NORTH SEA
SUSTAINABLE
ENERGY
PLANNING

WP 3.1.2 Green Energy Benchmark

North Sea – Sustainable Energy Planning

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European Community
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Summary

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1. Introduction

As stated in the Work Plan (Work Package 3, Activity 1) it is an aim of the project to explore the energetic status quo of each participating region. Therefore regional energy analyses were conducted and baseline papers illustrating the current situation of energy consumption, demand and production were elaborated. Such baseline papers were prepared for each of the participating regions in the NSR. The main aspects and results of the single baseline studies were combined and depicted in a synopsis paper.

The synopsis paper is not a comparison in a practical sense. So it is not possible and not favored to compare the single numbers mentioned in the paper. Obviously it is irrelevant to compare the energy demand of two regions by only comparing the MWh unless considering the number of inhabitants, the industrial density and other circumstances. So the synopsis paper lists the relevant facts by numbers and tries to explain the background of the regions. It is helpful to get an overview of the energetic situation in the single regions its conditions and implications. But it is not comprehensive. To get a broad insight of the regional characteristics regarding the energetic situations of the single regions it is recommended to have a look at the regional baseline papers.

The regional baseline papers were elaborated under assistance of a benchmarking tool. This is basically an Excel-tool which has to be fed with the relevant numbers and facts. The tool is calculating comparable key data like energy demand per capita or share of RES.

To maintain a comparing analysis different reference values were defined. The benchmark tool has a main objective: To figure – with its indicators – as a base to develop a regional energy strategy. Either a single region can use the tool to see if it is well set-up with its energy strategy or several regions can compare themselves to concerning their energy situation.

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2. Public energy benchmark

Within the scope of North Sea-SEP data was collected in order to determine the energy status quo and related potentials of renewable energies. The standardization of the data was guaranteed through providing a template which gave the project partners a guideline on adequately filling in the data. The table draws together some of the factors described by North Sea - SEP partners relevant to the approaches concerning energy planning taken in each region. Data was collected in following cities and regions: Osterholz (GER) Tynaarlo (NL), Leiedal (BE), Kronoberg (SE), Hedenstad (DK) and Aberdeen (UK). This template is now adaptable to every region and available on the North Sea - SEP Website.

2.1 Definition and aim

First of all it has to be stated that benchmarking is a widely used concept which is applied in different fields of study such as geology, economics and computing. Thus no consistent definition exists nor defined processes and methodologies. That is why the general concept of benchmarking is applied within this paper and the further process is defined with regards to the special needs of the project "energy benchmark". The approach applied within this paper makes no claim to be complete.

Benchmarking in general means a comparing analysis of results and processes with determined reference values. That points to the aforementioned problem of comparability. The results of measurement have to be compared to the reference values. Without reference values a serious benchmark is not possible. Thus reference values have to be defined in advance as well as the facts and figures which have to be measured. These facts and figures will be called indicators. Further the indicators have to be compared to the reference values. Based on this comparison of indicators and reference values an assessment and evaluation of the structures and contexts represented by the indicators can be undertaken.

The main objective of creating a common energy benchmark is to establish a database for comparing the baseline situation of different regions. According to the Oldenburg recommendation there is a need to determine a reliable basis for the planning processes. Comprehensive baseline studies should be conducted for every planning region by local agents. For reasons of better regional comparability and transferability, the introduction of European standards for these regional baseline studies would be advisable. Unfortunately, there are various kinds of measurements and data presentation on the European level making comparisons difficult. The UK uses other units of measure than Continental Europe, like miles determining distances instead of kilometers. The analysis of the baseline papers also shows that parallel use of hectare and square kilometers burden an adequate and fast comparison. Furthermore, the experiences in North Sea - SEP have shown that the baseline papers conducted in the scope of the project provide individually a high range of information. The reports differ significantly in their form, content and size. Therefore, there is a need to establish a tool which includes the relevant standardized data. This can be done by using the same templates. In that case, a benchmark provides a comparable overview of the re-

gional contexts and the ways in which they differ with respect to factors influencing the design and operation of Sub-National Energy Initiatives (SNEIs), their appropriateness, the opportunities and challenges they face, and their success or failure. A further advantage of a comparable structure is the usability of the data for online tools like the 'appraisal model'. The aim of this tool is to increase sustainability by creating a general economic-valuation-model, including social and ecological effects. The standardized data of the benchmark provide the basic data on which the calculations are based.

