European Union
European Regional Development Fund

EnercitEE

INTERREG IVC
INNOVATION & ENVIRONMENT
REGIONS OF EUROPE SHARING SOLUTIONS

Evaluation Report

GRACE

"Grants and other incentives for cost and energy efficiency"

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Freistaat
SACHSEN

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1 Description of the EnercitEE project and the sub-project GRACE

1.1 EnercitEE

EnercitEE means European networks, experience and recommendations helping cities and citizens to become Energy Efficient.

The EU Climate and Energy Package is considered key to an energy efficient and low-carbon Europe. The three overall objectives have become generally known as the 20-20-20 targets: a 20 % cut in emissions of greenhouse gases by 2020, compared with 1990 levels; a 20 % share of renewables; and a 20 % cut in energy consumption.

EnercitEE seeks to implement the EU targets on Energy Efficiency practically. The project, which is carried out under the EU programme INTERREG IVC, builds upon experiences and existing networks from the forerunner project enercy'regio.

EnercitEE will identify, analyse and transfer good practices, foster the exchange of experience and carry out light pilot implementation to increase the level of Energy Efficiency of local authorities and their citizens.

Practical guidelines and policy recommendations produced within EnercitEE will provide valuable assistance for European regions aiming to improve their energy performance and policies.

Partner regions (figure 1)

1 Saxony (Germany)
2 Smaland (Kalmar and Kronoberg / Blekinge (Sweden)

3 Emilia-Romagna (Italy)

4 Haute Savoie (France)

5 Lower Silesia (Poland)

figure 1: EnercitEE partner regions (picture: LfULG)

1.2 GRACE

The GRACE project is one of in total 12 sub-projects of EnercitEE.

Aims

The main aim of GRACE was to analyse costs and real impact on energy efficiency of public and private funding schemes for citizens and communities in the participating regions Saxony, Lower Silesia and Emilia Romagna.

Approach

Each sub-project partner developed a regional overview on available funding programmes for the target groups, consolidated in a joint comparative table. All partners searched for relevant data from their funding institutions. This part of the project was the most challenging one as collecting the data of funding programmes (e. g. beneficiaries, energy savings, CO_2 emission reductions, etc.) often means to ask for highly protected data in all regions. The partners also carried out an interregional comparison between the participating project regions in order to get an insight into the different funding modalities and to learn from each other. Furthermore, a joint methodology was developed and updated defining the way of analysing a minimum of three funding programmes per region.

Results

The participating regions of GRACE gained an overview on the programmes which support the EU 2020 strategy and their national strategies. All partners will use this overview for future activities, like energy advisory services. The evaluation report containing the project results describes through key figures like "kg of CO2-emissions reduced with 1,000 € governmental funding" or "energy saved with 1,000 € governmental funding" the effectiveness of the different funding programmes. This allows the formulation of policy recommendations for policy makers. Thereby, GRACE helps them to decide how to improve existing funding programmes and how to set up new programmes.

Future prospects

GRACE contributed to a better advisory service for citizens and municipalities, especially for the future activities of Bautzen Innovation Centre and the Energy and Sustainable Development Agency of Modena. The energy-related activities in the district of Bautzen will continue due to

the foundation of its Energy Agency on 1st October 2012. Moreover, the project assured the extension of the cooperation within the partnership: Wroclaw Research Centre EIT+ plans to cooperate with the Italian sub-contractor in a future project. Furthermore, the policy recommendations can be a great base to start cooperation on a regional and national basis.

Project partners:

Lead Sub-Project Participant: Bautzen Innovation Centre, Technologie- und Gründerzentrum Bautzen GmbH

Sub-Project Participant 2: Wroclaw Research Centre EIT+ Ltd., Wrocławskie Centrum Badań EIT+ sp. z o.o.; subcontractor: Stowarzyszenie Eko-Biegły

Sub-Project Participant 3: Energy and Sustainable Development Agency of Modena (AESS), Agenzia per l'Energia e lo Sviluppo Sostenibile (AESS); subcontractor: Nomisma S.p.A.

