenergoatom" "Kola Atomic power Station" and a network of the main and distribution LEG 1s, integrating the generating plants into the energy grid of the Murmansk Region, which in its turn is part of the Unified Energy Grid (UEG) of Russia (transits of 110 and 330 kWt with a transfer capability of 580 MWt). Operative-dispatch control of the energy grid is maintained by the branch OAO "CO EES"(Northern Department of Unified Energy Grid -NB UEG), Kola RDU (Kola Regional Dispatch Directorate-RDD).

The Murmansk Region is peculiar with its high level of heat supply centralisation. In Murmansk over 90% of total housing facilities are provided with heat supply from 4 sources (260 -461 Gcal\hr), which are the Murmansk Heat electrical power station (which besides the proper heat electrical power station includes the Southern and the Eastern boiler-houses) and the Northern boiler house. In city of Apatity, the entire housing fund has been connected to the Apatity Heat Electric Power station. In the rest of the cities, the centralised systems of heat supply are fed from departmental thermal electrical stations, and from large and small boiler rooms, which meet over 90% of entire demand in heating. In the region's territory, about 130 boiler rooms are under the departmental authority of the Ministry of Defense.

Problems in heat supply in the region are caused by:

- A high level of physical wear of source equipment and that of heat supply grids;
- Low efficiency of fuel utilisation;
- Lack of instrumental registration and effective regulation of heat energy consumption;
- High share of boiler oil utilisation as fuel for generating heat energy

In the sphere of water supply and water disposal (sewage), services are rendered in the territory of the region as valid from 2010 by about 70 institutions of various kinds of ownership. To maintain centralised, industrial, domestic needs and drinking water supply for the population and enterprises in the region, 63 sources are used, including 11 subterranean and 52 surface ones.

The actual provision of the region's population with a centralised water supply is 95.8%, with that figure being 1005 for the urban population and 91.6% for the rural population. Totally 93.7% of water consumers in the region use water from surface sources.

With the aim of the successful functioning of the water consumption system and the public utility complex, the following tasks are to be resolved:

- Decreasing wear level of public utilities infrastructure by means of the implementation of target-oriented programmes, investment and production programmes of the public utilities complex institutions;
- Decreasing specific water consumption and minimising water loss based on the introduction of energy saving technologies and energy-efficient equipment;
- Constructing and updating water consumption facilities fundamental goals to eliminate reasons for the non-conformity of water quality supplied to the population as compared to hygienic norms, and exercising differentiation in approaches to the selection of technological schemes for water supply in cities and rural settlements.

Natural gas is not produced in the Murmansk Region. Gas supply is accomplished with liquefied petroleum gas (hereinafter referred to as LPG) delivered to the region by rail from manufacturer companies.

Analysis of questionnaires regarding energy efficiency management in the Barents Region

This Questionnaire was conducted in accordance with the Technical requirements for the Market Study (under the Framework Agreement dated 29.08.2014).

Questionnaires were distributed to the addresses of 75 companies, enterprises and organisations (i.e. legal entities of different types including budgetary organisations). Thirty feedback forms were received, 40% of the companies questioned.

The spheres of activities of the responding companies included the following sectors of the regional economy: mining industry, transport, gas and oil, subcontractors and private entrepreneurs, housing and utilities, municipal services, construction, metallurgy.

I Was the energy audit conducted at your enterprise?

- 27 enterprises confirmed that the energy efficiency audit was conducted at their companies
- 2 respondents conducted the audit by themselves
- 1 company said that the audit had not yet been conducted

II Is there any programme (plan) to increase energy efficiency at your enterprise?

"Yes" – 29 respondents
"No" – 1 respondent

III If "Yes" which directions of the programme have the greatest priority for your enterprise?

The following responses were received:

- Decreasing TER consumption in the needs of their own boilers, reduction of heat losses during transmission, optimisation of generation of compressed air;
- Planning of energy consumption, replacement of insulation, elimination of leakages, output in reserve of the underloaded electrical equipment;
- Reducing costs of fuel and energy resources (oil, water, heat) to produce a unit of basic production;
- Reconstruction, modernisation;
- Reducing the cost of their own needs; reduction of heat and water supply losses; cost optimisation of technological cycles;
- Modernisation of domestic and street illumination of buildings using LED lights and motion sensors, modernisation of district heating boilers using automated heat substations, improving the thermal insulation of the facilities of the enterprise;
- Transferring oil-fired boilers to alternative fuels;
- Reduction in specific rates of fuel consumption of boiler units,
- Energy savings during the operation

of steam and hot water boilers;
- Reduction of heat losses during transportation and distribution, modern technologies of thermal insulation;
- Reduction of energy losses during its distribution in electrical systems;
- Use of modern heat exchangers for heat substations, installation of water meters and accounting for heat;
- Energy saving in energy supply systems including outdoor and intra-shop lighting, operation of electric motors, electric machines and devices;
- Use of technology, which can really help to save energy, electricity, water, heat supply, etc.
- Cost reduction in the use of electricity and heat transfer
- Reconstruction of the central heating station at one of the companies, adjustment of the hydraulic regime of the heating networks, implementation of the instrumental metering of energy resources
- Reduction in specific fuel consumption, reduction in heat losses during transmission, reduction in the consumption of electricity and heat power for industrial and own needs
- Reduction in electricity and heat consumption
- Reduction in heat losses through walls and building shells, cost optimisation of electricity consumption by automating the regimes of building engineering systems, use of energy-efficient heating, ventilation and lighting equipment
- Energy efficiency and energy saving
- Automation of the operating modes of heat networks

One respondent indicated that there is no programme, but the company is interested in the replacement of its light bulbs for energy-saving ones.

One respondent said that the company will develop the programme after the energy audit is finished.

IV Does your company/firm/enterprise have any experience in co-operation with foreign partners in the sphere of energy efficiency technologies?

"Yes" – 20 respondents
"No" – 9 respondents
1 respondent did not give any answer
If "Yes", indicate the country and name of the partner (optional)

The following answers were given:
Germany (4), France, Norway (2), the Czech Republic, Slovenia, Finland (3), Denmark, Sweden (2), USA, UK, the Netherlands

Foreign partner companies:

- ABB (Sweden)
- Vacon (Finland)
- Tebodin B.V. (Netherlands)
- Linde Engineering Dresden GmbH (Germany)
- Danfoss (Denmark)

V Is there any interest in establishing contacts with foreign partners in the sphere of energy efficiency technologies? Indicate your expectation regarding possible co-operation.

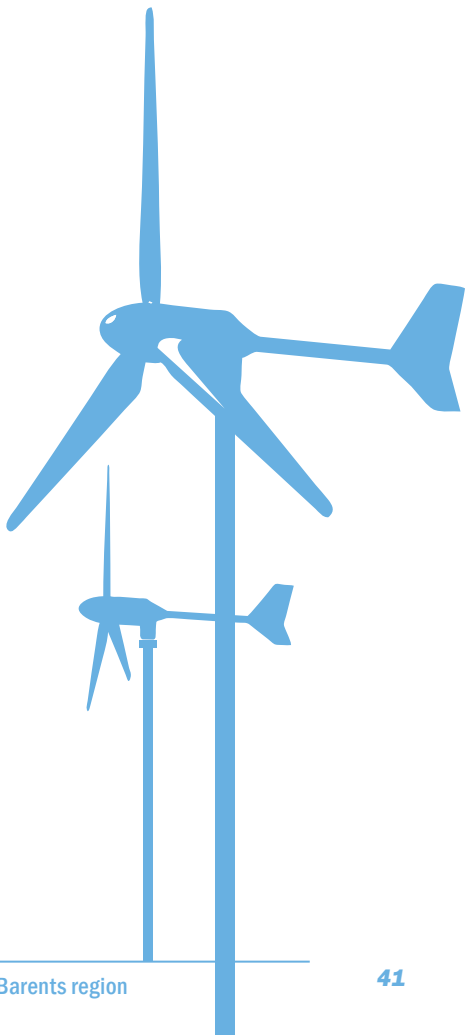
- Yes, the introduction and use of modern energy efficient materials, equipment and technologies in the enterprise.
- Yes, exchange of experience and ideas oriented to the improvement of energy efficient technologies
- Efficiency, reliability, profitability;
- Introduction of direct air heating systems using natural gas and LNG.
- Use of foreign expertise in the field of energy-efficient technologies
- One respondent was interested in obtaining accurate and reliable information and technology for using effective, affordable and technologically advanced additives to reduce the cost of marine fuel;
- Ability to attract investment in the implementation of energy efficiency projects and conversion of boilers to alternative and renewable fuels; joint implementation of investment projects;
- Future conclusion of energy service contracts with foreign partners;
- Implementation of resource-saving technologies and equipment;
- Conducting of joint informational and educational activities aimed at training and education in the field of energy saving and efficiency;
- Installation and use of energy-efficient technologies;
- Installation of heat pumps.
- Reduction of energy consumption.

One respondent said that concluding contracts with foreign partners would be considered after receiving the report regarding energy efficiency from the audit company.

Eight (8) respondents said that they were not interested in cooperating with foreign partners.

One was interested in finding a technical solution on how to organise energy saving measures in big industrial premises.

One company found it difficult to answer at present.



CHAPTER III
Studying the Potential of Efficient Energy Management

Measurement Results

The objective of the energy audit is to analyze the use of the overall energy of the real estate and evaluate opportunities to reduce energy consumption by identifying problem areas of the building and repair or replace them with energy-efficient solution. Energy audit report is a good tool for monitoring the energy efficiency of the real estate. Efficient energy use is one of the best ways to save money while saving the environment.

This chapter presents the results of the energy audit measurements which were done in the pilot buildings in the cities of Kirovsk and Kandalaksha during the ENERU project. The audits were implemented to find out the current situation and potential for efficient energy management. In the city of Kirovsk the energy audit was conducted in the Sport Centre and in Kandalaksha it was conducted in the Culture Palace.

The energy audits were done in cooperation with the Finnish and Russian experts in order to share the knowledge and methodologies and to adjust the auditing method and tools suitable for the target region.

Energy Efficiency Audit Analysis Report Kirovsk

Lauri Väisänen

The purpose of an energy audit is to analyse the use of energy and find out the potential energy savings targets in the building. An energy audit also can help clarify the possibilities for the use of renewable energy sources. This energy audit model used in the Kirovsk Sport Centre is Motiva (specialist in energy and material efficiency in Finland).

The building was built in 1938 and was renovated in 1958. It has 3,676 m 3 of heated volume and 4,004 m 3 of unheated. It is used by the town's children. Different lessons in physical education are held there from ballet to gymnastics and from chess to boxing.

