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Developing a Regional Cooperation for Renewables in the Electricity Sector

The Example of the Baltic Sea Region

By **Mats Abrahamsson**

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Edited by the Heinrich Böll Foundation

About the author

With a background in social anthropology, Mats Abrahamsson has worked most of his life in the international environmental and civil society movement. He spent 16 years as a campaigner for Greenpeace, including as a coordinator of the international climate campaign. Between 2003 and 2007, Abrahamsson worked as a freelance consultant specializing in environment and energy issues. Since 2008, he is the founder and Executive Director of FACTWISE, a public interest-oriented research group specializing in community development and change.

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Heinrich-Böll-Stiftung, Schumannstr. 8, D-10117 Berlin, Germany
P +49 30 28534-0 **F** +49 30 28534-109 **E** info@boell.de **W** www.boell.de

CONTENTS

List of Tables

PREFACE

Europe has the potential to generate all of its electricity from renewable energy sources if it combines its diverse natural potentials. The Heinrich Böll Foundation has strongly promoted such a European approach in the past years. In our study on a European Community for Renewable Energy (ERENE), published in 2008, we presented a concept how 100 % renewables in the EU are possible by the year 2050 if the EU member states work together. Since then, a number of studies have confirmed the feasibility of our findings. The EU is already on its way to changing the production of its electricity, and to investing more into renewable energy. Business and politics have in the last years begun to initiate large scale European cooperation projects, most notably Desertec and the North Sea Grid Initiative. While our overall objective remains that all member states of the European Union should combine their potential, these examples show that there will probably be regional approaches as a starting point.

In this paper we therefore take a closer look at a region that could be a pioneer for regional cooperation in the EU: the Baltic Sea Region. As the first region with a European Union regional cooperation initiative – the EU Baltic Sea initiative – and with a long-lasting tradition of cooperation, this region could play an essential role in showing the EU the way forward by sharing their large potential of diverse renewable energy sources.

We have asked Mats Abrahamsson from the think-tank factwise in Stockholm to examine the already existing cooperation mechanisms in the Baltic Sea region, to analyze how well they function and how they could be developed further to fully use the regional renewable energy potential. We hope that with this paper we can contribute to the discussions on how regional cooperation can help pave the way for a new European energy system based on 100 % renewables.

Berlin, June 2011

Ralf Fücks
Executive Board of the Heinrich Böll Foundation

Bastian Hermisson
Head of EU/North America Department

INTRODUCTION

As a proponent of renewable energy, one may often be asked questions like: "Is it possible to replace all our energy sources with renewable production?" Or: "Can we really phase out both fossil fuels and nuclear power at the same time?"

The answer is easy: "Of course we can, it is just a matter of cost." As "costs" we would include both financial costs (as in the cost to cover a certain percentage of the land with solar panels) and *external* costs. Among external costs we may have to include items like the loss of valuable land for food production (to produce bio-fuels), the loss of habitats for both wildlife and people (to build large-scale hydro-power), or the social unrest that could be the result of a forced, socially unaccepted development of wind power.

We may even conclude that the questions were the wrong ones. More relevant questions would be: "How long will it take us to change energy production to 100 percent renewable without unacceptable costs to society?" Or: "What are the most cost-efficient measures to promote renewable energy if we include external costs in the calculations?"

This paper will not be able to give exact answers to these questions, but it will attempt to provide some first steps to how they can be approached in the context of electricity production in the Baltic Sea region.

As a starting point, the paper lists some of the most important actors and processes in the field of renewable energy in the region. It goes on to provide an overview of some of the measures and mechanisms already in place – or in the making – for the region to promote the use of renewable energy sources. Further, it analyzes to what extent these measures are sufficient to make full use of the region's potential. Finally, we try to identify some gaps in renewable energy policy in the region and give some recommendations on further policy development.

It is our hope that this discussion paper will be used as inspiration in the development of a scenario of regional cooperation to make the Baltic Sea region a forerunner and showcase for the rest of the world in the field of sustainable energy production.

Energy cooperation in the Baltic region

Energy policy in the region is largely dictated by EU policies, in which the Baltic Sea Strategy is one focal point for development of the region. Within this framework and its objectives, there are a number of initiatives to create a common energy and electricity market as well as an integrated grid, but none of them are dedicated to the purpose of maximizing or developing the full potential of renewable energy in the region. These schemes typically aim primarily at creating a common grid and market, while accommodating for an expansion of renewable electricity in line with (but not above) the EU 20/20/20 objectives.

Apart from the EU initiatives on energy, particularly renewable energy, there are no official or specific regional programs to promote renewable energy. However, the Nordic and Baltic states are cooperating on energy issues under the auspices of the Nordic Baltic 8 (NB8 – see below) and have recently launched an initiative to accelerate cooperation on energy efficiency and the deployment of renewable energy in the region.

Within the framework supplied by EU energy policies, regulation and policies are mostly based at the national level and are very disparate – the exception being the Nordic energy market, which is converging with a potential to expand into the whole Baltic region. The same is valid for the development of transmission systems, which is mainly driven by EU programs – again the Scandinavian countries are an exception.

On the policy level, there is a widely held consensus that energy policies and transmission systems must harmonize, with the aim being to create a common market and energy grid. However, differences in market structure, pricing, technology, political and public awareness, etc., are obstacles to overcome in order to create the common market and grid, as well as joint programs and schemes for the utilization of renewable energy.

In this context it should be realized that the Scandinavian countries (Sweden, Norway, and Denmark) have a long history of political cooperation, while the Baltic nations and Poland for many years were dominated by Soviet policies and technology, causing a rift along the Baltic Sea. Although these countries are now EU Member States, there are still great differences in approaches to energy policy between the nations on the eastern and western shores of the sea.

Nevertheless, there are a large number of organizational, technical, and political bodies and initiatives for cooperation in the energy sector in the Baltic

region. They represent many ongoing projects in the making. Below is an assessment of those that we believe to be the most important and influential. It should be noted that some of them concern grid development while others are in the field of policymaking. Some cover both.