It is not the aim of the energy benchmark to compare single regions in terms of "better than" or "inferior to". The benchmark could help to get an idea of what was achieved in a region in terms of energy use and energy efficiency, where further potentials can be found and where a future path could lead to.

2.2 Methodology

Which values have to be defined as reference values and indicators? This depends on what has to be benchmarked. In the case of the regional energy studies it is obvious that the reference values and indicators have to be related to the energetic situation in the participating region. The indicators and how to measure them is described in detail in the following section.

To define the reference values is an ambitious undertaking. Due to the fact that there is no region, town or municipality like the other it is nearly impossible to define universal reference values. Too many factors like numbers of inhabitants, land use, industrial density, commercial density, housing stock, geographical shaping, political frameworks and potentials for RES are influencing a region´s energy situation. Every serious approach to define reference values would lead too far and would be much too laborious for this energy benchmark.

That's why we decided to refer to existing reference values which are easy to apply. These reference values are given by the European Union. Within its strategy Europe 2020 "A strategy for smart, sustainable and inclusive growth" the European Commission sets out three indicators that could be used as reference values:

1. The reduction of greenhouse gas emissions by 20 % compared to the 1990 level
2. The increase of the share of renewable energy sources in final energy consumption to 20 %
3. The increase in energy efficiency to 20 %

It should be possible for each region, town or municipality to evaluate its current energy consumption and the share of RES. This is the indicator which can be applied the easiest way. Some additional indicators have to be taken into account here. It is explained in the following chapter how to make use of them.

It may be not so easy to assess the greenhouse gas emissions of a region. That is why it was decided to not take it into account here. However, if the user of the

tool is able to assess the greenhouse gas emissions of an individual region by 1990 and later they can be applied of course.

The increase of energy efficiency is measured by the reduction of primary energy consumption. But the pure reduction of energy consumption does not always indicate a more efficient use of energy. In regions with a declining population the primary energy consumption may decrease. But if the remaining people are heating with old coal stoves and the houses are not insulated the energy is not used efficiently. In this case it is more helpful to measure the energy consumption per capita and compare it over the time.

So the reference values applied within this benchmark are the share of renewable energy sources in % of the gross final energy consumption and the energy efficiency in % and total reduction of primary energy consumption. How to measure and evaluate these reference values is explained in the following section.

Some more indicators are applied within this benchmark. They are not comparable directly to other regions but they can indicate how the current energy situation in a region has to be evaluated. It is also explained in the following section how to measure and assess these indicators.

3. Public Energy benchmark tool

3.1 How to use the tool?

This document has to be used as a manual or rather composure of operating instructions for the benchmark tool.

The necessary data should be procured in the most detailed way possible and filled in conscientiously. The more detailed the data filled in the tool, the more helpful and adequate will be the outcome for the region.

In this chapter the different indicators of the tool will be presented and explained following several guiding principles:

- What does the indicator provide?
- Why is this indicator important?
- How can the demanded data be procured?
- How should the results be interpreted?
- What consequences and possible forms of action are resulting? What can be done to improve a region's energy strategy?

The data should be filled in the tool in the required units.

Factsheet: Energy status quo

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Country - Region (Partners):	Contact person (Partner):	E-mail:	Phone:
		Date:	

Please, briefly describe your goal of regional energy planning:	