The heating of the building is district heating. It does not contain a heat exchanger but water comes along so-called straight pipes to the property and from it to the heating system.

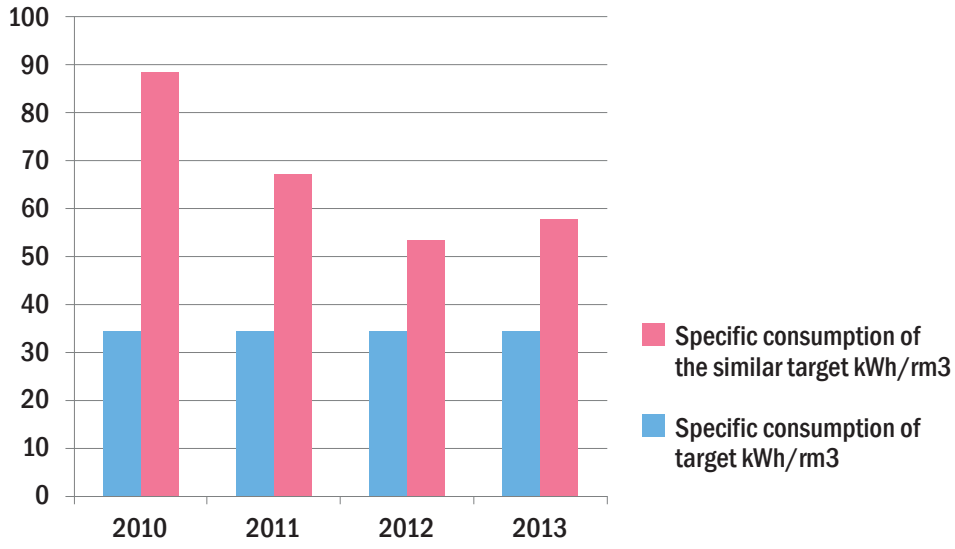


Figure 1. Consumption of the thermal energy of the property 2010-2013. (Väisänen 2013.)

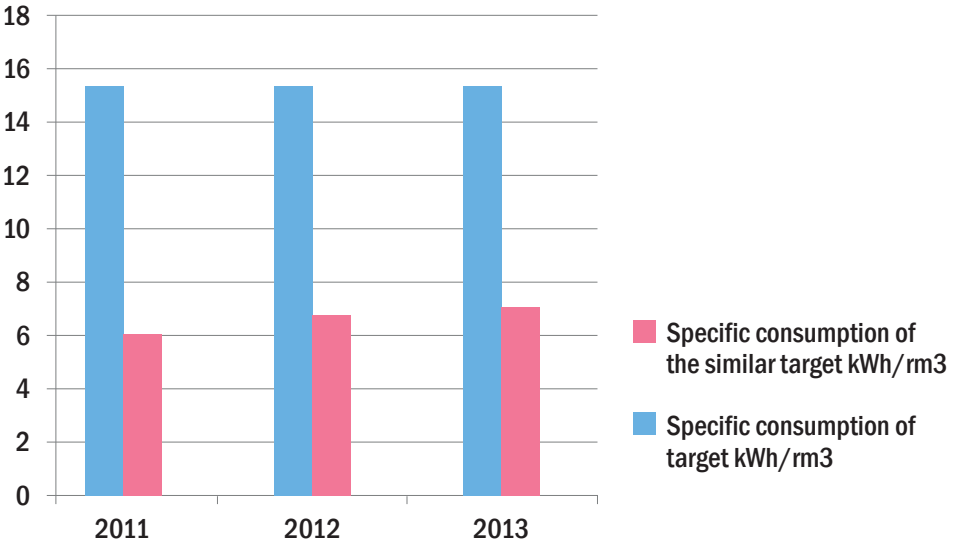


Figure 2. Consumption of target of the electricity during 2009-2011 (Väisänen 2013)

Before measuring, we received the information about the building and consumption and were able to carry out a preliminary study of it.

Measurements were taken on 2.10.2013. Measuring was performed with IR equipment. During the measuring day, the weather was cloudy with a light wind and the outside temperature was +5.6 degrees. At the time of measuring, the windows were open in several rooms cooling the air. The average temperature of the rooms was a +19.3 degrees on the first floor and +20.8 degrees on the second.

The temperatures of radiators were between +40 - 45 degrees as the heating season had begun 4 days earlier. The circulation system was not fully open.

At the time of measurement, the temperature of the input water was 61 degrees with a return temperature of 50 degrees. These figures were obtained from the technical area of the district heating system's analogue gauges.

Figure 3.
The technical room of the district heating meters and piping before insulation

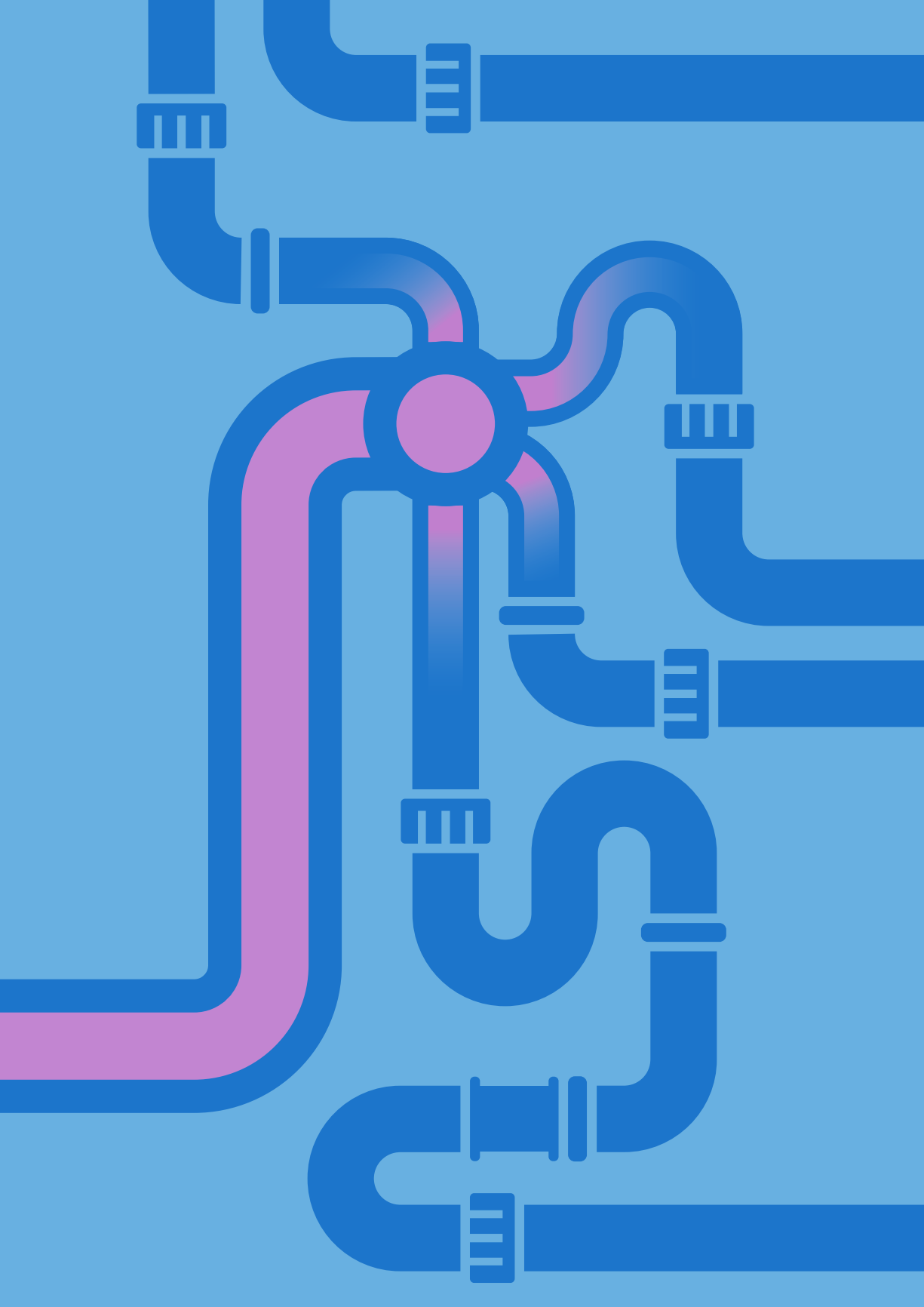
Figure 4.
The technical room pipelines, after insulation

Something else that we took into account was water consumption and electrical devices such as lighting, IT equipment, secondary heating devices and kitchen supplies. The building did not have electrical ventilation or an air exchange system.

The proposal to save heating energy was to install a heat exchanger in the district heating system. The heat exchanger separates the building from the heat distribution system, the district heating network and the water. In addition, radiator replacement was recommended. It was calculated that payback time would be only 5 months (N.b.: all the prices of equipment were Finnish prices and did not include work).

Water pressure was high, so it was recommended to install a pressure reducer.

Another proposal was to install an air ventilation system and additional insulation for the ceiling.



This energy audit model used in the Kandalaksha Culture Building was of the adjustment type, a co-operative effort between Russian and Finnish experts.

The building was built in 1957 and is made of plastered bricks. The floors are reinforced concrete, and the roof is metal ceramic on timber. Some of the windows have been changed to plastic windows (DGU) in single plastic frames.

The supplier of electrical energy for the Culture Building is JSC Kolskaya Energy Supply Company. The source is three-phase lead 0,4 kV. The permitted power is 100 kW.

The increase in electricity consumption is explained by the purchase of additional office equipment and the use of household electrical heaters during the cold season.

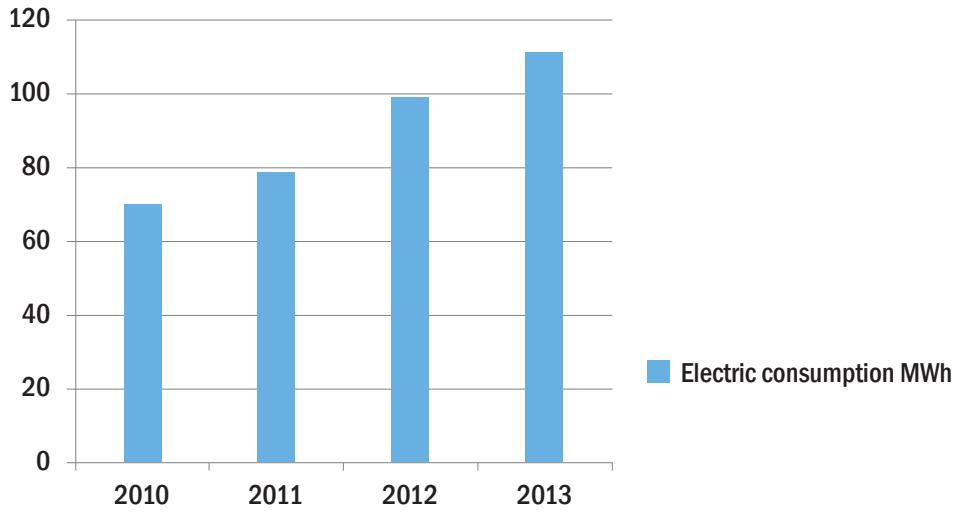


Figure 1. Electric consumption

The heating of the building is by district heating. The heating supply system is open-type with distribution to a hot water supply system. Heaters in the rooms are cast iron radiators. The system does not contain a heat exchanger.