For natural and practical reasons, we have chosen to include Norway but not Russia in this discussion paper. Norway is increasingly becoming integrated in regional energy cooperation through its integration in the Nordic energy market. The northwestern parts of Russia have a certain level of integration – especially with the Finnish and Baltic countries' energy systems – but as a nation, Russia acts more independently in the development of policy and regulatory frameworks.

Currently, most of these actors and processes work independently from each other without much coordination or shared framework.

The European Union

The Baltic Sea is surrounded by nine nations: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, and Sweden. All but Russia are members of the European Union. Hence, European energy policy is the main political influence in the region.

In 2007 the European Council adopted energy- and climate change objectives for 2020: to reduce greenhouse gas emissions by 20 percent (rising to 30 percent if the conditions are right); to increase the share of renewable energy to 20 percent; and to make a 20 percent improvement in energy efficiency. The European Council has also given a long-term commitment to the decarbonization path with a target for the EU and other industrialized countries of 80 to 95 percent cuts in emissions by 2050.

Clearly, the EU is the main driver of renewable energy policy in the Baltic Sea region. No major developments in this area will happen without the active support of the EU.

Norway

Although Norway is not part of the European Union, it is heavily influenced by European energy policy. The EU Renewable Energy Directive is also applicable to this country by virtue of the 1994 European Economic Area (EEA) Agreement, to which Norway is a party. The percentage by which Norway will have to increase its share of renewable energy in its energy production is currently being negotiated within the framework of the EEA Agreement.

Norway's position on energy issues is mixed, as it is both a major producer and exporter of fossil fuels (oil and gas) and a large-scale producer of renewable electricity through its almost total dependence on hydro-power for its electricity production.

The EU Strategy for the Baltic Sea region

Within Europe, the Baltic Sea region has had a special standing ever since the EU adopted its first regional strategy for the macro-area, which covers several community policy areas, the EU Strategy for the Baltic Sea Region, and the Baltic Sea Strategy. The Baltic Sea Strategy is accompanied by an Action Plan, covering some 80 projects under four main objectives, all aimed at making this part of Europe more:

- environmentally sustainable (e.g., reducing pollution in the sea);
- prosperous (e.g., promoting innovation in small and medium enterprises);
- accessible and attractive (e.g., providing better transport links);
- safe and secure (e.g., improving accident response).

Several of the projects covered by the Action Plan, adopted in 2009, concern energy issues, such as developing renewable energy production and improving energy efficiency. Some of these projects have had a slow start, but the Plan is currently under review, and in the future, energy security, energy efficiency, and renewable energy may be further emphasized.

The context of the Baltic Sea Strategy with its projects provides an arena for testing and piloting new initiatives on energy-related issues. This arena has not been fully explored and has a potential to become more of an influencing force in energy policy development.

The European Network of Transmission System Operators for Electricity

There are 46 transmission system operators (TSOs) in 34 European nations. Historically, the TSOs have been organized in six different associations. With the launch of the third European Energy Package and the aim to create a common energy market, there has been a need to bring the TSOs together under one association, The European Network of Transmission System Operators for Electricity (ENTSO-E), which recently has substituted the six predecessors. Accordingly, all TSOs in the Baltic Sea region (including Norwegian Statnett) are now integrated in the ENTSO-E.

In April 2010 ENTSO-E presented its first pilot Ten-Year Network Development Plan.[1] The Plan presents a proposal for electricity transmission infrastructure investments across 34 European countries. In accordance with EU Regulation (EC) 714/2009 on cross-border electricity exchanges, the Plan is non-binding and to be updated every two years.

This first release of the Plan puts forward a total of close to 500 investment projects, worth Euro 23-28 billion over the first five years. A number of the projects are located in the Baltic Sea region, which is considered a strategic region, with emphasis on Poland and Germany.

The objectives are to ensure transparency regarding the electricity transmission network and to support decision-making processes at the regional and

1 https://www.entsoe.eu/system-development/tyndp/.

European levels. ENTSO-E calls the Ten-Year Plan "the most comprehensive and up-to-date European-wide reference for the transmission network." It points to significant investments in the European power grid in order to help achieve the following European energy policy goals:

- increase the use of renewable energy sources to 20 percent of total energy production by 2020;
- further promote the Internal Energy Market by alleviating congestion on the transmission network;
- ensure security of supply and system reliability across the ENTSO-E area.

As an actor on energy policy, ENTSO-E naturally has an interest in matters relating to the development of the power grid, but also in issues relating to the security of supply, including diversification of energy sources. ENTSO-E has an official policy of promoting the "secure integration of new generation sources, particularly growing amounts of renewable energy and thus the achievement of the EU's greenhouse gases reduction goals."

As a representative of all major European grid operators, ENTSO-E is a powerful actor and should be engaged in any initiative to promote the development of renewable energy sources in Europe.

The Baltic Energy Market Interconnection Plan

Effective interconnection of the Baltic Sea region was identified as one of the six priority energy infrastructure projects in the Second Strategic Energy Review adopted by the EU Commission in November 2008. To this end, the Baltic Energy Market Interconnection Plan[2] (BEMIP) was launched in fall 2008 at the initiative of the Commission at the European Council.

The main goal of the BEMIP initiative – within the context of the EU's 20/20/20 objectives – is the full integration of the three Baltic states into the European energy market, through the strengthening of interconnections with their neighboring EU countries.

A High Level Group has been set up with the participation of Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden, and, as an observer, Norway. The Group, chaired by the Commission, started to meet in November 2008 and delivered an action plan by June 2009. Working groups on electricity and gas, as well as external consultants, supported the work.

The BEMIP also forms part – as two flagship projects on market integration and infrastructure development, respectively – of the Baltic Sea Strategy.

BEMIP has several working groups developing the cooperation. In 2009 the parties agreed on a Memorandum of Understanding[3] covering issues such as creating an integrated energy market, developing infrastructure and connections, etc.

2 http://ec.europa.eu/energy/infrastructure/bemip_en.htm.