Criteria	Value	Unit	Comments / Explanations
Regional Specifications			
Survey area		km²	
Population of a survey area		total	
Population density	#DIV/0!	per km²	
Forecasted population in survey area in 2020		total	
Forecasted population density in 2020	#DIV/0!	per km²	
Energy efficiency in buildings			
Building stock of survey area		total	
Private buildings		total	
Private buildings	#DIV/0!	% of total	
Public buildings		total	
Public buildings	#DIV/0!	% of total	
Administrative buildings		total	
Share in public buildings	#DIV/0!	%	
Energy consumption in the year 2000		kWh / m² / a	
Energy consumption in the year 2010		kWh / m² / a	
Residential buildings		total	
Share in public buildings	#DIV/0!	%	
Energy consumption in the year 2000		kWh / m² / a	
Energy consumption in the year 2010		kWh / m² / a	
Others		total	
Share in public buildings	#DIV/0!	%	
Energy consumption in the year 2000		kWh / m² / a	
Energy consumption in the year 2010		kWh / m² / a	
Energy consumption for all public buildings in 2000		kWh / m² / a	
Energy consumption for all public buildings in 2010		kWh / m² / a	
Energy Supply and Demand			
Total Primary Energy Supply 2005		TJ / a	
Total Primary Energy Supply by now		TJ / a	
Share of RES		TJ / a	
Share of RES	#DIV/0!	% of total	
Share of conventional energy sources		TJ / a	
Share of conventional energy sources	#DIV/0!	% of total	
Reduction of TPES compared to the level of 2005	#DIV/0!		
(Gross) Final energy consumption (electricity)		MWh/a	

Screenshot of the Benchmark Tool – the tool is available at www.northseasep.eu

3.2 Indicators

The experiences in the North Sea - SEP project have shown that data is not available in every region in the same way and to the same extend. In addition different units make comparison difficult.

In order to establish a common base to compare different regions as a first step to develop a regional energy strategy, different indicators have been developed. There are six different categories of indicators and data input sections which are described in the following part of this paper.

3.2.1 Regional Specifications

Each region has its specific characteristics which are determinant for energy demand as well as energy supply. It is important to take these factors into account to develop an adapt regional energy strategy. In addition to the indicators presented in the tool, it would be helpful as well to take into account climate conditions and land use information in order to get a clear and detailed overview of the region's status-quo and potential.

Survey area
The survey area is the respective region, which should be indicated in square kilometers to guarantee comparability.

Population of survey area
The population of the survey area is important to indicate, because a great share of energy demand comes from residential buildings.
Please note: Companies like steel mills or other heavy industrial sites consume very much energy and will raise the energy consumption per habitant. The result obtained won't be authentic in this case, so the different kinds of energy consumers have to be taken into account and distinguished well.

Population density
The population density is the number of habitants per square kilometer. This value is calculated and filled in automatically.

Forecasted population in survey area in 2020
In order to develop a regional energy strategy, it is important not only to take into account the present energy demanders but also the future ones. This information enables the regional actors to adapt the energy supply little by little to the future energy demand.

Forecasted population density in survey area in 2020
Analogue to the forecasted population in 2020 it is crucial to keep in mind the evolution of the population density in order to react to these changing parameters. This value is calculated and filled in automatically.

3.2.2 Energy efficiency in buildings

Buildings account for approximately 40% of final energy consumption.[1] Public entities often encounter difficulties in raising finance for investments in energy saving measures in public buildings, so that these are often old and the energy efficiency is low. For this reason, it is crucial to draw out how much energy public buildings consume. They often offer a high potential for energy saving.

Building stock of the survey area
In a first step, it is important to get information about the composition of the building stock in the survey area. In this aim it is necessary to indicate the building stock in total. It should be indicated by the area in m², if assessable.

Public buildings
After the classification of buildings in private and public buildings, it is interesting to see what the public buildings are used for. In this context it is important to indicate the total and the relative data, so that not only different categories in one region, but also different regions can be compared.

[1] Directive 2012/27/EU Of The European Parliament and of the Council of 25 October 2012 on energy efficiency, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:EN:PDF.