Figure 2. Individual heating plant

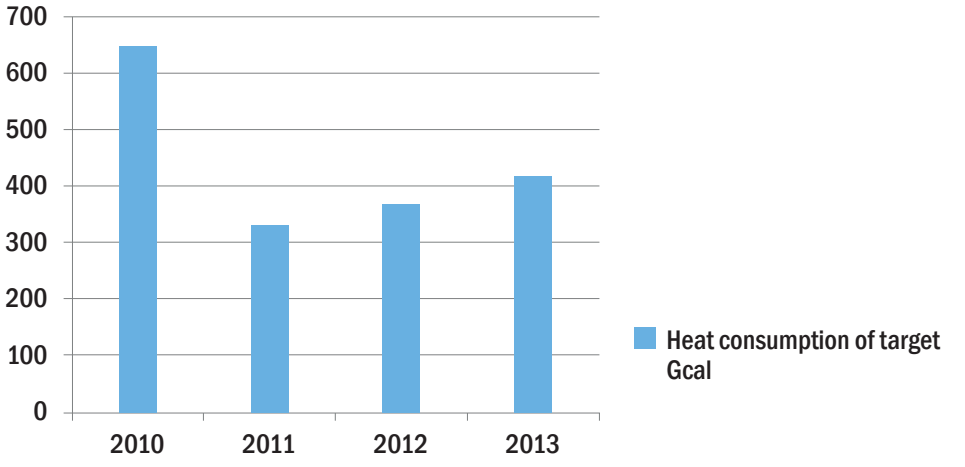


Figure 3. Heat consumption

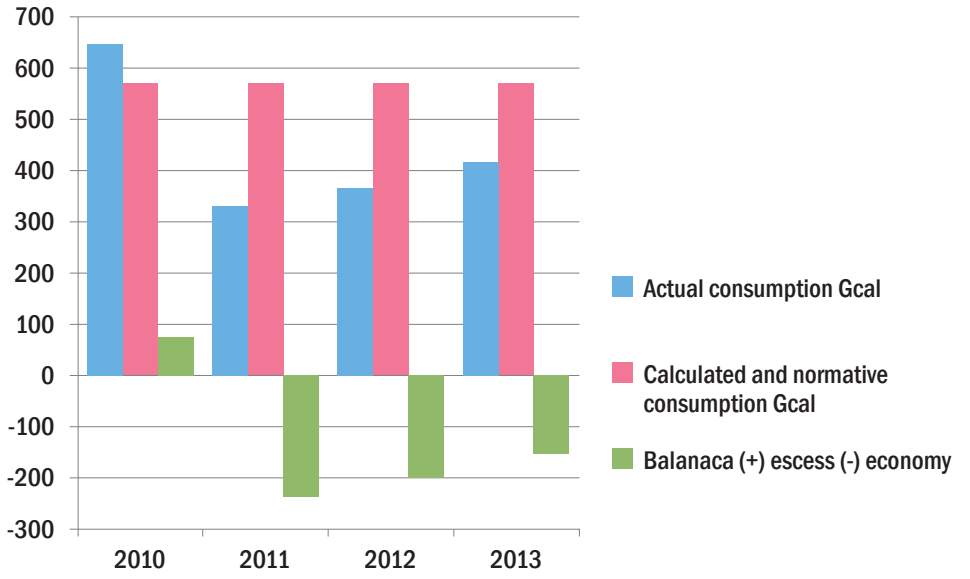


Figure 4. Calculated and actual heat consumption

The comparative analysis of heat consumption in different years shows that the uneven character of consumption is probably explained by an extremely cold and long winter season in a given year.

The documentation of electrical energy supply is sufficient. The agreement corresponds with existing legislation and has a standard form.

The documents for heat energy supply are insufficient. There is no certificate of the energy supply system (certificate of the heating system and hot water supply system). The agreement is standard and meets the requirement of the existing legislation.

Something else that we took into account was water consumption and electrical devices such as lighting, IT equipment, secondary heating devices and kitchen supplies. The building did not have electrical ventilation or an air exchange system.

The proposal to save heating energy was to install a heat exchanger in the district heating system. The heat exchanger separates the house from the heat distribution system, the district heating network and the water. It was also proposed that a reflecting screen be installed behind the radiators

Proposal to save electrical energy was to change the light bulbs to energy-saving ones.

CHAPTER IV
Renewable Energy

Photo: Alpo Hassinen / Vastavalo.fi

Review of Renewable Energy Potential in Kirovsk and Kandalaksha

Anastasia Sipari

The review of renewable energy potential in the Kirovsk and Kandalaksha regions was made within the framework of border co-operation project ENERU. Current energy production in the region is highly dependent on fossil fuels such as mazut and coal. The prices of fuel have a tendency to increase, which leads to the increasing of prices for utilities in the municipality. That is why it is important to recognise alternative energy technologies that can be applied on-site and decrease the dependency of the municipalities on expensive fossil fuels, brought from outside.

At the moment, the use of renewable energy there is quite limited. There was no alternative energy production in Kirovsk. Kandalaksha has five hydroelectric stations that produce about one-third of total electricity consumption in the Murmanskaja oblast.

The land in the Murmansk Region is rich in peat deposits. According to surveys, deposits are sufficient to provide heat for all Murmanskaja oblast for the next 100 years. Some large deposits are situated near Kandalaksha and Kirovsk. This favourably affects the possibility to develop deposits and start using peat in energy production.

The significant renewable energy potential of the territory comes from forest biomass or rather from forest management waste such as thinning trees, branches and roots left after deforestation. In order to achieve this potential in practical terms, forest management measures need to be adopted there. At the moment, waste from the forestry and wood industries is not exploited in energy production.

At present, the vast majority of building stock is connected to the district heating network. The use of heat pumps can be justified for public buildings during the summertime, or in other circumstances, when district heating is not available and direct electric heating is used. Heat pumps allow a significant decrease in energy cost compared to direct electricity and oil heating.

The wind and solar energy potential of Kandalaksha and Kirovsk is quite modest. The use of both technologies currently involves relatively big investments, the payback period of which is rather long. However the development of solar energy technology and windmills is continuously progressing and the situation may change in future.

Kandalaksha is planning to build a new waste processing centre that will also serve the needs of neighbouring municipalities and will consist of a landfill and waste sorting facility. Kandalaksha has good possibilities to include locally produced biogas in energy production in the future, if biogas collection from waste to use in energy

production is taken into consideration during the process of planning new landfill. Waste from Kirovsk is delivered to landfill at Apatity, a different municipality.

	Kandalaksha	Kirovsk
Peat	Potential is significant	Potential is significant
Forest biomass	59	90
Heat pump	27	18
Biogas from sewage sludge	N/A	0,38
Biogas from landfill	60	10,8
Wind energy	-	2,6
Hydro energy	-	15,3
Solar energy	1,6	4,2

Table 1. The renewable energy potential of Kirovsk and Kandalaksha , GWh/a

At the moment renewable energy sources are not used widely enough in energy production in Kandalaksha and Kirovsk, but the potential for forest biomass and peat use is significant. Production of these types of fuels has its own challenges such as harsh climatic conditions and lack of infrastructure. However, introducing locally produced renewable energy resources into the energy production sector may have a positive long-term effect on the self-sufficiency and energy efficiency of the territory, and will create new jobs for local people, which in turn will strengthen the economy of the region.

Energy Efficiency Action Plan for Pilot Cities in ENERU Project

Anastasia Sipari

The energy efficiency action plan was made in order to meet the goals of the ENERU project to spread know-how in energy efficiency. The basis for it was an action plan model widely applied by Finnish municipalities. According to it, the principles of energy efficiency can be integrated into all spheres of municipal activity. Everywhere where there is energy consumption, energy savings can be achieved. The action plan provides tools for municipal authorities to incorporate the principles of energy efficiency into the daily activity of the whole municipality.

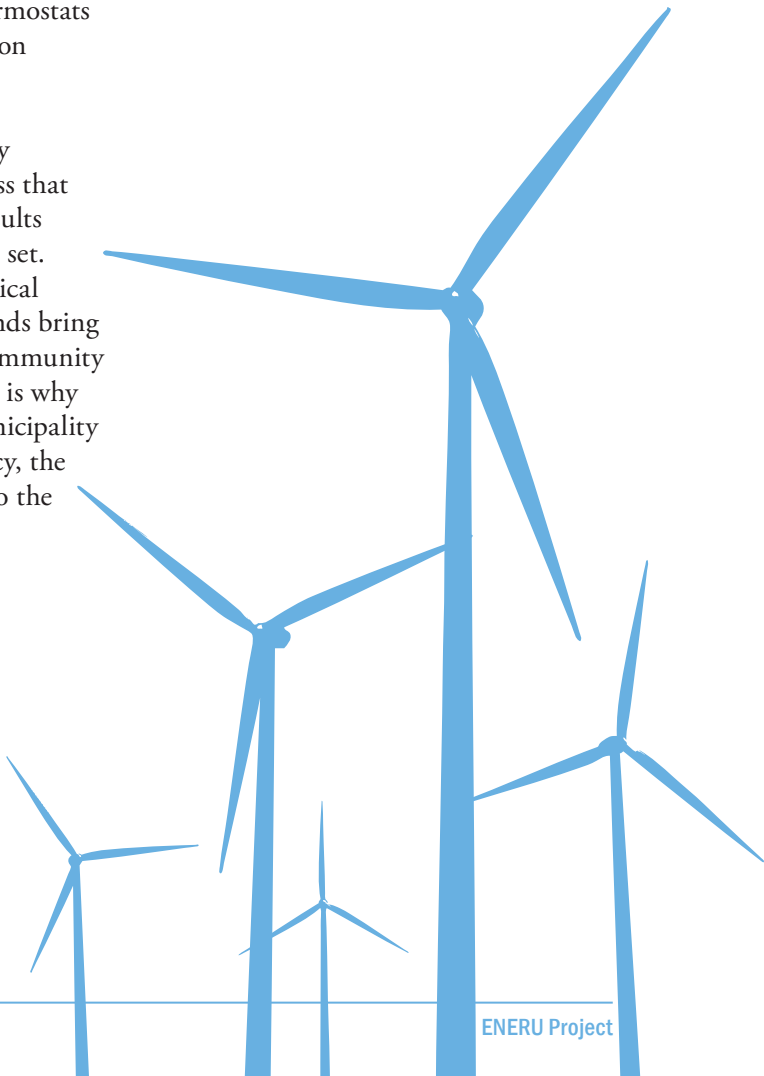
It used to be thought that the action plan on energy efficiency would focus mainly on the energy sector, but actually it can be applied over a much wider sphere. In the action plan made within the framework of the ENERU project, actions were suggested for such spheres as purchasing, city planning and design, the energy efficiency of buildings, monitoring arrangements, education and advisory functions, implementing new actions, and the introduction of renewable energy sources in energy production. Such a complex approach to the problem of energy saving allows us to obtain comprehensive and long-term results that can improve the efficiency and quality of a number of municipal services.