3 http://ec.europa.eu/energy/infrastructure/doc/2009_bemip_mou_signed.pdf.

BEMIP's first priority is to establish a number of electricity interconnections and gas pipelines between the Baltic states and their neighboring EU Member States. BEMIP's concern is market integration and energy security, and it has no specific objectives relating to renewable energy. Its importance to regional initiatives on renewable energy can be served by providing needed infrastructure.

The Nordic energy grid and market

The Scandinavian energy grids and markets have been converging over the past decade. Today this common market – Nord Pool – constitutes the largest market for electrical energy in the world. Integration began with cooperation between the Norwegian and Swedish TSOs – Statnett and Svenska Kraftnät – and has today developed to also include Finland and Denmark, although the major players in grid development are still the Swedish and Norwegian TSOs.

Jointly, Svenska Kraftnät and Statnett have been developing the Nordic grid and have a number of ongoing projects in the making. The primary focus is on Scandinavian connections, but reinforcements to Finland, the Baltic nations, and Denmark are also developing quickly.

Recently, the TSOs presented a Swedish-Norwegian Development Plan,[4] which also envisions expansion of the electricity grid and market to the whole Baltic region. The Plan is considered to be a supplement to the Ten-Year Network Development Plan of ENTSO-E.

The aim of the proposal is to provide a stable grid that accommodates for the introduction of a larger amount of electricity from renewable sources, mainly wind power. The proposal is dubbed "a planning tool" for the TSOs and will be developed continuously.

The proposal builds on three possible scenarios with a varying amount of renewable energy. In the two scenarios with a higher amount of renewable energy – the highest being in line with EU 20/20/20 policies – it is predicted that the Norwegian-Swedish transmission grid will have a large surplus: 30 and 40 TWh annually in the year 2020.

A prerequisite in these scenarios is that the system of Tradable Green Certificates or Renewable Energy Certificates – a quota obligation scheme currently used in Sweden and about to enter into force in Norway in 2012 – is functioning according to plan.

There is a strong driving force toward deregulation and integration of electricity markets in the Nordic region. Combined with the high level of renewable energy sources, the Nordic region can be an important actor in the development of a renewable energy market in the Baltic Sea region.

4 http://www.svk.se/PageFiles/42341/Swedish-Norwegian-Grid-Development-Three-Scenarios.pdf.

The Council of the Baltic Sea States

The nations around the Baltic Sea also cooperate on energy and environmental issues through non-EU political bodies. The Council of the Baltic Sea States (CBSS) is one of them, an overall political forum for regional intergovernmental cooperation. The members of the Council are the eight EU Member States in the Baltic Sea region, Russia, Norway, and Iceland. The European Commission also has a representative in the Council.

The Council consists of the Ministers for Foreign Affairs from each Member State and a member of the European Commission. The Presidency of the Council rotates among the Member States on an annual basis. The role of the Council is to serve as a forum for guidance and overall coordination among the participating states.

Energy- and climate-related issues are one of CBSS' five long-term priorities. To this end, the Council has established the intergovernmental Baltic Sea Energy Cooperation.

The Baltic Sea Energy Cooperation

In 1998 CBSS established the intergovernmental Baltic Sea Region Energy Cooperation (BASREC), which has become an important political platform. The cooperation is strictly on a policy level and basically aims to harmonize policies. Ministerial meetings – where Energy Ministers issue statements and define the political roadmap – are held every three years.[5] The next ministerial meeting is expected to take place in 2011.

BASREC's main objective is "to promote sustainable growth, security and prosperity in the region and therefore supports the creation of competitive, efficient, and well-functioning energy markets." BASREC has defined the following energy policy topics in order to meet global energy policy and climate policy challenges:

- security of energy supply;
- development and integration of energy infrastructure in the region;
- energy efficiency and savings;
- increased use of renewable sources with specific focus on the forms of energy potentially dominant in the region;
- increasing renewable sources in the heat market;
- rehabilitation and development of district heating systems and combined heat and power (CHP) in order to facilitate the use of biomass;
- development of clean coal technology.

Even if BASREC does not have any legally binding mandate, it can be a very important high-level platform for discussions and development of renewable energy policy in the region.

5 http://www.cbss.org/Energy/creating-a-secure-efficient-and-renewable-energy-market.

The Nordic Council of Ministers

The Nordic Council of Ministers, established in 1971 in an attempt to create Scandinavian economic cooperation, is the official cooperation body of Denmark, Finland, Iceland, Norway, and Sweden. Today, the Council is active on a large number of issues, notably in this context energy,[6] climate, environment, forestry, agriculture, sustainable development, innovation, taxation, and others. The Council takes initiatives – such as the creation of the Nordic energy market – funds research, issues reports and policy documents, holds workshops and conferences, etc.

Earlier this year, the Council issued an Action Program for Nordic cooperation on energy policy 2010–2013.[7] The plan covers many policy areas and aims to:

- enhance the harmonization of the Nordic electricity market;
- increase the proportion of renewable energy in energy systems;
- ensure the efficient use of energy resources;
- contribute to the development of innovative energy technologies;
- improve the efficiency of the transport sector and develop green fuels.

The basis for the development of renewable energy into the system are the EU 20/20/20 objectives. Among the action points in the plan, one is to "further develop the cooperation with the Region's neighbours, particularly the Baltic states and North-West Russia."

The formal status of the Nordic Council is a "parliamentary co-operation forum," acting as an advisory body for the Nordic governments. The Nordic Council has a long history as an important platform for policy development and harmonization in the Nordic region.

NB8

An offshoot of the Nordic Council of Ministers is the Nordic Baltic 8 (NB8) – an agreement for cooperation between the five countries of the Nordic Council and the three Baltic nations (Estonia, Latvia, and Lithuania) around a few areas of priority. In spring 2010 Latvia and Denmark – in their capacities as the presidents of the Baltic Council of Ministers and the Nordic Foreign Policy Cooperation, respectively – decided to establish a "Wise Men's" group to look into how to advance cooperation in order to strengthen relations and address common regional and global challenges more efficiently. One of the first tasks of the group was to make suggestions regarding which policy areas to prioritize and how to move forward. The Latvian and Danish foreign ministers, Valdis Birkavs and Søren Gade, led the process.