Webpages:

EnercitEE: http://enercitee.eu/Sub-Projects/GRACE---Grants-and-other-incentives-for-cost-and-energy-efficiency,53/

Bautzen Innovation Centre: http://www.tgz-bautzen.de/projekte/laufende-projekte/grace.html

Wroclaw Research Centre EIT+: http://www.eitplus.pl/en/enercitee_grace/2338/

AESS Modena: http://www.aess-modena.it/it/component/content/article/34-istituzionali/334-grace-en.html

2 Regional Context

2.1 Regional overview

2.1.1 Country context

Germany is divided in 16 federal states. The Free State of Saxony (figure 2) is located in the south-east of Germany and borders to the following federal states of Germany:

South-West: the Free State of Bavaria (41 km)

West: Thuringia (274 km)

North-West: Saxony-Anhalt (206 km)

North: Brandenburg (242 km)

Moreover it borders to the Republic of Poland in the east and to the Czech Republic in the South.

The length of the border to both countries amounts to 577 km.

figure 2: map of the Free State of Saxony

Saxony has an area of 18,416 km² and is inhabited by approximately 4,134,000 million people, which means 224 inhabitants per square kilometer. Saxony is divided in 10 districts and 3 urban districts, which also have the status of a district. The biggest rivers are the Elbe, Mulde, Spree and Neisse. The mountain ranges Erzgebirge and Oberlausitzer Bergland separate Saxony from the Czech Republic. The eastern border to Poland is separated by the river Neisse. In the northern part of Saxony there are lowlands with lakeland areas, whereas the farer you go to south you have hill countries and highlands. Around 55 % of the total area of Saxony are used for agriculture, 27 % are forest areas and 2 % are water areas. Approximately 12 % of the area is constructed as traffic area and 4 % are mining or other areas (cf. 1).

2.1.2 Socio-economic and cultural context

Saxony has a GDP of approximately 95,100 million EUR. The GDP per capita amounts to 23,000 EUR. The per capita salary per employee amounts to 2,017 EUR per month. The average monthly available income per household is 3,609 EUR (cf. 10).

The monthly expenditures for households amounted to 3,362 € in 2008 (cf. 10). The expenditures for living, energy and maintenance increased from 287 € in 1990 to 568 € in 2008, which means an increase by 98 % within 18 years. Related to the total expenditures the share of the expenditures for living, energy and maintenance increased from 21.5 % to 30.8 % (cf. 3).

The unemployment rates decreased from 18,2 % in 2005 to 10,5 % in March 2013 (cf. 2). Reasons for that are the demographic change Saxony and the currently well situation of the economy in Saxony.