A common thread through the plan is that every decision made today will affect tomorrow. Every year, municipalities make plans on land development and decide on the procurement of goods and services. In comparing alternative solutions, not only the cost of investment but also expenditure during the whole life cycle needs to be compared in order to choose an efficient and profitable solution. Making energy efficiency one of the criteria in the process of decision-making allows us to save energy and natural resources during the period of exploitations of goods and services and to avoid unnecessary energy consumption during project implementation. It involves less resources and time to take energy efficiency into account during project planning than later, when every change will require a lot of money, time and might be hard to implement.

Improving energy efficiency requires a high degree of commitment from municipal authorities, municipal workers, companies working on-site and the population. However, the process needs participation from different entities, with the main initiator being the municipality. It is necessary to appoint relevant structures and officers in the municipality who will be in charge of and take control of the execution of energy efficiency development programmes in specific areas. Deadlines must also be set for performers to submit reports on the results achieved.

In order to involve as many people in the process as possible, the motivation and awareness of municipal workers and all entities participating in the process needs to be raised. Therefore, information about the goals and benefits of energy-efficient actions, how results can be achieved and what different groups of the community can do should be widely disseminated. Energy efficiency can became part of the daily actions of every person, and the municipality can help to implement this action by making recommendation lists for different groups of people. Sometimes easy changes in daily life can result in significant savings. It may be as simple as using thermostats for interior temperature regulation instead of opening windows.

The increase of municipal energy efficiency is a long-lasting process that can continue for years. Once results are achieved, new targets can be set. Energy consumption, technological development and societal demands bring new challenges, to which the community should be able to respond. That is why the more active a position a municipality takes to increase energy efficiency, the more confidently it can look into the future.



Renewable Energy Sources (RES) Directive

Vilho Palosaari

The EU has issued rules and guidelines to increase the use of renewable energy: the RES Directive and the Directive to increase the number of compressed methane filling stations throughout the EU area. Both of these will promote demands for the production and use of biogas in Finland.

Renewable Energy Directive (RES Directive)

The EU has set a target that by 2020 at least 20% of Europe's energy should be generated from renewable sources such as solar power, hydropower, wind power and heat pumps as well as wood, energy crops and other biofuels. The RES Directive sets specific renewable energy targets for all Member States, who must find ways to reach their respective goals.

Finland's target as proposed by the Commission is to increase the share of renewable energy sources in total energy consumption to 38% by 2020, an increase obligation of 9.5 percentage points. The most significant sources of renewable energy currently exploited in Finland are bioenergy, especially wood and wood-based by-products, hydropower, wind power, ground source heat and solar energy.

Today as much as 70% of the renewable energy used in Finland is derived from the wood-based by-products of industrial pulp and paper making processes.

To reach our national target, Finland will have to increasingly exploit other sources of bioenergy (wood chips, wood pellets, energy crops and organic wastes), enhance the use of existing hydropower facilities, and urgently increase the use of wind power and ground source heat, while also realising energy savings that reduce the need to use fossil fuels.

The RES Directive also includes a separate blanket target that biofuels should make up 10% of all vehicle fuels by 2020 in all Member States, including Finland.

New Directive on compressed methane filling stations throughout the EU area

The Directive requires refuelling networks to be established in all Member States for cleaner transport propulsion, i.e. for renewable electricity, hydrogen and methane. The Directive applies to all forms of transport but, in respect of infrastructure construction obligations, only road and waterborne transport. The Member States must transpose the Directive into their national legislation by 18 November 2016 and produce, approve and deliver to the Commission an official plan, a so-called national framework to implement the content of the Directive.

The Directive has been drawn up in order to reduce both the environmental impacts of transport and the dependency

of transport on crude oil. The aim is to solve in part the EU's quality problem in the transport use of renewable energy which has arisen from the implementation of the obligations of the RES Directive (2009/28/EC) mainly by means of less optimal technologies in terms of environmental quality. It was essential to create this Directive, as the markets and national policy in a number of Member States have failed to sufficiently invest in the best technologies with regard to quality. Another directive is also under preparation to reduce the same problem. The Directive that has now been published is targeted at the end of the fuel chain, while the directive under preparation is targeted at the beginning of the fuel chain. In addition to these, a Directive concerning the procurement of clean vehicle and transport services for the public sector (2009/33/EC) as well as a carbon standard under the Fuel Quality Directive (2009/30/EC) has been established which requires that the greenhouse gas intensity of fuels used in road and non-road mobile applications and inland waterway transport decreases by 6–10% of the level of 2010 by 2020.

A refuelling network for methane must be constructed throughout the country in all Member States to enable transport by means of methane throughout the EU. The requirements for electricity and hydrogen will be lower. The Directive applies mainly to refuelling points accessible to the public, as the aim is to make clean propulsion available for everyone in an open and non-discriminating manner. This means, for example, that they can be used without separate agreements or customer cards (agreements for electric recharging points and customer cards in line with the Directive are, however, acceptable).

The first requirement is to achieve by 2020 a comprehensive compressed methane gas (CMG) and electric refuelling/recharging network accessible to the public in built-up areas.

By 2025, the demand for a CMG network will expand to comprise the whole country with the aim of ensuring that CMG vehicles can move throughout the entire EU area. In addition, a liquefied methane gas (LMG) refuelling network accessible to the public for heavy road transport on major roads with the aim of ensuring that LMG vehicles can move in the area of the TEN-T Network throughout the EU.

The Directive does not stipulate a minimum condition regarding number in order to achieve coverage; rather Member States will initially be given the freedom to implement it in the manner they deem most appropriate. Indicative targets are available, however:

In addition to built-up areas CMG stations accessible to the public are to be constructed throughout the country in such a way that the maximum distance between the stations is 150 km.

National guidance on the utilisation of manure

The national aim set out in the National Waste Plan (2008) prepared by the Ministry of the Environment is for all manure produced in economic activities in rural areas to be utilised as of 2016. The aim is for 10% (i.e. approx. 2.1 million tonnes) of the total manure volume arising in Finland to be treated in the biogas plants of farms. In addition, these plants would treat at least 10% of septic tank and cesspool sludge from sparsely populated areas. Biodegradable waste from communities could also be treated in biogas plants. This will be of considerable benefit, as landfill disposal of bio-waste will decrease substantially. According to the Bio-waste Strategy, as of 2016 only 35% of the 1994 volume of community bio-waste may be disposed of landfills. (Ministry of the Environment 2008, 32)

Photo: Aarno Isomäki / Vastavalo.fi - A cowhouse with biogas facilities. Finland.

CHAPTER IV
Multidiscipline Approach in Energy Management

Triple Helix Approach in the Energy Efficiency project

Elena Kluchnikova

This article presents the analysis of multidisciplinary co-operation within the energy efficiency project, which we hope will be useful for other projects of the Kolarctic programme and the future cooperation in the field of energy efficiency.

ENERU – is the only project of the Kolarctic ENPI CBC 2007-2013 Programme, which was from the very beginning based on the so-called Triple Helix approach. The Triple Helix Model, known as an active partnership between science, business and government was described in the mid-1990s. The works of H. Etzkowitz (Stanford University) and L. Leydesdorff (Amsterdam University) describe such a partnership as a hybrid social structure possessing the advantages of DNA molecule (linkage of helix structures), high adaptability and resistance to changes in the outer environment [1]. In the 2000s this structure was for the first time introduced into the economy of developed countries (from Scandinavia to Japan) as a basis for the organisation of regional clusters and generating innovations [2]. This Model appeared in Decrees of the Baltic Development Forum and in strategic documents of the EU as a new approach to integration and establishment of a united knowledge market.

The co-operation of government (municipalities of Kandalaksha, Kirovsk and Piteå in our case), scientific organisations (Lapland University of Applied Sciences (Rovaniemi), Kola Science Center, Educational Consortium Lappia) and business (companies Bionova, Micropolis and Bothnian Arc Union) in our project was aimed at finding the best possible instruments for the improvement of energy efficiency in municipalities. The most successful example of such co-operation is the elaboration of the Action Plan for the improvement of the energy efficiency of the Kirovsk municipality. This work was carried out by the Finnish company Bionova (business) in collaboration with Kirovsk city administration (government) and with the expert support of Kola Science Center (science). Joint study visits and seminars were also organised for better understanding by each participant (business, government and science) of policy instruments in the energy efficiency field.

The network collaboration of science, business and government (Triple Helix Model) is an institutional matrix for an innovative type of growth under conditions of constant updating, a new method of creating economic stability. Each institution has its function, i.e. the government guarantees the established rules in society, science generates and spreads knowledge and the businesses are engaged in production.

It is important for the collaboration to create the mechanisms, which will assist in co-operation development between the participants of the model. Such co-operation creates a synergetic effect because competitiveness is increased due to a decrease in the degree of uncertainty and the ability of the system participants to create innovations. It is not the participants themselves who play the most important role in the Triple Helix approach but the mechanisms of their co-operation [3].

In our analysis, we tried to assess to what extent the Triple Helix approach was used during the realisation of the ENERU project, to determine the opportunities for broadening links between local authorities, science and business and to reveal the advantages of using the TH approach in international projects.

The choice of study methods was based on the following statements [4]:

- All activities increasing the behaviour diversity of economic agents contribute to innovative development
- The Triple Helix system indicators should answer the question how wide is the economical "knowledge database"
- The interaction between science, government and business is analysed using the concepts of "institutional knowledge infrastructure", which guarantee their creation, accumulation and use

At the same time it is impossible to collect statistical indicators. They are missing in the reporting system, so we used a case-study method. We interviewed the representatives of business, science and government participating in our activities. The respondents were from Russia, Sweden and Finland (total of 14 people) and analysed the project results from the point of view of receiving "new knowledge" and "added values", which appeared during the project.