Their report, *The Wise Men's Report*,[8] was presented to the Nordic Council in August 2010. One of the proposed areas of priority is energy. On this topic the

6 http://www.norden.org/en/areas-of-co-operation/energy.
7 http://www.norden.org/en/publications/publications/2009-777.
8 http://www.mfa.gov.lv/data/nb8%20wise%20men%20report.pdf.

report states that there has been too little emphasis on energy efficiency and the deployment of renewable energy in the region. To accelerate this, the Wise Men suggest the establishment of a high-level working group in the region with a representative from each of the countries. The working group should present an action plan with specific recommendations for the expansion of renewable energy sources and improved energy efficiency in the NB8 countries. Finance is considered to be a key issue and the Nordic Investment Bank is mentioned as a possible partner. The report also mentions the possibility of further cooperation on research and development in the region but makes no specific proposal regarding how this should be developed.

Also, the NB8 should be seen as a potentially important platform for discussions and development of energy policy. As a form of "think tank," it can have a profound influence on developments.

The Baltic Development Forum

Possibly the most influential nongovernmental organization in the region is the Baltic Development Forum (BDF), an independent networking organization with members from large companies, major cities, institutional investors, and business associations in the Baltic Sea region. BDF works with a wide range of partners, including business, governments, regional organizations, as well as research and media institutions.

The organization calls itself "the leading high-level and agenda-setting networking organisation in Northern Europe." As such, they facilitate and develop new initiatives, partnerships, and international contacts to stimulate growth, innovation, and competitiveness in the Baltic Sea region and its 11 countries. It regularly publishes reports on a number of issues – for example energy – and stages conferences and other events, often in cooperation with CBSS.

The network involves more than 6,000 decision-makers from all over the region and beyond. The mission of the Baltic Development Forum is "to promote the Baltic Sea region as an integrated, prosperous, and internationally competitive growth region."

BDF is chaired by Uffe Ellemann-Jensen, Minister for Foreign Affairs of Denmark 1982–1993. Mr. Ellemann-Jensen is co-founder of the Baltic Development Forum (as well as of CBSS). The Baltic Development Forum Honorary and Advisory boards consist of high-level political dignitaries and prominent business executives representing the entire Baltic Sea region.

"Being the preferred platform for decision-makers from business, politics, and academia, Baltic Development Forum is a unique platform for innovative thinking, informal cross-sector/cross-border/cross-level encounters, and concrete new business opportunities with a global perspective."[9]

9 http://www.bdforum.org/show/english/organisation.aspx.

In 2009 BDF issued a comprehensive report[10] on energy issues in the region together with the Nordic Council of Ministers and Ea Energianalyse a/s: *Sustainable Energy Scenarios, Energy Perspectives for the Baltic Sea Region, Setting an Agenda for the Future*. Arguably, the report may be one of the most informative documents available on the issue today, as it takes a 2030 perspective, includes a scenario where the EU extends its climate objective to a 30 percent reduction, and includes a number of important statistics.

Although BDF's main focus is on growth and economic development, the organization could be an important and highly influential partner in the promotion of renewable energy in the region.

The Baltic Sea Parliamentary Conference

The Baltic Sea Parliamentary Conference (BSPC) is a forum for political dialogue between parliamentarians from the Baltic Sea region. The BSPC aims at raising awareness and opinions on issues of current political interest and relevance for the Baltic Sea region. It promotes and drives various initiatives and efforts to support a sustainable environmental, social, and economic development of the Baltic Sea region.

The BSPC gathers parliamentarians from 11 national parliaments, 11 regional parliaments, and 5 parliamentary organizations around the Baltic Sea. The BSPC thus constitutes a parliamentary bridge between all the EU and non-EU countries of the Baltic Sea region.

BSPC's external interfaces include parliamentary, governmental, sub-regional, and other organizations in the Baltic Sea region and the Northern Dimension area, among them CBSS, Helsinki Commission (HELCOM), the Baltic Sea States Sub-regional Cooperation (BSSSC), and BDF.

The organization has a working group on energy and climate change that published a policy recommendation document[11] in June 2009. The main point is to radically transform the energy system in the region and make the focus of this effort the ongoing revision of the Baltic Sea Strategy's Action Plan. In short, the recommendations of the Conference are to:

- develop a coherent energy strategy for the Baltic Sea region;
- launch Action Plans for CHP and housing innovation;
- use the economic crisis as an opportunity;
- establish a regional educational approach.

The BSPC can be an important platform for discussions and a contact point to reach parliamentarians in all Baltic Sea countries.

10 http://www.bdforum.org/show/english/reports_publications/research_reports.aspx.
11 http://www.bspc.net/file/show/126.

Support schemes for renewable electricity

Although renewable energy sources are the only sources of energy that are sustainable in a longer perspective, short-term perspectives favor other – non-sustainable – sources such as fossil fuels and nuclear power. To change this situation, there is a need to find support mechanisms that ensure deployment of renewable energy and the phase-out of unsustainable sources.

This holds true also in the Baltic Sea region. The convergence of the markets into a single Baltic energy market carries a potential to simply open up the possibility for more unsustainable generation of electricity. Hence, harmonization has often meant harmonizing downward. For example, a few years ago Finland was planning to extend its national CO_2 tax to the generation of electricity, but scrapped these plans since Sweden has no such tax and also had no intention of introducing one.

Any plan to vastly increase the deployment of renewable energy in the Baltic Sea region beyond the EU 20/20/20 objectives (and possible even to meet those objectives) requires an extensive and efficient policy of support throughout the region.

There are a number of ways for governments and authorities to promote the introduction and expansion of renewable energy sources on the market. These fall into four main categories: feed-in tariffs, quota obligations, tendering procedures, and fiscal incentives. Currently, all are being used in the Baltic Sea region, with great variations in system design and financial incentives, which is not practical in the development of a common energy market.