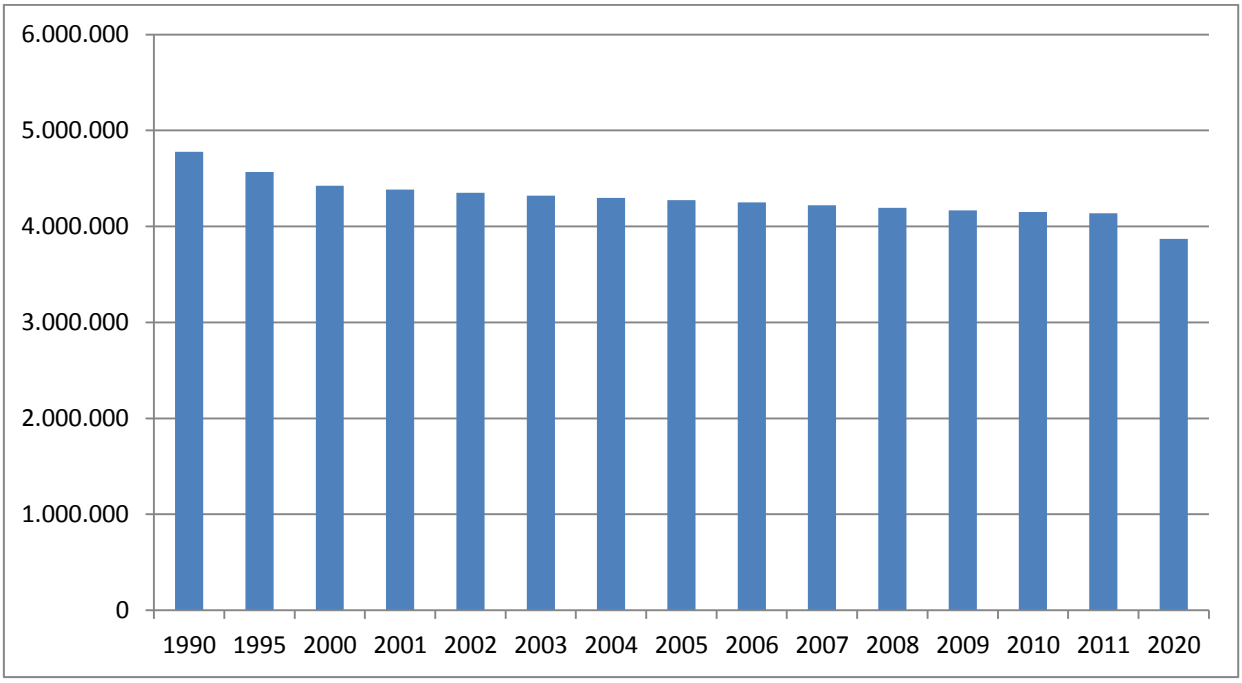

figure 3: population development in Saxony (1990 - 2020)

In Saxony there are 2,214,600 households. Around 43 % of them are single households, 37 % are 2 person households, 12 % are 3 person households and 8 % are households with 4 and more people. Between 1990 and 2008 the Saxon population decreased by 700,000 people, whereas the number of households increased by around 150,000 in the same time. This led to a shrinking average of people per household in the last years. In 1991 there were 2.3 people per household, whereas in 2012 there were only 1.9 people per household. Beyond the decreasing population this also shows that Saxony is really faced by the demographic change. Especially the population under 18 years is faced with that problem, which is shown by a

decrease of 31.3 % from 2000 to 2009. The statistical State Office of Saxony predicts that the whole population will decrease by 21% up to 2020 in comparison to 1990 (see figure 3) (cf. 4).

2.1.3 Energy context

General information

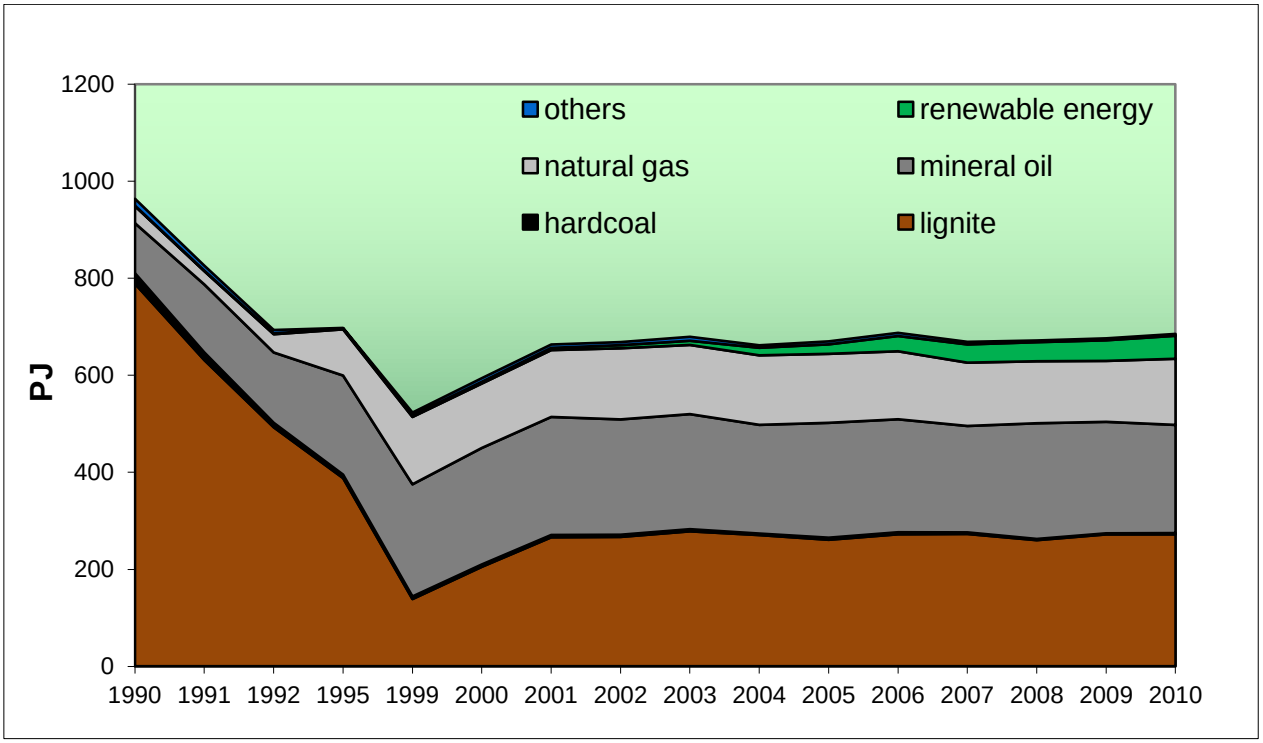

figure 4: primary energy consumption concerning the energy sources in Saxony (1990-2010) (cf. 4)