From the opinion of the respondents, the organisation of collaboration between local authorities, business and science to improve the energy efficiency of a utilities service is fruitful, because "business and authorities receive qualified consultations", "research developments are based on the real needs of business and authorities", and "educational institutions (science) start to train the specialists having the skills, which are needed on the labour market". From the opinion of the respondents, it is government that should organise such collaboration, although Finnish respondents noted that this can be done by the organisations empowered by the government.

Businessmen assume that a business is ready to pay for new knowledge (consultations, research and development) when "long-term agreements are concluded and opportunities for international co-operation are available", "at a certain level of the company's development", also "when it is possible to include knowledge costs into the product price". A representative of a Finnish company said that they already "buy new knowledge in order to enlarge the database which they use for development of their

services". The organised partnership in our project was useful for the business representatives because they could receive new data in the field of energy efficiency, find partners and receive information about the trends in municipal and regional policy in this sphere".

The representatives of science are interested in co-operation with business and local authorities because "it is an opportunity to receive actual data for the choice and practical application of technologies".

The representatives of local authorities consider that co-operation with science and business in the field of energy efficiency is useful. They do not see any administrative restrictions to such co-operation.

To analyse the study results, we used an approach by Chinese researcher Chuan Zhou (Table 1). We analysed the project activities from an institutional point of view and pointed out the role of the organisations establishing the co-operation. We tried to point out the functions of each of the three agents in the project and find out those, which were not typical for them.

The analysis of results was based on the determining to what extent the project objectives were achieved from the point of view of each institutional sphere. The main goal of the project was to reinforce trans-border co-operation in the field of energy efficiency management. That was the goal for all participating partners. We regarded the objectives, which the partners from different spheres had had before the project start. These objectives are quite conventional for the institutions and not necessarily reflected in the project application (Table 2).

	Inner Core	Outer Field
Institutional spheres	Independent core? Government University (science) Industry	Interaction in adjacent (hybrid) fields?? Hybrid organisations Non-hybrid organisations (not adjacent spheres)
Functions	Unique function? Government University (science) Industry	Common functions? Fields of interaction Non-interacting spheres

Table 1. Three perspectives of the Triple Helix [5]

Inner Core	Objective	Results
Municipalities: Kirovsk Kandalaksha Piteå	Realisation of national policy in the field of energy efficiency management Realisation of national policy in the field of international co-operation Economic development of the municipality (taxes, work places).	(1) Integrated Action Plan for improvement of energy efficiency management (Kirovsk) (1) Change of windows in the House of Culture (Kandalaksha) (2) Teachers are acquainted with the methodology of energy efficiency related education and training, teaching aids are purchased. (Piteå, Kandalaksha, Kirovsk)
University (science) Lapland University of Applied Sciences (LapinAMK) Kola Science Center Municipal educational consortium Lappia	Receive new knowledge in the field of energy efficiency management Study practical aspects of Triple Helix approach in international co-operation	(1) The methodologies of energy audit in Russia and Finland are studied and a joint audit method is worked out (KSC, LapinAMK) (1) Audit equipment is purchased (KSC, LapinAMK) (2) Basic assessment of Triple Helix approach in international co-operation is done (KSC) (1,2) Research articles are published, presentations at international conference are made (KSC, LapinAMK, Bionova).
Business Micropolis Bionova	Receive new knowledge New business opportunities	(1,2) Bionova enlarged its knowledge database and gained a better understanding of how to consult Russian municipalities. (1,2) A market study was carried out and a catalogue of companies willing to work on the international level was made (numerous companies on both sides of the border)

Table 2. Project results from the point of view of science, business and local authorities (inner core)

We found out that the success of the project was achieved through active participation of the organisations that work with entrepreneurship and companies, for example, Bothnian Arc (Sweden), Technopark-Apatity, the Murmansk Regional Business Incubator and the Northern Chamber of Commerce and Industries (Russia). *(Table 3).* They played the role of intermediate parties or mediators and it would be difficult to work within the Triple Helix approach without their assistance, because science, government and business are concentrated on their own achievements and work.

It is said in literature *(*H. Etzkowitz, 2010; I. Dezhina, N. Kiseleva, 2008; Zhou C., 2014) that in the process of Triple Helix practical application, the stakeholders start to play not only their conventional roles but also accept some functions of other stakeholders *(Table 4).*

Hybrid organisations Outer field	Co-operation on adjacent fields?	Project results
Bothnian Arc **Micropolis** **and** **companies attracted during the project period:** **Murmansk regional business incubator** **Northern chamber of commerce and industries**	**Involvement of companies in project activities** **Organisation of collaboration between science government (local and regional authorities) and companies.** **Co-operation with business (market study)**	**(1,2,3)** • new knowledge • new contacts • paid work **(all organisations participating in the project, including the hybrid ones)**

Table 3. Project results from the point of view of hybrid organisations (outer field)

	Government (local authorities)	Science	Business
Unique functions	• Development of municipal programmes on energy efficiency • Development of technical requirements and guidelines for procurements • Within the framework of Action plan related activities	• Study of heat conditions of buildings depending on weather conditions • Comparative analysis of audit methodologies in Finland and Russia • Development of the energy audit methodology suitable for both countries	• Working out of the Action plan for energy efficiency management in municipalities
Common (unconventional) functions	• Establishment of common knowledge platform	• Assistance for municipal workers in decision-making through active consultations	• Nature conservation
Functions of hybrid organisations	• Organisation of some common space (seminars, study visits, etc.) • Organisation of a dialogue between companies and local authorities (interpreting from "official" language into "business" language and vice versa. • Organisation of a dialogue between business and science (interpreting from "scientific" language into "business" language and vice versa).		

Table 4. Functions of the participating institutions

We suppose that the additional results of ENERU project received through the application of Triple Helix approach were as follows:

- Energy-service companies, which participated in project activities received data on the joint energy audit methodology, suitable for two countries. This can be used to enlarge the service market in the neighbouring country.

- The Russian municipalities received knowledge of the complex approach to the development of energy-efficiency-related municipal programmes; the suggested pilot programme can be downloaded from ENERU website.

- Finnish consulting company Bionova obtained knowledge on how to work with Russian municipalities and propose its services to them. Thus, the knowledge database in the project area was amplified.

- The project partners, belonging to different institutional spheres (science, business and government) assumed some unconventional functions during the project period; this can be considered as an increase in behaviour diversity of the agents. So, the project contributed to the innovative development of the project area.

- The links that appeared between the participating organisations during the project implementation period belong to "institutional knowledge infrastructure", which supports knowledge accumulation and use. The knowledge obtained in the project is available to all participants. Furthermore, all project participants obtained knowledge of where and how they can receive all necessary consultations on a wide range of questions from engineering to marketing ones.

[1] *Etzkowitz H., Leydesdorff L. The Triple Helix of University- Industry-Government Relations: A Laboratory for Knowledge- Based Economic Development // EASST Review 14, № 1. 1995*

[2] *OECD, 2007. Competitive Regional Clusters: National Policy Approaches*

[3] *Etzkowitz H., The Triple Helix. Universities - companies - state. Innovations in practice edited by A. Uvarov (in Russian) - Tomsk:, 2010.-238 p.*

[4] *Dezhina I.G., Kiseleva V.V. State, science and business in the innovative system of Russia. Moscow. 2008. -115p.*

[5] *Zhou C. Four dimensions to observe a Triple Helix: invention of 'cored model' and differentiation of institutional and functional spheres. Triple Helix 2014, 1:11. p. 1-20.*

Educational Co-operation in the Field of Energy Efficiency

Fredrik Marklund

As part of the ENERU project, an exchange between teachers and schools in Kandalaksha and Piteå was initiated. The area for the co-operation was energy and sustainability. Some of the schools in Piteå have been part of another project in the same area "Smart and sustainable", financed by the Swedish Energy Agency, SEA in Sweden. The schools gained quite a lot of experience, models and experiments from the project, some used in the ENERU project.

Event in Kandalaksha, November 2013

The first meeting with the teachers and headmasters of School #19 and School #2 took place in Kandalaksha (Russia) on 27-29 November 2013.

During the meeting, participants discussed what the Russian teachers felt they needed in the area of energy and sustainability and what the schools in Piteå could contribute.

We also had the possibility to visit two classes and to hold a short lesson about energy. During the first lesson with children 8-9 years old, we explored where the children could find energy and what forms of energy there are, such as sausage energy, which came from eating sausage and then using your muscles.

We brought some small experiments for the students to test. To see the interest and engagement of the students was very inspiring. Later that day, we held a lesson with students, 13-14 years of age, on the same subject, and again it was very interesting to hear the questions and learn more about what Russian students thought about energy and sustainability.

Later we had a discussion with the Russian teachers. One thing we learned was that there were almost no adult men in school and, as we belonged to the "weaker sex", we were a rare sight. Another interesting thing we learned was that doing experiments was not something they did in elementary school.

We also noticed the high technical level in Russian schools, with video projectors and computers in every classroom we saw. This opens new possibilities to cooperate in the future

Meeting, Piteå March 2014

Ten people from Kandalaksha, Apatity and Kirovsk, visited Piteå 24–26 March 2014.

The group got an introduction to Piteå and met with Mayor Helena Stenberg and with the Head of the Education Department of Piteå. There was a brief introduction to regulations and how quality in Swedish schools was measured. A very interesting discussion followed about quality and other school issues, and we can clearly see that we have methodology and everyday life in school, to share with each other.

During the stay in Piteå, the group met and discussed with teachers from all different stages in elementary school. The subjects varied from energy and sustainability to how to work with "difficult" children or how to motivate students. We were very glad to have Valentina Carlsson with us, a teacher of Russian origin who has worked in Russia as a teacher and now works with the youngest students in elementary school

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Wind power excursion

We made one longer excursion, to Markbygden - a wind turbine Plant. Our guide Jonas, from the Wind Power Centre of the Barents Region, followed us to Dragaliden where we saw one of the turbines and Jonas gave a short lecture about the plan to build 1,101 wind turbines in the area!
We learned that wind turbines are rare in Northern Russia, and one of the Russian participants, Tina, who works

at Kirovsk Technical High School, used the occasion to invite Jonas to Kirovsk to lecture.

The group also met our municipal energy engineer, specialised in energy saving.