Regardless of whether a national or an international support system is considered, it should be emphasized that typically only having one instrument would not be sufficient to stimulate a long-term growth of renewable energy sources for the generation of electricity. Since generally a broad portfolio of technologies should be supported, the mix of instruments selected should be adjusted to this portfolio.

Feed-in tariffs

The system is designed to guarantee the producer a certain price for the electricity produced. The price varies depending on the technology being used so as to create development and market penetration in technologies that are otherwise overlooked since they are not least-cost technologies in the short term. By targeting all desired technologies with different price guarantees, it becomes possible to support technologies that are not economical yet, but that

are expected to be so in the near or mid-term future. Another major advantage is the long-term certainty of financial support.

There are two versions of this scheme in use today in Europe. The most common one is the *fixed tariff*, which guarantees a certain price irrespective of the price on electricity on the market. Another way to go is the *premium tariff*, adding a certain amount on top of the market price.

In the Baltic Sea region, the feed-in tariff scheme is the dominating or only scheme used in Germany, Denmark, Estonia, and Lithuania, although price levels vary significantly. Finland is planning to introduce feed-in tariffs in January 2011. Most countries in Europe applying a feed-in tariff are using the fixed-price model. Only Spain, the Czech Republic, Slovenia, The Netherlands, and Denmark have applied premium tariffs.

Table 1: Feed-in tariffs in the Baltic region in April 2010, Euro/kWh[12]

Country	Onshore wind	Offshore wind	Solar	Biomass	Hydro
Denmark	0.078	0.078	n/a	0.039	n/a
Estonia	0.051	0.051	0.051	0.051	0.051
Germany	0.05 – 0.09	0.13 – 0.15	0.29 – 0.55	0.08 – 0.12	0.04 – 0.13
Latvia	0.11	0.11	n/a	n/a	n/a
Lithuania	0.10	0.10	n/a	0.08	0.07
Poland	n/a	n/a	n/a	0.038	n/a

Quota obligations and tradable green certificates

This method means an obligation for all suppliers of electricity to include a certain amount of electricity from renewable energy sources in their energy mix. If the supplier does not have the capacity to fulfill the obligation, he can purchase renewable energy from other suppliers through a system with tradable green certificates (TGCs). Quota obligations, especially when combined with TGCs, are perceived to be more in line with requirements for market conformity and competitive policies that provide an incentive for short-term technology cost-reductions. The drawback is that the system tends to support short-term, low-cost, and mature technologies, whereas technologies that need financial support to develop are neglected. Thus, the scheme requires supplementary policies. Sweden, Latvia, and Poland use this system and Norway will introduce it in 2012.

Fiscal incentives

The scheme basically creates tax incentives for avoiding a certain technology, such as using fossil fuels (thereby promoting renewable energy alternatives). The

12 Europe's Energy Portal, http://www.energy.eu/.

main advantage of the scheme is that it produces an immediate incentive to final energy users to switch over to renewable energy sources. The main drawback is that it lacks long-term reliability, thus increasing uncertainty and risk to project developers and investors. To some extent this scheme is used in most countries, for example tax exemptions for renewable energy, but only Finland currently uses it as the main scheme for the introduction of renewable energy. However, Finland is planning to abandon the program and introduce feed-in tariffs in January 2012.

Tendering procedures

Another way to increase investments in renewable energy is to specify demands in public tender processes. The advantages of the scheme include the amount of attention that is drawn to renewable energy technology and projects, which are mostly large-scale, offshore wind-farms and hydroelectric plants. Similarly, the competitive component of the scheme is considered to efficiently push technological development. Currently, this is mainly used in France for the deployment of large-scale projects.

A mix of support schemes

Whereas investment grants are normally a very suitable instrument for supporting immature technologies, feed-in tariffs fit well for the interim stage of market introduction of a technology. A premium feed-in tariff or a quota obligation based on TGC could be the proper instrument once the following conditions are in place: markets and technologies are sufficiently mature; market size is large enough to guarantee competition among the market actors; and competition on the conventional power market is guaranteed. Such a mix of instruments can then be supplemented by tender procedures, which can be very efficient – for example in the case of large-scale projects such as wind offshore – and with fiscal incentives, such as tax reductions or direct financial support in niches and technological areas that need a special incentive in the long or short term.

In the Baltic Sea region, almost all nations have their specific combination of schemes for supporting renewable energy sources. This may indeed be necessary and efficient within a country or a single market, where rules are the same for everyone. But where there are different and complex systems in several nations within an emerging market, it becomes highly impractical and may lead to perverse market distortions. Thus, harmonizing the supporting schemes within the Baltic region is key to creating a functioning market for renewable energy sources.

An additional problem, especially in the former Eastern Bloc nations, is that the systems have undergone fundamental changes over time, undermining credibility and long-term predictability.[13]

13 *Assessment and Optimisation of Renewable Energy Support Schemes in the European Electricity Market*, OPTRES, 2007.

Energy and electricity in the region today

Assessing data for the production and use of energy and electricity in the region raises a necessity to define the region as such. As mentioned earlier, we have chosen to include Norway but to exclude Russia.

Another issue is whether to include the whole of – or only the northeastern parts of – Germany. As energy policy is developed on the national (and larger) level, it has made most sense to include Germany as a whole.

Another challenge has been the availability of data concerning renewable potentials. The most consistent and conclusive data sets publicly available are those used by The Heinrich Böll Foundation in the ERENE (European Community for Renewable Energy) study, based on data from Deutsches Zentrum für Luft- und Raumfahrt and the European Bank for Reconstruction and Development. These data have been supplemented with data from other studies, primarily *Energy Perspectives for the Baltic Sea Region*, published by The Baltic Development Forum, Ea Energianalyse, and Nordic Council of Ministers in 2009.