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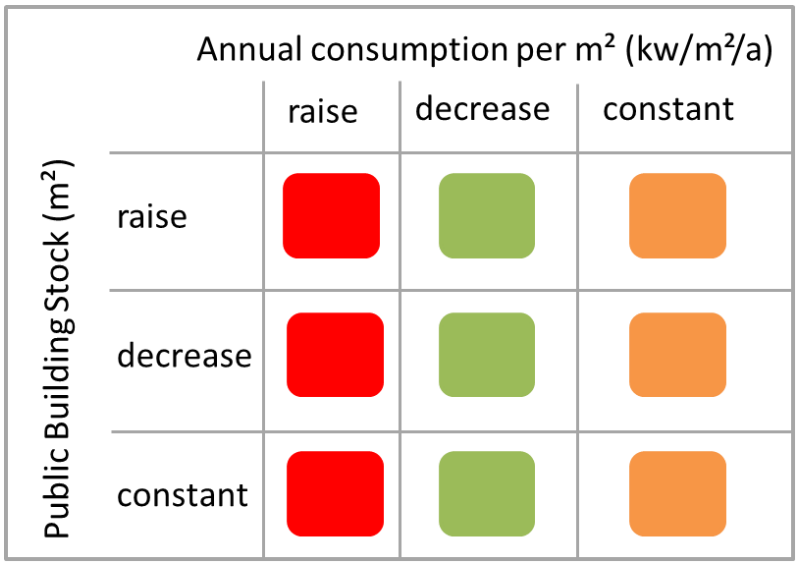
The energy consumption of these buildings should be indicated in energy use per unit area per year (kWh/m2/a).
When a region has a high share of residential buildings among public buildings the energy saving measurements should concentrate on them (e.g. tips to use household appliances in an energy saving way, etc.) and analogue for administrative buildings (e.g. provide them with energy saving bulbs). Every kind of building demands a specific strategy.

As the major part of public buildings is covered by residential and administrative buildings, all the others are combined in one single category "others".

In order to evaluate the energy efficiency of these buildings and its evolution it is important to compare different data. Related to the Europe 2020 strategy, it is advisable to enter the energy consumption of 2000 and 2010, but one can also chose another range of time. With the same building stock the energy consumption of 2010 should be less or at least equal the consumption stated for the year 2000.
However, the following possible interrelations can occur:



The development can be rated positively if the annual consumption per m² has decreased (at best by at least 20%). Constant values are in any case (risen, decreased or constant building stock) acceptable – there should still be potential to work on energy effiency and consumption in order to reach the 20/20/20 goals of the EU Strategy. However, if the annual consumption per m² in 2010 is higher than in the reference year (e.g. 2000) the development must be stated as negative and the reasons for an increased consumption have to be identified.

3.2.3 Energy supply and demand

Energy supply and demand certainly are the most important indicators when talking about energy in general and energy efficiency in particular. The energy supply refers to the delivery of fuels (coal, wood, oil) or transformed fuels (electricity, heat) to the point of consumption. So it describes how many energy is delivered and ready for consumption.

The energy demand refers to the consumption of energy. It can be distinguished in primary energy consumption and final energy consumption.

Total primary energy consumption

The total primary energy consumption (tpes) describes the total amount of energy which is fed into a national economy or a region. It refers to the direct use at the source, or supply to users without transformation, of crude energy, that is, energy that has not been subjected to any conversion or transformation process[2]. It includes the losses occurring when transforming the primary energy to final energy ready for consumption. Primary energy can be transformed by burning coal for power generation e.g. Energy carrier or energy sources can be conventional carriers like brown coal, stone coal, crude oil or nuclear power. Renewable energy sources can be water, wind, solar energy or biomass.
Primary energy usually cannot be used directly for purposes of energy consumption. It has to be transformed into final energy. Crude oil has to be transformed into heating oil. Stone coal has to be transformed into electricity. However, some renewable primary energy sources like wind and solar power can be used directly for energy consumption of course.

Due to the transformation process and the nature and quality of the primary energy source the efficiency factor of different energy sources is differing. Using only a little amount of final energy does not necessarily mean that something is efficient: if a large amount of primary energy has to be provided to receive only a small amount of final energy the efficiency factor is very small. So the primary energy consumption shows the real figures on the level of energy consumption.
This indicator is very important because it is a reference value coevally. The primary energy consumption predicts how many energy is used effectively. It helps to assess how energy efficient or inefficient a region is.

The unit of measurement is Joule. The use of energy sources in Joule is usually indicated annually. Due to the fact the Joule is a quiet small unit it is predicted in Gigajoule (GJ), Terajoule (TJ), Petajoule (PJ) and Exajoule (EJ), whereas 1 TJ/a equals 0.0317 MW. To assess this indicator for a region it is helpful to ask the local energy suppliers if they can provide some data.