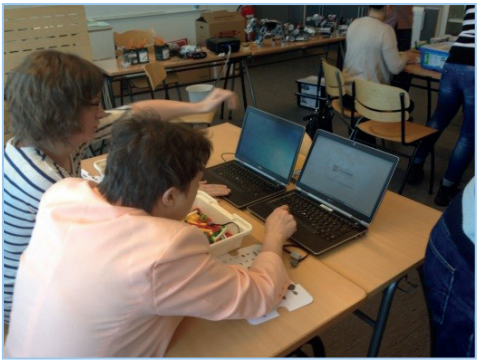
Before our guests went back home, we had a discussion about the next step in our co-operation through the ENERU project.

We agreed to arrange a workshop for the Russian teachers in Kandalaksha, about energy and sustainability, during the autumn. We also decided to use "The sustainable box" with some of the experiments that we had used in our earlier project with Piteå's teachers

Lego

If there is a will to understand, everything is possible. During the visit in Piteå, we saw the Lego Lab where Tony usually educates both teachers and students in using Lego to understand physics, mechanics and energy. An interesting coincidence was that Grigori (one of the Russian teaches), uses the same material in his classes.

Although they did not share any language, Tony and Grigory continued to share ideas and tips through Google translate. Some things were lost in translation, but they both found it possible to communicate that way.



Meeting in Russia, November 3-7 2014

During the autumn, we chose experiments to be used in the coming workshop and translated some of the instructions. Finally, in November, it was time to see how the material and instructions worked in a Russian environment.

Our November trip actually began in Kirovsk, where Jonas gave a lecture to teachers and students at Kirovsk Technical School, about wind energy. The lecture was much appreciated and Jonas stayed for a long time to answer many questions from teachers and students about wind energy. Kandalaksha was our next goal, but before that we made a stop in Apatity

to see their geological exhibition, which included the mantle of the drill that has made the deepest hole ever in the surface of the Earth.

The next day it was time for our study day with the teachers from Kandalaksha. One challenge was the language. Most teachers understood no English and we wanted to communicate how fun and exciting it is to experiment with children in elementary schools.

The content of the workshop was:

1. Based on a report called "Milder winters and longer summers – climate change in Norrbotten", we laid the foundation for the workshop by talking about climate change, consequences and our behaviour. Why we are working with energy. i.e. saving the planet comes before saving money.

2. About forms of energy. A discussion based on a couple of experiments with mechanical toys and a model with angels dancing above candles.

3. The next challenge for the teachers was to build a wind turbine and test how much energy it produced by connecting it to a multimeter and then putting it in front of a fan.

4. Another experiment was to build a motorised propeller and then run the engine backwards. During the experiment, the atmosphere was hilarious and many happy comments were made.

5. The translated instructions Valentina had prepared made it easier. Both Valentina and Tatyana, the Russian Project leader helped us to facilitate the workshop that I think everyone enjoyed, both students and teachers.

6. Tony also presented a couple of experiments about renewable energy that the Russian teachers have in their "Sustainable box", which we had equipped and which they bought.

CHAPTER V
Future Co-operation Possibilities in the Field of Energy Efficiency

Future Co-operation Possibilities in the Field of Energy Efficiency

Energy is at the heart of everybody's life whether it is cooking a meal, driving a car, heating a house, lighting a street or running a factory. It is also a crucial factor for economic competitiveness and employment. At the same time, current fossil-fuel based energy system is unsustainable, not only due to scarce resources, but also because of a negative impact on climate change.

Therefore, the energy efficiency always has been at the heart of the EU policies. Recent economic, environmental and political changes put energy efficiency and security aspects at the very center of attention of the European community. Energy efficiency is seen not only as the essential condition for reducing energy consumption and curbing the negative effects of human activities, but also as the factor fostering energy security.

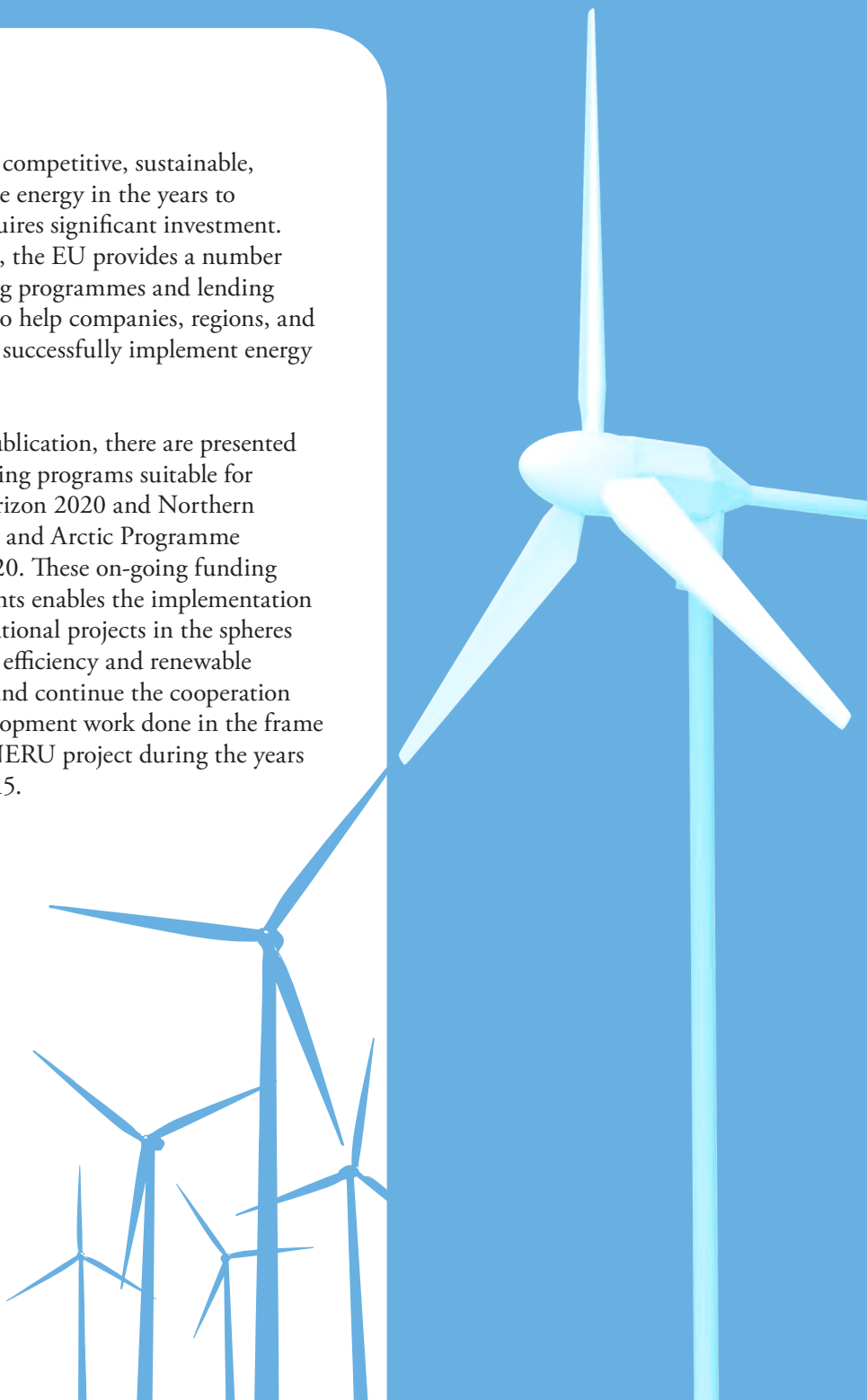
Challenges and realities of today call for increased solidarity and trust, a fully integrated European energy market, decarbonisation of the economy as well as increased efforts as regards research, innovation and competitiveness.

The enhancement of the transition to secure, sustainable, competitive and affordable energy required the EU to set itself tangible milestones. Thus, at first there was put a target of a 20% energy savings by 2020. Recognizing achieved success the EU countries agreed on even more ambitious energy efficiency target of 27% or greater by 2030. Furthermore, in framework for climate and energy policies for 2020–2030, there have been proposed more targets for greenhouse gas emissions reduction and renewable energy as part of the Union's transition to a competitive low carbon economy. This framework also promotes reduced energy dependency and more affordable energy for business and consumers via a well-functioning internal market.

These objectives call for new measures in regards to research and innovation to accelerate energy system transformation and underpin Europe's ambition to become the world leader in renewable energy. It is essential, that the process involve all relevant actors – Member States, industry, research and finance community, consumers and the European Commission - in an integrated approach generating innovative solutions, triggering additional investments also from the private sector, building European industrial capacities for developing supply chains that are responsive to global competition and fostering active participation of citizens.

Ensuring competitive, sustainable, and secure energy in the years to come requires significant investment. Therefore, the EU provides a number of funding programmes and lending schemes to help companies, regions, and countries successfully implement energy projects.

In this publication, there are presented two funding programs suitable for the – Horizon 2020 and Northern Periphery and Arctic Programme 2014–2020. These on-going funding instruments enables the implementation of international projects in the spheres of energy efficiency and renewable energies and continue the cooperation and development work done in the frame of the ENERU project during the years 2013–2015.



HORIZON 2020: Secure, Clean and efficient Energy

Irina Gerashchenko

Horizon 2020 (herein after H2020) is a new European financial instrument, reflecting priorities of the Europe 2020 established with the idea to securing Europe's global competitiveness.

This is the biggest EU Research and Innovation programme so far with nearly €80 billion of funding available over years from 2014 to 2020. The program aims to ensure that Europe produces world-class science, remove barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

Horizon 2020 takes a challenge-based approach giving the researchers more freedom to come up with innovative technology solutions.

The greatest portion of the Horizon 2020 budget (nearly 40%), is allocated to research on the so-called 'Grand Challenges' including health and climate change.