Generation and use of energy and electricity in the region

The generation and use of energy varies greatly in the region, as does energy intensity and sources. The total capacity in the region is estimated to be 300,000 MW in 2010 (Table 2). The dominating source is hydro-power – mostly located in Norway and Sweden – and the use of coal and lignite in Germany and Poland. (For practical purposes, lignite is included in the column for coal in the following tables.)

Table 2: Existing capacity in the Baltic region 2010, MW

Source	Wind	Hydro	Biomass	Nuclear	Waste	Gas	Oil	Coal
Capacity	31,747	84,529	9,407	38,051	1,962	41,569	12,750	82,514

The sources in Table 2 generated approximately 1,177 TWh of electricity in 2010. Again coal, lignite, and hydro-power are the dominating sources, together with nuclear power (Table 3). Renewable energy sources contributed 373 TWh, giving a share of almost 32 percent (Table 4).

Table 3: Generation of electricity by country and source 2010, TWh[14]

	Wind	Hydro	Bio-mass	Other RES	Nuclear	Waste	Gas	Oil	Coal	Shale	Peat	Total
Denmark	8.6		3.8		0	1.9	12.4	0.7	26		.	53.4
Estonia	0.5*		0.4*		0	0.1	0.7	.		3.2		4.9
Finland	0.3	13.8	8.1		18	.	11.8	1	9.7		6.5	69.2
Germany	44.7	18	32.8	9.5	166.8	9.9	95.8		215.3	.		592.8
Latvia	0.4*	3.3*	0.3*		0	0.1	2.3			.		6.4
Lithuania	0.3	0.4	0.1		0		5.6	0.4				6.8
Norway	1[15]	135[16]	0.1*		0	0.2	5.2					141.5
Poland	2	2*	0.9*		0	0.3	9.7		126.8			141.7
Sweden	4.8	71.3	10.6		63.3	0.9	5.4		4.5		0.1	160.9
Total	62.6	243.1	57.1	9.5	248.1	13.4	148.9	2.1	382.3	3.2	6.6	1,177.6

* *Energy Perspectives for the Baltic Sea Region,* Baltic Development Forum, Ea Energianalyse, and Nordic Council of Ministers, 2009. Figure 24. Other RES includes geothermal, solar, tidal, and wave.

Table 4: Total generation of electricity and generation from renewable energy sources 2010, TWh

	Total	RES	Percent RES
Denmark	53.4	12.4	23.2%
Estonia	4.9	0.9	18.4%
Finland	69.2	22.2	32%
Germany	592.8	105	17.7%
Latvia	6.4	4	62.5%
Lithuania	6.8	0.8	11.8%
Norway	141.5	136.1	96.2%
Poland	141.7	4.9	3.5%
Sweden	160.9	86.7	53.9%
Total	1177.6	373	31.7%

Expected power generation in the region in 2010 is slightly less than demand. As seen in the table below, the countries as a group have a negative energy balance

14 Figures **for renewable energy**: Where other not indicated, the source is Renewable Energy Projections as published in the National Renewable Energy Action Plans of the European Member States, European Environment Agency, 2010. **Figures for other energy sources**: *Energy Perspectives for the Baltic Sea Region*, Baltic Development Forum, Ea Energianalyse, and Nordic Council of Ministers, 2009. Figure 24.

15 Center for Renewable Energy, http://www.sffe.no/energi/vind/index_e.htm.

16 The figure refers to generation in 2007. Facts 2008, Energy and Water Resources in Norway.

amounting to -17 TWh, or 1.3 percent. However, in the business as usual projections for 2030 – based on the latest estimates from the European Commission[17] – demand will increase by approximately 223 TWh in the region. This indicates that the deficit will increase if demand is not curbed or new capacity is not added.

Table 5: Estimated electricity use by country in 2010 and projected demand for 2030, TWh[18]

	DK	EE	FI	DE	LV	LT	NO	PL	SE	Total	Balance
2010	36.9	8.6	98.1	615.4	8.6	11.7	127.4	130	151.4	1290.5	-17.2
2030	40.8	12.5	111.5	682.1	13.2	17.1	147.3	185.1	163	1513.3	-

Potential for generation of electricity from renewable sources

In the above, it has been concluded that approximately 370 TWh of electricity are generated from renewable sources in the region in 2010. The use of electricity is estimated to be 1,290 TWh, indicating a shortfall of roughly 920 TWh in reaching the objective of supplying 100 percent from renewable sources. Considering that demand for electricity in a business as usual scenario is predicted to increase with a further 223 TWh until 2030, the shortfall increases to over 1,100 TWh per year.

Clearly, to achieve the objective, a massive expansion of generation from renewable sources is needed. In Table 6, the economic potential for renewable generation of electricity in the region is assessed.

17 *European Energy and Transport, Trends to 2030*, European Commission 2008.

18 *Energy Perspectives for the Baltic Sea Region*, Baltic Development Forum, Ea Energianalyse, and Nordic Council of Ministers, 2009. Table 12.

Table 6: Generation of electricity from renewable sources in 2010 and economic potential in the region, TWh[19]

	Wind		Hydro		Biomass		Other		Total	
	2010	Potential	2010	Potential	2010	Potential	2010	Potential	2010	Potential
Denmark	8.6	55		0	3.8	6.6		3.5	12.4	65.1
Estonia	0.5*	3		0.4	0.4*	10.5			0.9	13.9
Finland	0.3	27	13.8	14.2	8.1	53.7		5.7	22.2	100.6
Germany	44.7	262	18	26	32,8	87	9.5	58.6	105	433.6
Latvia	0.4	1.3	3.3*	4	0.3*	4.6			4	9.9
Lithuania	0.3	0.9	0.4	1.5	0.1	12.5		0.8	0.8	15.7
Norway	1[20]	76	135[21]	178	0.1*	25.8		11	136.1	290.8
Poland	2	65	2*	7	0.9*	52.1		5.8	4.9	129.9
Sweden	4.8	63.5	71.3	90	10.6	80.4		7	86.7	240.9
Total	62.6	553.7	256.1	321.1	62.2	333.2	9.5	92.4	390.4	1300.4

* *Energy Perspectives for the Baltic Sea Region,* Baltic Development Forum, Ea Energianalyse, and Nordic Council of Ministers, 2009. Figure 24. Other includes geothermal, solar, tidal, and wave.