The European Union states a reduction of primary energy consumption from 1.704 bn. toe (tonnes of oil equivalent) to 1.474 bn. toe. This is a reduction of

[2] OECD: http://stats.oecd.org/glossary/detail.asp?ID=2112, 20th August 2011

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approx. 14 %. By 2010 the reduction was approx. 4 %[3]. The benchmarking tool calculates the reduction in a region compared to the level of 2005. If the data for primary energy consumption of a region for the year 2005 is entered and again for the current year, the tool assesses the development. The reference value in this case is the energy amount in the year 2005. The same method is applied by the EU.

Share of renewable energy sources

The share of renewable energy sources (RES) indicates the contribution of renewables to the overall primary energy consumption. Due to the fact that the efficiency factor of RES is predicted 100 % these energy sources are the most efficient ones. The EU has set no target regarding the share of RES in primary energy consumption. But it may be assumed that it is desirable that the share of RES in primary energy consumption is as high as possible.

(Gross) final energy consumption

The final energy consumption is defined as the total energy consumed by end users, such as households, industry and agriculture. It is the energy which reaches the final consumer's door and excludes that which is used by the energy sector itself[4]. The energy consumed by public administration is included as well.

Another concept applied by the EU is the gross final energy consumption. The share of RES in gross final energy consumption shall increase to 20 % by 2020. The Directive 2009/28/EC defines the gross final energy consumption as the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission[5].

For our purposes the concept of gross final energy consumption should be applied because the EU is referring to this indicator when talking about 20 % share of RES. Due to the fact that it may be quiet difficult to assess the gross final consumption of a region it may be sufficient to apply the concept of final energy consumption. But it should be kept in mind that the gross final energy consumption is always slightly higher than the final energy consumption.

The final energy consumption can be assessed by just “looking at the electricity bill”. This is in fact a quiet casual and not really sufficient guidance. But taking into account that the final energy consumption means the energy consumed by end users it should be possible to count the energy used for electric-

[3] Eurostat: http://epp.eurostat.ec.europa.eu/portal/page/portal/europe_2020_indicators/headline_indicators

[4] Eurostat: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Final_energy_consumption

[5] European Union: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=Oj:L:2009:140:0016:0062:en:PDF

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ity, heating and cooling and other purposes. In terms of electricity it could be sufficient to have a look at the electricity bill. The used amount of energy should be reported here. Public administrations should display their energy related costs and the amounts of used energy permanently. The regional suppliers and utilities should be able to provide the relevant data. The mentioned energy use for transportation is relevant if a public administration provides public transport. Depending on how the public transport is provided the energy used can be expressed in MWh/a or in toe (tonnes of oil equivalent). If public transport is provided by electrical devices like trams or trains the used energy should be displayed in MWh/a. If public transport is provided by buses ran by conventional fuels the used energy should be displayed in toe. Toe can be transferred into MWh. 1 toe is 11.63 MWh.
Assessing the gross final energy consumption is far more difficult. It could be helpful to ask the local energy suppliers and utilities to provide the relevant data. Maybe already existing studies or evaluations can be used.

Share of RES in (gross) final energy consumption

The next step in the benchmarking tool is the assessment of the share of RES in (gross) final energy consumption. It can be evaluated as an overall data or as data for single sectors such as electricity, cooling and heating and transportation. It may seem easier to assess it as an overall data but it is more detailed and significant to assess it for the single sectors. As stated in Article 5 of the respective directive, the gross final energy consumption of energy from RES should be calculated as the sum of gross final energy consumption of electricity, heating and cooling and the final consumption of energy from RES in transport[6]. The share of energy from RES should be calculated as the gross final energy consumption from RES divided by the gross final energy consumption of energy from all energy sources. The formula is provided in the benchmarking tool. Attention needs to be paid to the difference between data for final energy consumption and gross final energy consumption – when filling in the form only one concept should be applied.

The European Union expects a share of RES in the gross final energy consumption of 20 % in 2020. There are different national goals defined. Please see the special goals for several countries at the Eurostat homepage[7]. Here an excellent reference value can be found which is comparable to other countries and regions. It can be compared what has already been achieved in the EU and in single countries. So individual achievements can assessed quiet exactly.