The primary energy consumption in Saxony in 2010 amounted to 635,651 TJ. Figure 4 shows the shares of the energy sources concerning the primary energy consumption. The overall primary energy consumption decreased from 1990 to 1992, due to the economical breakdown in the Eastern part of Germany. Especially the share of the lignite shrank enormously between the years 1990 and 1999. Since 1999 the primary energy consumption grew slowly to a higher level and remains on nearly the same level until the end of 2010 (cf. 4). Lignite will remain the most important energy source in the future due to an enormous mining potential in Saxony

(figure 5). The policy makers of Saxony passed the Saxon Energy and Climate Programme on the 12th March 2013. The further usage of lignite is also laid down there (cf. 5).

In 2010 lignite (43 %) and mineral oil (35 %) had the biggest share on the primary energy consumption. The energy consumption of renewable energies had an amount of around 40,000 TJ. The export amount of energy amounted on circa 40,000 TJ, but is not shown in the above mentioned graph. (cf. 4)

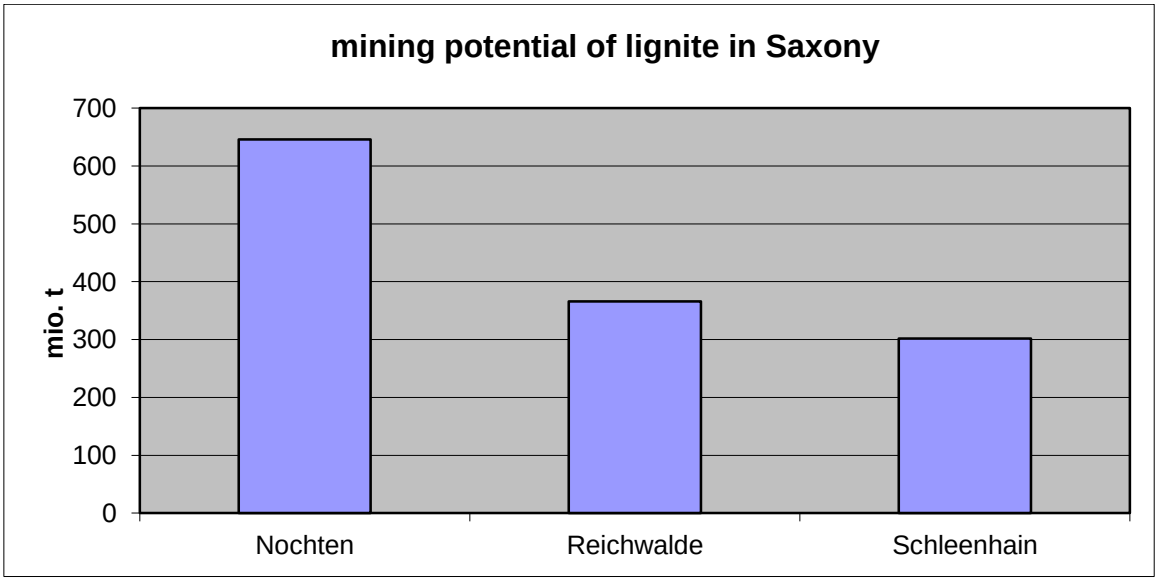

figure 5: mining potential of lignite in Saxony

The renewable energies still have a very low share on primary energy consumption in Saxony (7.47 % in 2010). Beyond lignite the natural gas, mineral oil and renewable energies will complete the energy mix in the future. The number of renewable energy plants is steadily growing. In 2010 there were 819 windmills (961.48 MW_{peak}), 16,796 solar plants (504.38 MW_{peak}), 339 biomass and biogas plants (203.14 MW_{peak}) and 293 hydroelectric power stations (86.85 MW_{peak}) installed in Saxony. (see figure 6 and 7) (cf. 6) The total energy produced by renewable energy sources and the share of the renewable energy sources referred to the net electricity consumption (1991-2010) in Saxony are shown in figure 8 and 9.