As mentioned above, the assessment has inherent uncertainties, the main ones being the inclusion of all German electricity generation, use, and potential, and the complete lack of data for the potential in northwestern Russia.

Bearing this in mind, the potential for electricity generation from renewable sources in the Baltic Sea region is sufficient to supply the region with 100 percent renewable electricity at the current level of demand. However, if the projection for use in 2030 described above is realized, the potential is too small, indicating that an ambition to generate 100 percent of the power from renewable sources might need to be combined with an energy-efficiency program in order to be successful.

The assessment also indicates that the potential is fairly evenly distributed among technologies for wind, hydro, and biomass, with an emphasis on wind power. Potentials in geothermal, solar, wave and tidal power only amount to roughly 7 percent.

19 Where other not indicated: **2010 figures**: Renewable Energy Projections as published in the National Renewable Energy Action Plans of the European Member States, European Environment Agency, 2010. **Potentials**: DLR (German Aerospace Center), *Trans-Mediterranean Interconnection for Concentrating Solar Power*, 2006; and *ERENE, European Community for Renewable Energy*, Heinrich Böll Stiftung, 2008.

20 Center for Renewable Energy, http://www.sffe.no/energi/vind/index_e.htm.

21 The figure refers to generation in 2007. Facts 2008, Energy and Water Resources in Norway.

Table 7: Estimated potential by technology, TWh, and percent

	Wind	Hydro	Biomass	Other
TWh	553.7	321	332	92.4
Share	42.6%	24.7%	25.6%	7.1%

The small margin between potential generation and energy demand for 2010, together with a heavy reliance on wind, hydro, and biomass sources, may be an issue of concern for energy stability and security of supply. Although a thorough assessment of availability and security of supply should be carried out, it seems unlikely that the region could be self-sufficient at all times. Balancing power from other regions is likely to be necessary. However, over time the region could supply itself with 100 percent renewable electricity at the present level of demand.

An interesting observation can be made by comparing the regional potential for renewable power production with estimated electricity consumption in 2020 (Table 8).

Table 8: Potential for renewable power production in the Baltic Sea region compared to expected electricity consumption in 2020 in TWh*

	DK	EE	FI	DE	LV	LT	NO	PL	SE	Total
RES Potential	65.1	13.9	104.4	433.6	9.9	15.7	290.7	129.9	240.9	1,304
Cons 2020	51.1	10.9	76.4	548.8	8.7	13.9	112.0	190.9	110.5	1,123
Difference	14.0	3.0	28.0	-115.2	1.2	1.8	178.7	-61.0	130.4	181

* Potential taken from ERENE; electricity consumption taken from ERENE except for Estonia, Latvia, and Lithuania, which are taken from their respective NREAP.

As we can see from the table, a 10-year projection would give us a slight positive balance of 181 TWh in 2020 for the whole region.

Assessment of current measures

As mentioned above, there is currently a heterogeneous mix of measures to reduce emissions of greenhouse gases and to promote renewable energy in the region. EU Member States are bound by the EU 20/20/20 climate and energy targets and Norway has committed itself to at least a similar level of ambition.

The EU targets can be summarized as:

- a reduction in EU greenhouse gas emissions of at least 20 percent below 1990 levels;
- 20 percent of EU energy consumption to come from renewable resources;
- a 20 percent reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

The burden to reach the targets is shared between Member States according to wealth and technical capacity.

Sufficiency of current measures

Each EU Member State has had to provide a National Renewable Energy Action Plan (NREAP) to show how it intends to meet its renewable energy targets. By comparing the levels of electricity produced from renewable energy sources in these plans with the potential mentioned earlier, it can easily be shown that current measures are far from enough to reach the full potentials (Table 9).

Table 9: National targets in National Renewable Energy Actions Plans compared to potential and as a percentage of potential (in TWh and percent)*

	DK	EE	FI	DE	LV	LT	NO	PL	SE	Total
NREAP 2020	20.6	1.9	33.4	216.9	5.2	3.0	156.5	31.2	97.3	566.0
RES potential	65.1	13.9	104.4	433.6	9.9	15.7	290.7	129.9	240.9	1,304.1
% of potential	32%	14%	32%	50%	52%	19%	54%	24%	40%	43%

* Data from NREAPs and ERENE (except for Norway, where the top figure uses Norway's production in 2005 increased by 15 percent).

Projections into the future should always be read with caution, but even so, the figures clearly show that there is a lot of untapped potential for renewable energy in the region under current policies.

Constraints to further progress

Essentially, there are four constraints for reaching the objective of supplying the Baltic Sea region with 100 percent renewable electricity generated within the region.

- *Energy demand*. The projections show that demand for electricity in a business as usual scenario is set to increase in all countries but especially in the former Eastern Bloc countries. This needs to be addressed, but today there are no binding regulations or incentives in sight.
- *Grids*. The grids in the region today cannot harness the regional distribution required. The main areas with potential for increased generation are the Scandinavian countries, Germany, and Poland. Grids in these countries and interconnections to the rest of the region need to be updated and developed. Current plans from BEMIP, the Scandinavian TSOs, and ENTSO-E do not foresee this development and there is a need to further assess what problems may arise regarding transmission capacity and load-balancing.
- *Market and policy harmonization*. The Baltic region needs to become a single market for an effective scheme to be realized. Today, energy policies, regulations, tax systems, and support systems for renewable energy are very disparate in the region. Policies need to be harmonized. There is a movement in this direction but it needs to be speeded up.
- *Common support schemes*. At the end of the day, there will be limited demand for renewable energy as long as electricity from fossil fuels and nuclear power is cheaper, even if the Baltic Sea region becomes a single energy market. Limited demand means that plans to expand renewable energy production will not be realized. There must be strong financial incentives to increase demand for renewable electricity, presumably through a support scheme consisting of a combination of feed-in tariffs, quota obligations, and fiscal incentives – or regulation to close down non-renewable sources.