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[6] European Union: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=Oj:L:2009:140:0016:0062:en:PDF

[7] Eurostat: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=0&language=en&pcode=t2020_31&tableSelection=1

Specific energy demand per km^2

The following four indicators can help to get an overview of the overall energy situation and the energy demand of a region. The specific energy demand per km^2 shows how much energy for electricity and heating and cooling is used per km^2. But this indicator always has to be seen within its context and may never be interpreted just by looking at the pure figure. In rural areas where only a few people live, where the industrial density is low and the area is large in terms of km^2 the figure will be low. In a densely settled, highly industrialized urban area with a high population this figure will be much higher of course. Here it could be helpful to have a look at other regions that are in a similar position in terms of population, industry, area and density. Some examples of European region can be found within the synopsis paper connected to this benchmarking tool. Further information on single regions and the detailed energy baselines can be found at the North Sea – SEP home page.[8]

Specific energy demands for electricity, heating and cooling and transportation per capita

These figures indicate how much (gross) final energy is used for purposes of electricity as well as heating and cooling and transportation per capita. These figures have to be interpreted with caution. Depending on whether the gross final or the final energy consumption is the basis for the evaluation the calculated values will differ. At the one hand the gross final energy consumption seems a bit more realistic and detailed because the energy which is used to produce electricity and heat is included as well as the losses occurring during transmission and distribution of energy. At the other hand the final energy consumption depicts the amount of energy which is consumed by the user directly.

Due to the fact that the value applied here is calculated by dividing the overall energy demand of a region (including all non-residential matters like transport, industry, commerce…) through the number of inhabitants, another point to be aware of is, once again, the specific situation and the specific conditions of a region. As already mentioned in the section about the specific energy demand per km² the specific energy demand per capita does not always allow conclusions on the real amount of energy used by capita. Nor does it allow a conclusion on the energy efficiency of buildings people live in or the energy awareness of the people itself. In rural areas with a small number of inhabitants the specific energy demand may be lower than in highly industrialized urban metropolitan areas. But it may be assumed that the energy efficiency in buildings is better in metropolitan areas than in rural areas with traditional old buildings. To avoid this bias it would be advantageous to assess the energy demand by households directly. It might be helpful to ask regional energy suppliers to provide adequate data on how much electricity and energy for heating and cooling is used per household averagely.

[8] http://www.northseasep.eu/servicedownload/

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Energy mix of the regional suppliers

It may happen that in very "green energy regions" the amount of energy produced from RES is very high. It is often favored to measure the amount of green energy produced in a region and compare it to the energy consumed in the same region. Some regions might produce some hundred percent of the consumed energy by renewable resources. But the green energy produced in a region is not always consumed in the region. This is often the case when wind power is produced. Due to the high voltage the energy is fed into a high voltage grid and is exported out of the region. There are some examples, especially in Germany, where a region produces a huge amount of green energy from wind power but the energy mix of the regional suppliers indicates 60 % and more of fossil fuels. So it is helpful, despite or precisely because a lot of green energy is produced in a region, to have a look at the share of fossil fuels, the share of RES and the share of nuclear power in the energy mix of regional suppliers. That figure gives an idea about how green the energy used in a region really is.

RES produced in survey area

As mentioned in the section before, the amount of green energy produced in an area does not always allow conclusions on how green a region is in terms of energy consumed. But nevertheless it gives an idea on the contribution a region is making.

It should be not very difficult to assess how much RES are produced in a region. Especially when the municipalities itself act as site operators. This may be the case with wind power, biomass or hydro power. Otherwise many RES sites are clearly visible and can be assessed quiet easily.

It may be a bit more difficult in the case of PV, solar power and geothermal energy. Such sites are often privately ran and are not visible very well. In this case it may be helpful to contact the public authorization boards that may be affected when it comes to an authorization procedure. In some cases and countries already exiting online tools can be helpful.

Identified energy potential

It may be easy to assess the amounts of RES produced in an area but the situation is completely different when it comes to the identification of potential for RES.

To assess the potential for RES it is necessary to work together closely with all related entities in a region. That may be the public authorities like the board of construction or the cadastral land register. Further a cooperation with the regional energy suppliers, housing companies, private housing companies and house owners as well as farmers and land owners is helpful. Further it is important, once again, which pre-conditions can be found in a region. So it makes a difference whether the RES potential in a rural area with a lot of space for growing crops and energy plants have to be assessed or an urban area with nearly no agricultural area but a lot of roof top areas. Another point to consider is the national and regional legislation. There may be other regulation regarding the installation of wind power sites in Denmark than in France.