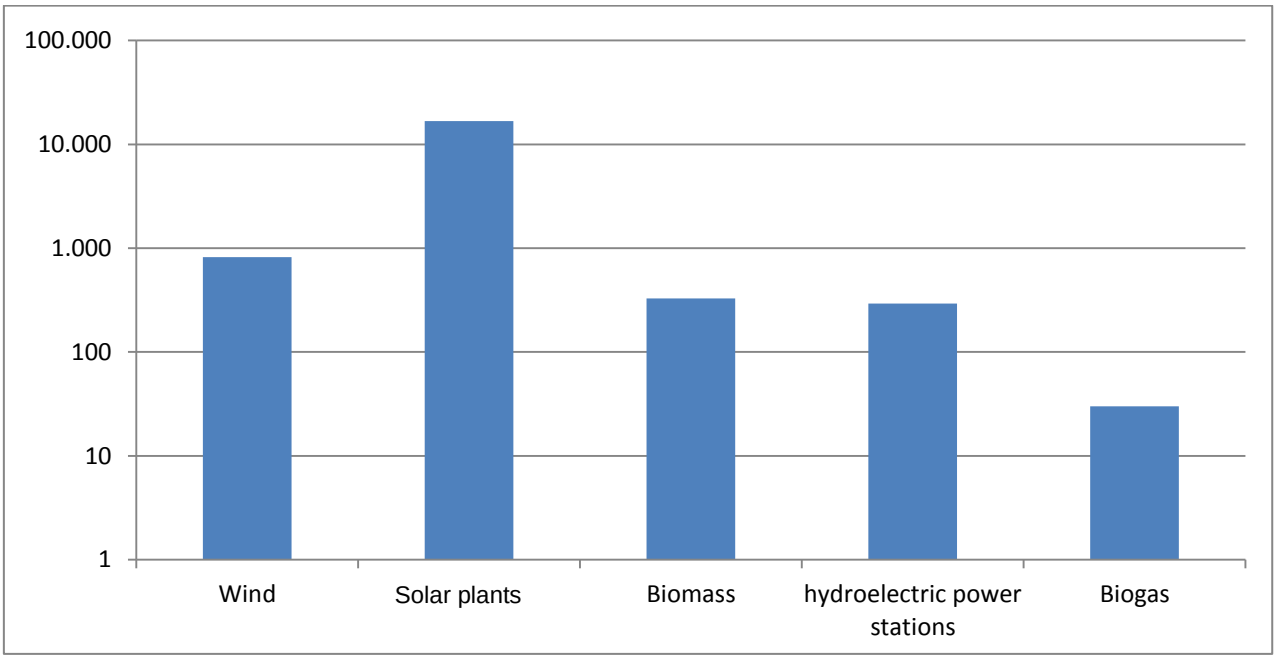

figure 6: number of EEG-plants installed in Saxony 2010

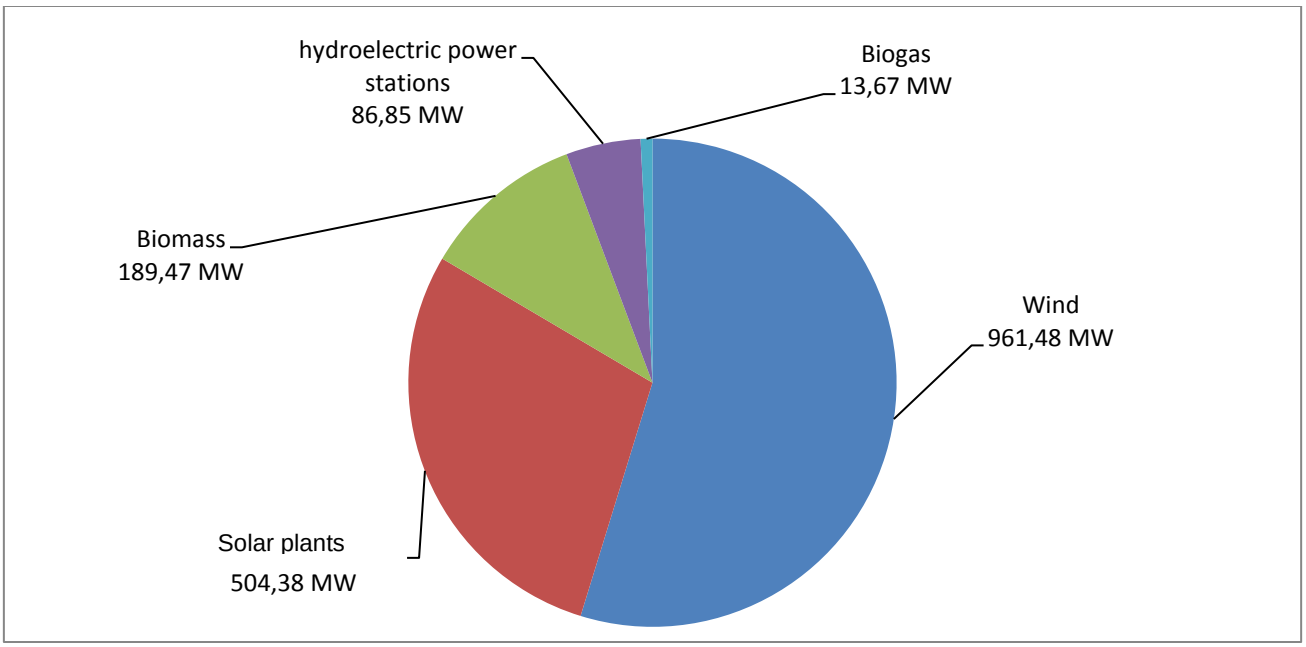

figure 7: installed power of renewable energies in Saxony 2010 (cf. 6)