Horizon 2020 is comprised of three main themes or pillars' as the Commission refers them:

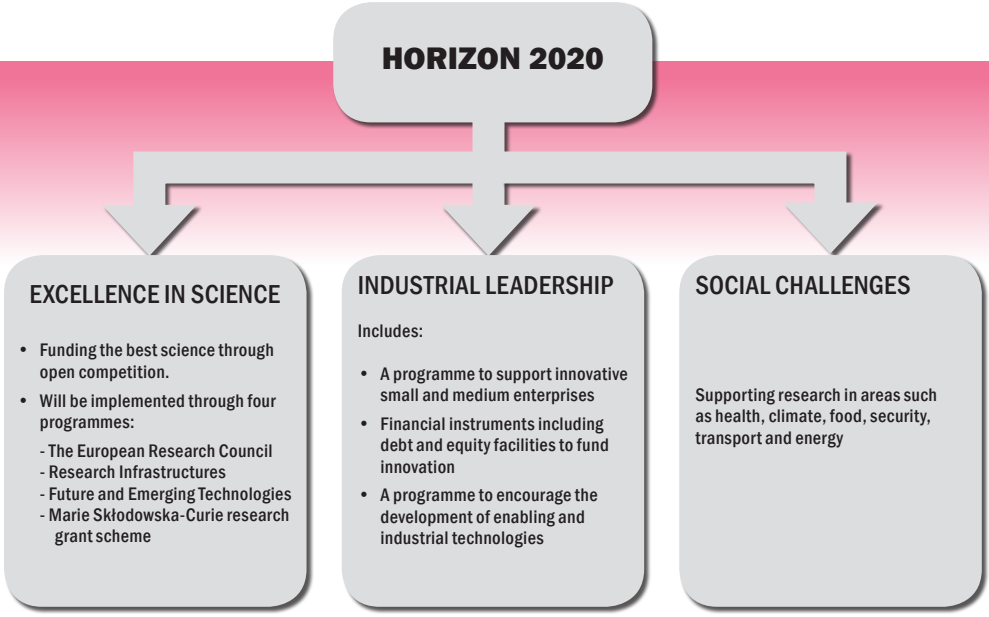


Figure 1. Main themes of Horizon 2020

As shown in the picture, the energy theme is one of seven social challenges identified in the Pillar 3. Section Energy (Secure, Clean and Efficient Energy) covers all aspects of energy apart from nuclear and intends for the projects and initiatives supporting the EU's transition to reliable, sustainable and competitive energy system.

Horizon 2020's 'Secure, clean and efficient energy' Societal Challenge aims for a competitive energy system, through seven specific research areas:

- Reducing energy consumption and carbon footprint
- Low-cost, low-carbon electricity supply
- Alternative fuels and mobile energy sources
- A single, smart European electricity grid
- New knowledge and technologies
- Robust decision making and public engagement
- Market uptake of energy and ICT innovation

Energy subsection is allocated with 7.7% of the overall Horizon 2020 budget, or €5.2 billion. Of this, 85% has been reserved for renewables, energy efficiency, smart grids and storage, with approximately €787 million dedicated to encouraging market uptake. The remaining fifteen per cent of the energy budget will be spent on research in fossil fuel technologies, including carbon capture and storage.

Underlying principles of H2020

Horizon 2020 builds up on three previously separate initiatives - Framework Programme 7 (FP7), the innovation related activities of the Competitiveness and Innovation Framework Programme (CIP) and the EU's contribution to the European Institute of Innovation and Technology (EIT). Despite the fact that H2020 carries certain similarities with those, there are distinctive features, which have to be taken into account when planning.

As in the preceding programs, in the H2020 energy research and innovation continues to play an essential role in addressing the challenge of satisfying security of energy supply, competitiveness of the EU industry and ensuring affordable prices for the citizens, at the same time combating climate change.

However, the significant difference of the H2020 comparing to predecessors is its stronger focus on innovation and close-to-market activities. Industrial participation in the programme is crucial. Given the central role of SMEs as a source of innovation, growth and jobs, this work programme features a number of topics particularly tailored to the needs of SMEs, including one topic for the SME instrument. There are also new instruments devoted to regions with less-developed science infrastructures and to SMEs, which participation is increased.

Open access will be mandatory for published papers based on research funded under Horizon 2020. The EU

says this is part of its effort to promote sharing and collaboration between scientists, to avoid duplication and generate a greater return on public investment.

Thus, today the Horizon2020 is one of the main funding programs for the projects dealing with the energy efficiency issues. The program offers range of the advantages:

- Open calls feature wide range of themes
- Welcomes wide range of partners (academia, industry, authorities)
- Possibilities for synergies with other priorities
- Not limited to specific geographical area, allows participation of all EU countries and Associated states
- Gives the opportunity to experts from the third countries

Applying for Horizon

The program is open to everyone. H2020 funds collaborative projects with at least three organisations from three different EU Member States or Associated countries. H2020 also aims to enhance EU international research cooperation, thus there are possibilities to cooperate with Third Countries. Those possibilities however are mainly limited to the participation of researchers from non-EU countries.

Specific areas and priorities of the Energy section may change every second year and are stipulated in the two-year work programme produced by the Commission. The Energy work program 2016–2017 identified three focus areas, each with its specific goal and targets:

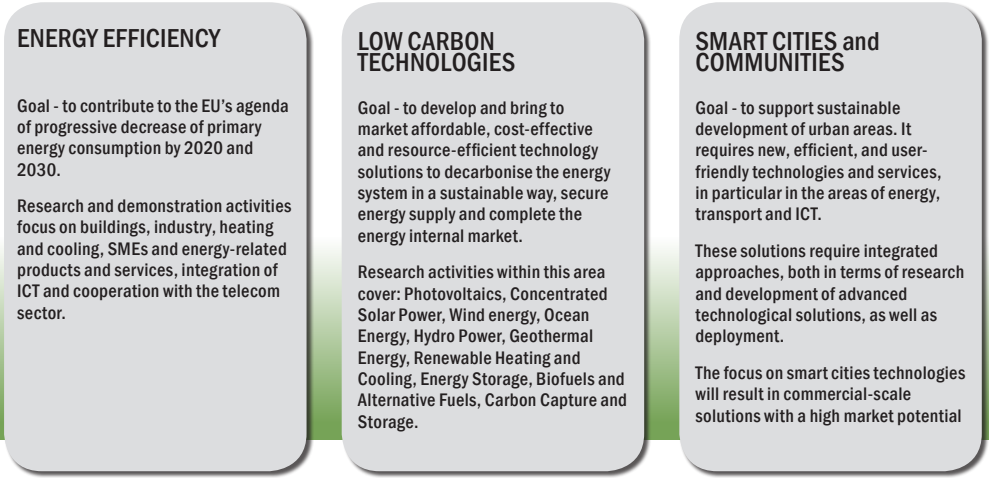


Figure 2. Three focus areas of the Energy work program 2016–2017

From the beginning, it was promised that red tape would be simpler for applicants so participants can focus on what is important. With that, the Commission also wanted to make sure new projects get off the ground quickly – and achieve results faster. The experience of the first year demonstrated that with some exceptions the program generally lived up to that promise.

First of all, the application process became easier in the sense that there is no need for papers anymore. All proposals are submitted online. Calls for the Secure, Clean and efficient Energy get open once in year.

The Commission selects projects following calls for proposals with help from independent evaluators/experts 11. Project ideas must be submitted within a certain deadline, comply with clearly defined themes and have the required partnership structure, which is usually trans-national.

After the deadline has passed, all proposals under a call are thoroughly examined to check their eligibility and to assess their quality. Funding is awarded to the best project proposals that are within the limits of the total available budget. The reimbursement model has also been simplified and a twenty five per cent flat rate system will be implemented for indirect costs.

Furthermore, the time to grant will be shortened to eight months (comparing to average of one year under FP7 – predecessor of the H2020). Within those eight months, the Commission has to inform applicants on the results after five months and allow three more months to sign a grant agreement.

At the same time, pan-European and exclusive character of the H2020 funding puts is in a high demand, which causes extensive competition. The average odds of getting a Horizon 2020 grant in the first 14 months were 15%.

In practice that means, the H2020 project proposals require thorough preparation, sufficient time and have to demonstrate the high scientific and challenge-oriented quality.

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Northern Periphery and Arctic Programme 2014–2020

Milla Hirvaskari

The Northern Periphery and Arctic Programme 2014–2020 (herein after NPA Programme) is part of the European Territorial Cooperation Objective in the framework of cohesion policy, supported by the European Regional Development Fund. During the period 2014–2020, the NPA Programme will allocate approximately 56 million Euros to projects through bi-annual calls.

The NPA Programme forms a cooperation between 9 programme partner countries. The Member States of Finland, Ireland, Sweden and the United Kingdom (Scotland and Northern Ireland) and Non EU Member States Faroe Islands, Iceland, Greenland and Norway. Under specific circumstances it can be accepted that a partner located outside the programme area in particular partners in North-eastern Canada or North West Russia. It is not always that the entire country that participates in the NPA Programme.

Horizontal Principles of the NPA Programme are environmental sustainability, equality and non-discrimination. The Arctic dimension plays a cross-cutting role in the Programme. The NPA Programme have 4 priority axes to achieve the vision of the Programme.

PRIORITIES ARE:

1. Using Innovation to Maintain and Develop Robust and Competitive Communities
2. Promoting Entrepreneurship to Realize the Potential of the Programme Area's Competitive Advantage
3. Fostering Energy-Secure Communities through Promotion of Renewable Energy and Energy Efficiency
4. Protecting, Promoting and Developing Cultural and Natural Heritage

Particularly Priority axis 3 is suitable for the projects aiming to develop energy efficiency and renewable energy solutions in transnational cooperation. Specific objective of the priority 3 is to increase use of energy efficiency and renewable energy solutions in housing and public infrastructures in remote, sparsely populated areas.

Projects to be supported

Projects must address the main challenges and potentials but also fulfill qualitative objectives. Objectives must be concrete, innovative, focused and transnational. The project outputs must be recognizable as a tangible solution, which is most commonly a product

or service. Output must be new or innovative to the partner organizations, the partner countries involved, or to the programme area. The aim of the NPA Programme is that projects must contribute the positive change within the wider programme area, not only for project partners directly involved in the approved projects. The output clearly draws on the result of transnational cooperation, like transferring models, knowledge and technology and partners completing each others' competences and resources.

Examples of supported actions from the NPA 2014-2020 are:

- Facilitating decision-making about the development and use of renewable energy solutions for public infrastructure and housing that are suitable for cold climates and dispersed settlements.
- Developing models to sustainably utilize by-products from economic activities as energy sources for public infrastructures and housing.
- Fostering and facilitating the transfer and development of new energy efficiency concepts and smart energy management concepts for constructing, maintaining and running housing and public infrastructures which are suitable for cold climates and dispersed settlements. This includes the use of ICT technologies for the energy efficiency such as smart metering, and other energy efficiency measures.

Available funding in the NPA 2014-2020 Programme

The NPA Programme will allocate funding to projects with a total budget between 250 000 EUR and 2 MEUR. Projects must provide at least 35–40% of the total project costs through own or national or regional sources. The share of match funding depends on the country where the partner is located. The national match funding can include both national public funding and national private funding in Axes 1 – 3. SMEs always have to match fund a minimum of 50% of their costs.

The NPA Programme values cooperation with partners outside the programme area if this benefits the programme area. If the project would not be able to achieve its objectives without partners from external areas, and external cooperation will bring added value for the project, external partners are possible to include but adequate justifications are needed to provide. This so-called geographical flexibility could be used to support cooperation with northern peripheral regions in North West Russia and North East Canada, but may also support other regions outside the Union part of the programme area.