To get a brief overview of how to assess energy potentials in different regions it is recommended to have a look to the results of the EU funded project

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"Public Energy Alternatives" PEA. At the website information on how to assess the RES potential in several regions specifically is available[9]. It is laid down in the regional energy strategies. Information can also be found in the synopsis paper of the North Sea SEP project as well as in the regional baselines.

Wind power:
When assessing the potential for wind power there are two ways to proceed. The first one is to assess new areas where no wind power sites are erected currently. These wind park areas are identified and reported as "areas possible for wind power production". So this is the case in Germany e.g. It should be cross-checked what the national legislation is in other countries. The second possibility is to repower already existing sites. Here the potential can be assessed a bit easier due to the fact the sites are already there.

Solar energy:
The estimation of solar energy installation can be done similar. There are two possibilities for the installation of photovoltaic. One option is the installation on roof tops. Another one is the installation of solar parks. Basis for the calculation of the potential installations on roof tops is the building area in a region. The layout of the houses will be estimated as the roof size. Further estimations are that 20% of the roofs are usable for the installation of PV-sites and that the average efficiency factor is 0.15. But here again it is important to consider the regional conditions. So the efficiency factor may be higher in Southern Spain than in Northern Germany.
Hydro:

For hydro energy the geographical conditions are extremely crucial. So first of all it is important to know whether the hydro power comes from inland sites like water mills in rivers or water reservoirs or whether the hydro power is produced off-shore e.g. in tidal power plants. Further specific factors have to be kept in mind like the velocity of rivers or the tidal range. Other aspects to consider when assessing the potential of water power are ecological aspects like the impact on rivers or the fauna.

Geothermal energy:
When it comes to assessing the potential for geothermal energy it is quiet impossible to give some universally valid advices. Geothermal sites are mostly used in small-scale applications in a private background. Sometimes housing companies make use of it to provide heat for their premises. It always depends on the local geological conditions. In some areas it may be nearly impossible to apply geothermal advices due to a craggy underground. In other regions it may be necessary to excavate so deeply that there is no economic benefit anymore. In some countries special legislations have to be considered, in some cases the mining law e.g.

[9] http://peaproject.eu/index.php?id=74

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Biogas and biomass:
The estimation of the potential of biogas and biomass is closely related to the area feasible for agricultural activities in a region. Further it has to be considered whether biomass is taken from wood, from crops or agricultural residual products. Generally some questions have to be considered when thinking about biomass:

- Is the biomass a by-product of something e.g. slurry or residuals from crop production?
- Or must the biomass be produced for its own purpose?
- Can the biomass be acquired from near-by areas or has it to be delivered by trucks from far away?
- Is it really sustainable in terms of CO_2 footprints, mono culture and biodiversity?

4. Conclusion

This manual shall help to use the benchmarking tool and so to assess the current energy situation in a region. As stated before it is quiet ambitious to assess the overall energy situation of a region, especially when it comes to the comparison of different regions. A lot of factors, facts and figures have be considered and calculated. Many varying concepts of energy, final energy, primary energy, renewable sources or reference values have to be checked whether they are applicable for the special needs of a region and the analysis. So there is no patent remedy how to evaluate a region in terms of energy and energy efficiency.

That's why this benchmark tool and the manual are drafted as an appliance to assess a region. Some possibly applicable indicators and reference values are explained and provided in the Excel-tool. Its strengths and weaknesses are explained as well.

To have at least a reference point on how to evaluate the current energy situation of a region and to make a comparison to other regions possible, two reference values were applied within this tool: the energy efficiency and the share of RES in the gross final energy consumption. These are the values applied by the European Union as well. So the achievements of a region within a transnational context can be assessed and compared. These reference values are also helpful to evaluate what has to be done in the future in terms of energy efficiency and the application of RES.

To make it more descriptive the cells regarding to the reference values are colored. When a region is on good way and comes close the reference values set by the EU is even achieving them, the cells are turning green. When there is only little achieved and some efforts have to be taken, the cells will remain red. So this is a very simple way to get an overview and an idea on the energy situation in a region.