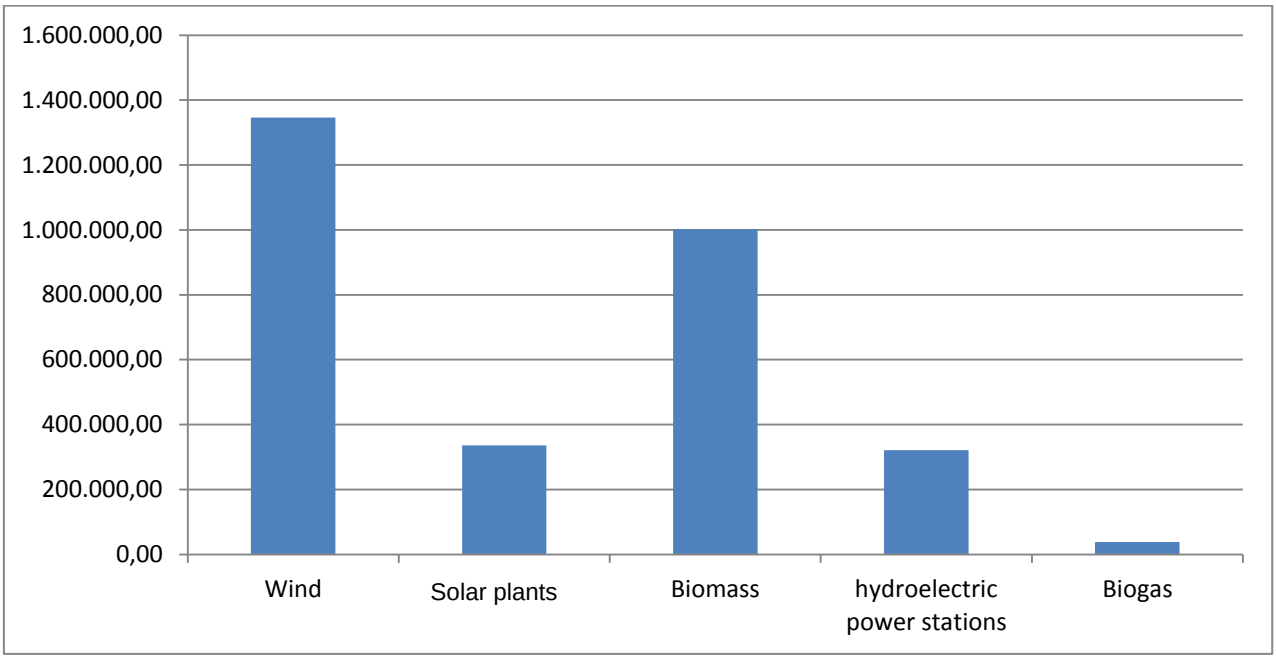

figure 8: fed in electricity (in MWh) by renewable energies in Saxony 2010

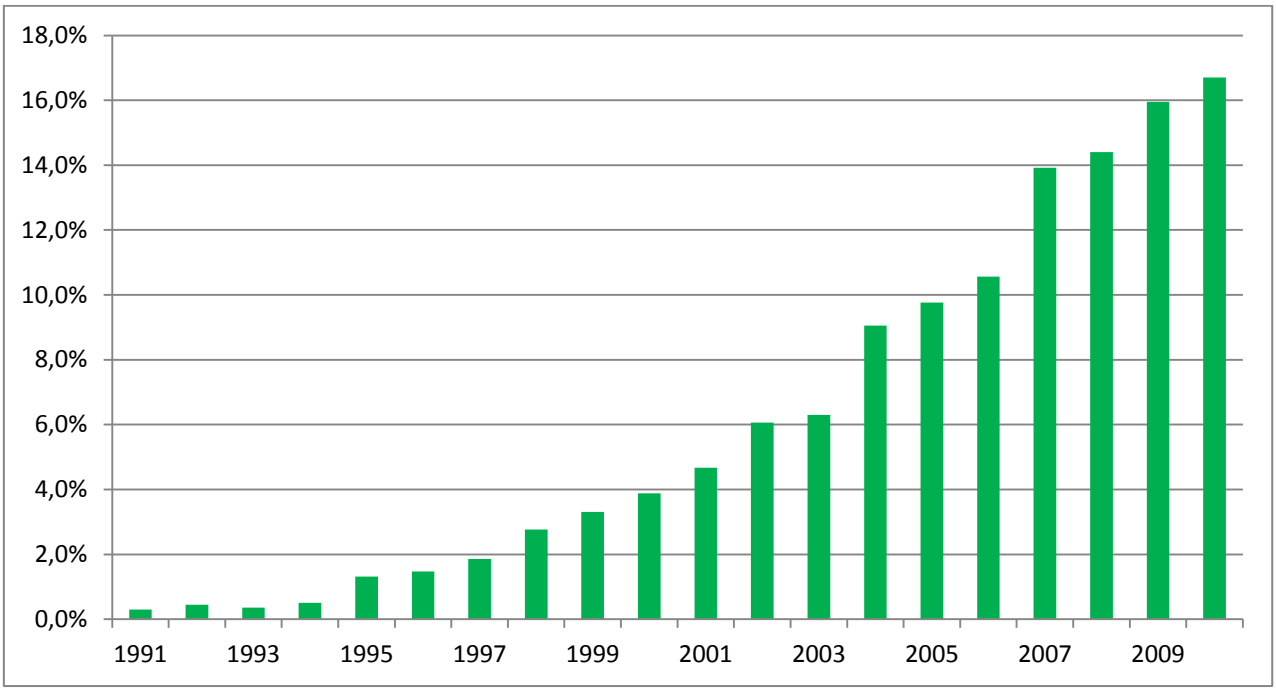

figure 9: share of the renewable energy sources referred to the net electricity consumption (1991-2010) in Saxony

Framework conditions and Legal requirements in Germany

The Saxon State Ministry for Economic Affairs, Labour and Transport (SMWA) and the Saxon State Ministry for Environment and Agriculture (SMUL) are responsible for the energy policy in Saxony. The Saxon Energy Agency (SAENA) was founded in 2007 and supports the Saxon energy policy. The shareholders of the SAENA are the Free State of Saxony and the Saxon Development Bank (SAB). Beyond the SAB, the German Reconstruction Loan Corporation (KfW) and the Federal Office of Economics and Export Control (BAFA) are promoting citizens, municipalities and enterprises in energy efficiency and renewable energy measures.

There are different roadmaps, which rule the expansion of renewable energies and the more efficient use of the energy. On European level the EU 2020 strategy plans to increase the share of the renewable energies on the primary energy consumption to 20 % until 2020, the more efficient use of energy of 20 % until 2020 compared with 1990 and to reduce the CO_2-emissions by 20 " until 2020 compared to 1990. On German level the Hightech-strategy Germany 2020 and the energy concept of the federal government laid down the aims in the energy sector until 2020. European goals were there transformed into national goals. On 12th March 2013 the Saxon Cabinet passed the Saxon Energy and Climate programme, which shows a roadmap for Saxon's energy policy until 2023. For example Saxony plans to increase the share of the renewable energies concerning the gross electricity consumption to 28 %. Moreover there are many regional and local concepts, e. g. the Energy and Climate Concept of the planning region Upper Lusatia / Lower Silesia for East Saxony.