With these constraints properly dealt with, a combination of the support schemes mentioned earlier in this paper can be applied. The potential for a 100 percent renewable energy production is there. The speed with which it will be implemented will depend on what we are willing to pay to avoid the dangers of nuclear power and climate change. With clever policies, early action, and regional cooperation, the cost will be lower. If we include the (often external) costs of nuclear risk and a changing climate, we are likely to find that the cost is negative, that is, that there is a net benefit to society in a quicker adoption of a 100 percent renewable energy production.

Governance structures needed

The fact that today's policies are insufficient to reach the full potential for renewable energy is in itself a sign that today's governance structures are far from optimal. As Table 8 clearly shows, not all countries in the Baltic Sea region can realistically reach renewable energy self-sufficiency. Regionally it is possible, though.

A development toward a 100 percent renewable power production in the region would need stronger cooperation at the governance level. The structures might be there, but they are not utilized to their full extent. Opening and integration of markets, harmonization of support schemes, and the development of infrastructure all need a more ambitious level of regional cooperation.

Also, looking at the four constraints for renewable energy development mentioned above, a concerted action will be needed to mitigate all four. Some (e.g., bringing down energy demand and regulation against non-renewable energy sources) will need action on the European level. On others (market and policy harmonization and improving grids), the Baltic Sea region can well take a step ahead and lead the way for the rest of Europe.

In fact, due to several specific conditions, the Baltic Sea region is more than well-adapted to play this role of a pilot region. These conditions include:

- the already high level of renewable energy production in (at least parts of) the region;
- the advanced development of the Nordic electricity markets;
- the tradition of regional cooperation (including the bodies and processes mentioned earlier in this paper);
- specifically the implementation of the EU Strategy for the Baltic Sea region will provide opportunities for pilot projects and other initiatives to enhance cooperation on energy issues further, toward the goal of 100 percent renewable electricity.

Already the former European Commissioner for Energy, Mr. Andris Piebalgs, saw the potential of the Baltic Sea region to be a showcase for the rest of Europe and pointed at the untapped potential in the field of energy collaboration. Or in the words of the Baltic Sea Parliamentary Conference Working Group on Energy and Climate Change:

The positive experience and the best practice of the Baltic Sea region could be transferred to other regions in Europe. The challenge is to develop the region into a highly energy-efficient and growing economy while at the same time reducing the dependence on carbon-based energy sources. Given the favourable situation that the countries in the Baltic Sea region have a strong tradition in innovation and possess the necessary financial, organisational, and human resources and given the recommended intensified regional cooperation, it should be possible to execute

the vision of the Baltic Sea region as a world leader in energy efficiency and renewable energy.[22]

22 Baltic Sea Parliamentary Conference Working Group on Energy and Climate Change, *Final Report of the Working Group on Energy and Climate Change*, June 2009.

Conclusions

As this paper has shown, there is clearly a potential for an energy system built on 100 percent renewable production in the Baltic Sea region. However, two questions remain:

- What policy changes are needed to realize this potential?
- What can be done to promote these changes?

On the first question, we have listed a number of support schemes and highlighted the need for a well-balanced mix of these as well as initiatives for regional harmonization. The main challenge is to allow for the opening and integration of electricity markets but at the same time to avoid:

1. a continued growth in non-renewable energy sources, driven by short-term economic incentives; and
2. a concentration of ownership (and subsequent control of pricing), leading to inefficient and overpriced markets.

To achieve this, a combination of work within the established political institutions (national, regional, and European) with cooperation with other influential actors will be needed, some of which have been listed in this paper.

The main argument to drive such a development is the potential for long-term sustainable and stable growth in the region. Any energy system that is dependent on non-renewable commodities, or that contributes to climate change and therefore has an uncertain future, has a disadvantage over a system that only depends on long-term sustainable sources that can be produced within the region.

The challenge now is to show, in pure (macro-) economic terms, the advantage of a renewable energy system; to communicate this advantage in a convincing way; to build partnerships with influential and powerful actors in the region; and, together with these actors, define in more detail the set of measures that should be taken.

Judging from the findings presented in this report, we believe that the critical pathway is to create enabling conditions, including political acceptance and support for such an objective within the framework of the Baltic Sea Strategy. The first objective is to identify, and work with, the driving forces that work toward renewable energy production.

In all likelihood, the most efficient way forward is to cooperate with, and influence, the stakeholders that have political influence in this context. Besides entities within the EU, the most relevant actors are the Scandinavian governments (Denmark, Norway, and Sweden), as well as CBSS (including BASREC), NB8, and BDF.

LIST OF ABBREVIATIONS

BASREC	Baltic Sea Region Energy Cooperation
BDF	Baltic Development Forum
BEMIP	Baltic Energy Market Interconnection Plan
BSPC	Baltic Sea Parliamentary Conference
BSSSC	Baltic Sea States Sub-regional Cooperation
CBSS	Council of the Baltic Sea States
CHP	combined heat and power
EEA	European Economic Area
ENTSO-E	European Network of Transmission System Operators for Electricity
ERENE	European Community for Renewable Energy
HELCOM	Helsinki Commission
NB8	Nordic Baltic 8
NREAP	National Renewable Energy Action Plan
TGC	tradable green certificates
TSO	transmission system operators

Europe has the potential to generate all of its electricity from renewable energy sources if it combines its diverse natural potentials. This paper gives a closer look at a region that could be a pioneer for regional cooperation in the EU: the Baltic Sea Region. It lists some of the most important actors and processes in the field of renewable energy in the region, and it provides an overview of some of the measures and mechanisms already in place – or in the making – for the region to promote the use of renewable energy sources. Further, the paper gives some recommendations on policy development.

Heinrich-Böll-Stiftung e. V. Schumannstraße 8, 10117 Berlin
The Green Political Foundation **P** 030 285340 **F** 030 28534109 **E** info@boell.de **W** www.boell.de

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