Target groups

Main target groups in the priority 3 are local communities, the public sector and local companies in the field of energy efficiency and renewable energy solutions for housing and public infrastructure. The involvement of the private sector, primarily small and medium sized enterprises (SMEs), is encouraged as the

contribution that private sector can make to a project is valuable. Private sector partners can participate as full partners to the NPA projects. SMEs are able to be recipients of aid in projects as a partner or direct recipient under any notified State Aid Scheme or GBER (General Block Exemption Rules) or de minimis rules applicable to the region in which the activity is being undertaken.

Partnerships should involve a cross-sector of partners from the national, regional and local level, using so-called triple helix model in the development. A triple helix partnership provides an ideal networking solution to utilize the competences from the academia, public and business sectors in the development of new products, services and methods.

Partnerships in the NPA 2014–2020 has four types of partners: Lead Partner, Project partner, associated partner and sub partners. For main projects, at least three eligible project partners from three different programme partner countries are required, of which one must be from an EU Member State. Genuine transnational cooperation and successful results can be achieved by multinational projects with the correct mix of transnational partners.

Associated partners are not part of the formal partnership, but they are directly involved in the project's implementation for various reasons. To avoid the administrative burden of full project partnership, in some cases it is easier to involve companies in the project as associated partners. If an organisation has an important role in the implementation of the project outcomes, it is expected to participate as a full partner where possible. If the partner contribution to the project is relatively small they can join to the project as a sub partner. Any sub partner construction should be appropriate and well justified.

Preparatory Projects

Prerequisite for successful project is a strong and well balanced project partnership. However in planning phase often costs and distance are obstacles potential partners to meet and form strong partnership. Preparatory project enables to bring potential project partners together and examine the need for the project outputs among end users and stakeholders and to build up strong transnational partnerships. The purpose is to develop project ideas in a more specific and focused direction and to prepare high-quality main project applications. Generally a preparatory project runs for up to 6 months. However, the Monitoring Committee may decide on other arrangements on a call-by-call basis.

There are several minimum requirements for the preparatory projects. The preparatory project must involves a minimum of 2 partners from 2 different programme partner countries, one of which must be located in a European Union Member State, an eligible Lead Partner and eligible match funding in place, completion of the preparatory project application form and financial information for all partners.

The processing time of the application is approximately 6 weeks. Submissions for preparatory projects is continuous.

Budget for the preparatory projects can normally have a total budget of up to 45 000 EUR, and a grant rate of 65% of eligible costs applies to all partners (both Member State and Non Member State). A preparatory project is intended to lead to an application for main project funding in the Northern Periphery and Arctic Programme 2014–2020.

Photo: © Rodeo.fi

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Energy Technology Focus Areas in 2020

Petri Kuisma

The European Union's main themes in the energy sector in 2020 will be improvement of energy security, creation of an internal energy market, enhancement of energy efficiency, low carbon in the energy sector as well as research, development and innovations. Increasing the use of renewable energy and improvement of energy efficiency will, along with emission reductions, promote the energy security in the EU by replacing imported energy. They will also promote innovations and cleantech.

Finland's special strength is that, among other things, our businesses have long-standing know-how in developing energy efficient solutions and potential for the export market.

The ENERU – Efficient Energy Management in the Barents Region project being implemented between 2013 and 2015 has carried out multi-sector co-operation in the energy industry to improve energy efficiency in the Barents region. The ENERU project surveyed the current situation of energy management in the South Kola region and conducted a survey of investment needs in the cities of Kandalaksha and Kirovsk in Russia. The project studied the thermal behaviour of pilot buildings, energy consumption and new technologies used to regulate heating systems in the buildings. An action plan for the future was carried out in the project to improve energy efficiency and reduce the use of fossil fuels in the target area. The use of renewable energy sources in the area and the business opportunities it would bring were also assessed. The future action plan and energy audit method developed for the target area are practical tools to improve energy management in the South Kola region.

The development of energy efficiency and planning of future actions should accommodate the EU's visions for the future. The Energy Performance of Buildings (EPB) energy technology specialisation course addressed future energy issues, with themes including energy use and energy efficiency in buildings as well as the impact of building services engineering systems on energy efficiency. These themes and perspectives were also included in the ENERU project's development.

Heat load more harmful than before

The elimination of extra heat loads is based on successful regulation in buildings. Comfort and low energy consumption can be regarded as the main criteria in regulation. In future, the emphasis in development measures must be more in methods that are proactive and utilise weather forecasts. The application of smart and learning

methods, among others, in regulating heating systems in the pilot buildings is under investigation. Future projects should investigate the regulation of heat and ventilation curve settings in current buildings in any new pilot locations.

Attention should be paid to set points and they should be changed to correspond to the original design values. Premises involved in the project lacked radiator thermostats, and therefore these were obtained for some of the properties in order to improve energy efficiency. In future, attention should be paid to radiator thermostatic valves and correct set points for them to enhance energy efficiency. Future development measures should consist of balancing of the heating system in respect of the existing system. A simulation model should be prepared for simulating energy use in buildings for the buildings in Kirovsk and Kandalaksha. It would be ideal if two properties in both cities could be obtained as targets. Simulation would provide information on the impact of adjustment and modification work on the building's energy use.

Importance of solar energy in the future

Under the current legislation it is not worth considering that utilisation of the solar power that is currently generated could be made use of in domestic consumption. Future projects should examine Russian legislation more closely in respect of renewable energy sources. In Finland, overproduction of solar power is sold or, in the case of small-scale systems, in practice donated to the electricity network of an energy company. A compensatory payment is generally the price compliant with the electricity exchange – the broker fee. In other words, the energy company pays compensation of a few cents per kilowatt hour for solar electricity fed into the network. In addition to this, there is often a monthly charge. Decision-makers seldom have a commercial or political interest to take into account small-scale electricity suppliers by paying them reasonable compensation for the electricity supplied. This slows down the spread of small-scale generation. In other words, experts consider that the role of solar energy will not play a crucial part in energy production in future either. In the Kirovsk and Kandalaksha region, the amount of solar radiation on an annual level is nearly the same as in Finnish Lapland.

Problems in service buildings

The problems in repair and maintenance work in service buildings have become even more apparent recently. There have been problems especially in the indoor air quality of schools and day-care centres. Schools, for example, are used in a wide variety of ways, and special requirements are set for their functionality. At the end of the day's teaching, the schools' facilities are used by hobby groups, etc. Air conditioning timers should be set correctly in order to ensure that indoor air quality remains good. Follow-up projects should more extensively look into improving energy efficiency in Russian buildings and ascertain building design. In addition, attention should be paid to the method of constructing houses and to investment and operating costs. The functionality of space solutions, the moisture control

function of structures and indoor air conditions are also important. In Finland, the aim is for new public buildings being taken into use from the beginning of 2019 to be built as nearly zero-energy buildings.

The construction magazine "Rakennuslehti" reported on 28 November 2014 that "The nearly-zero E-number based on the delivered energy of an office building would seem to be settling at 90 kWh per square metre per year." This is the energy form coefficient weighted consumption of delivered energy. Consumption is based on standard use by a normal building. The present consumption by an office building is approximately 170 kWh/m2a. Schools and day-care centres have the same level of consumption. Consumption in apartment buildings, however, is approximately 130 kWh/m2a.

The Finzeb (Finnish nearly zero-energy building) project has addressed the requirements necessitated by the Energy Performance of Buildings Directive. The Finzeb zero-energy analysis will be based on the balance calculation for the limit value of developed heating capacity, the limit value of energy consumption, the limit values of the nearly zero E-number for different types of buildings with current energy form coefficients as well as on the specification of the minimum level of renewable energy. The energy certificate's A class is not the same as the "nearly-zero limit value." The nearly zero-energy target has not yet addressed locally generated renewable energy. Inclusion of renewable energy will lower the E-number of a building.

Photo: Mikko Korhonen / Vastavalo.fi

The "nearly zero-energy" regulations will enter into force at the beginning of 2017 and will be applicable at the beginning of 2018. Follow-up projects shall compare the Finnish energy certificate and the new changes in the Russian energy passport with each other. The new specific consumptions differ from the present values as follows:

	E-number limit D3/2012	Proposal with nZEB-E figure	Change from present
Single family houses	160...204	120...204	
Apartment buildings	130	116	-11%
Office	170	90	-47%
School	170	104	-39%
Day-care centre	170	107	-37%
Commercial building	240	143	-40%
Sports hall	170	115	-32%
Accommodation establishment building	240	182	-24%
Hospital	450	418	-7%

Source: www.finzeb.fi

Desire to improve energy efficiency

The future will set major challenges for energy production. Climate change and population growth will affect production. People will live in smart housing and drive electric cars. Finland will have a carbon-neutral energy system and a smart electricity transmission grid. The majority of buildings will be plus energy houses whose energy efficiency will be continuously improved.

Construction in the future will develop new options for heating systems and hybrid systems will become more common and diversify. Building engineering systems will evolve and need-based controls will play a key role in achieving energy efficiency. Lighting, cooling and renewable self-sufficient energy systems will develop the most rapidly. For the purpose of studying the energy efficiency of buildings, construction of pilot sites in the Kola or Lapland region should be considered in the future. Planning in follow-up projects is facing a considerable challenge: where and how can suitable professionals to solve future challenges be found and trained?

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Kolarctic ENPI CBC | CROSS-BORDER COOPERATION

Länsstyrelsen Norrbotten

REGIONAL COUNCIL OF LAPLAND

Photo: © Rodeo.fi

Multidisciplinary Approach to Develop Energy Efficiency in the Barents Region

This publication is an outcome of the cross-border project ENERU – Efficient Energy Management in the Barents Region, funded by the Kolarctic ENPI CBC programme and Länsstyrelsen Norrbotten. The project was implemented by the multidisplinary consortium of organisations involved in the field of energy management in Finnish Lapland, Norrbotten, Sweden and the South Kola region in Russia. The primary goal of the project was to strengthen cross-border co-operation in the energy management sector and particularly to increase business co-operation in the Barents region.

The purpose of this publication is to raise the awareness about the current situation and development prospects in the energy efficiency sector in the Barents region. The publication recaps the main results and findings of the ENERU project.

It includes summaries of market surveys from the partner countries, measurement trip reports, and reports on renewable energy potential in the target region. The publication comprises articles by project experts on current and future co-operation possibilities in the field of energy efficiency.

ENERU publication provides useful information for the broad range of stakeholders - experts, professionals, businesses, public authorities - all those involved in the field of energy efficiency on the daily basis. The presented materials give stakeholders useful ideas and prospects for the future cross-border cooperation in the field.

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