The following paragraphs are taken from the final brochure of the EnercitEE sub-project RIEEB. You can download this brochure under the following link: www.enercitee.eu/rieeb

"The issue of the **Energy Saving Act (EnEG)** on the 22nd of July 1976 should have helped to reduce the dependency of the Federal Republic of Germany on the established energy sources after the energy crisis in 1973. The new law for the reduction of the energy consumption of buildings dealt mainly with the energy saving potential and demanded an effective use of heating and cooling energy. The Energy Saving Act (EnEG) was revised in 2005, in order to integrate the requirements of the Energy Performance of Buildings Directive." (cf. 9)

"The **Energy Saving Ordinance (EnEV)** forms an important building stone of the energy and climate protection politics of the Federal government. The innovations in the EnEV 2007 serve

the implementation of the Energy Performance of Buildings Directive (2002/91/EG), mainly the introduction of energy performance certificates for existing buildings.

The Energy Saving Ordinance applies to all buildings, which are heated or cooled using energy. This also applies to technical building equipment, e.g. heating, cooling and indoor air technology, as well as domestic hot water and illumination systems. The use of energy for production processes does not fall under the Energy Saving Ordinance.

Newly constructed non-residential buildings are calculated by a method using a reference building in accordance with DIN V 18599. Non-residential buildings have to achieve certain requirements. The annual primary energy demand for heating, hot water, ventilation, air conditioning and lighting cannot exceed the annual primary energy consumption (QP) of a reference building, regarding the same geometry, useable floor area, orientation and utilization with the predefined technical reference execution in the EnEV. Additionally, the upper limiting values of the average heat transfer coefficient (Ū) are not to be exceeded.

Since the EnEV 2009, this calculation method can also be applied for residential buildings. In this case the planned residential buildings cannot exceed the requirements of the annual primary energy consumption (QP) of the reference building and in the EnEV predefined maximum transmission heat loss (H'T) of the entire building envelope." (cf. 9)

"Since the 1st of January 2009, all new buildings must fulfil the requirements of the **Renewable Energies Heat Act (EEWärmG)**. This applies to residential and non–residential buildings, whose building application resp. building proposal was submitted after the 1st of January 2009. Since the revision from the 1st of May 2011, this law also applies to renovations of public buildings, since these work as example buildings.

The law states, that a certain proportion of the heating demand should be covered with renewable energy. The percentage depends on the energy form. When solar installations are used, they must cover 15% of the heating demand. For simplification reasons, solar collectors must be installed on an area that corresponds to at least 4% of the buildings useful floor space in single- family houses, 3% in apartment buildings. When heat is generated from liquid or solid biomass or from geothermal or environmental energy, it has to cover at least half of the heating demand. When using biogas, the proportion is 30%."(cf. 9)

"The objectives to the expansion in the electricity sector from the energy concept of the Federal government from the 28th of September 2010 should be reached through the **Renewable Energy Act (EEG)**. Accordingly, the proportion of the renewable energy in electricity consumption should be at least 35% by 2020 and at least 80% by 2050. The Renewable

Energies Act regulates the priority purchase obligation of renewable energies from the network operators, the (decreasing) rate of compensation of the individual production type, as well as the division methods of the resulting additional costs for the electricity customers.

Due to the EEG, the system operators receive, for 15 to 20 years, predefined compensation for the electricity fed into the grid for the electricity which they produced themselves. The Network operators are obliged to use this electricity preferentially. The rate of compensation depends on the technology, the produced amount of electricity and the date of commissioning. An economical operation of the system should be achieved through the proportional subsidies. A cost pressure in the form of an incentive regulation should be created through a constant decrease of the fixed rates of compensation. Technical systems should therefore be produced more efficiently and cost–effectively, in order to succeed on the market in the long–term even without government subsidies." (cf. 9)

2.2 SWOT Analysis summary

The SWOT analysis shows strengths, weaknesses, opportunities and risks of a system. In the following paragraph, the Free State of Saxony is analysed with the help of a SWOT analysis. Especially the following indicators were analysed for each section of the SWOT:

- Economy and market
- Society
- Infrastructure
- Environment and Agriculture

Strengths

Economy and market

Saxony's economy is the strongest economy of the East German individual federal states, which can be seen in figure 10 (cf. 7). Moreover it contains a high quality in research and development. This becomes clear by the fact that the Technical University of Dresden is funded within the German Universities Excellence Initiative since 2012. The Free State of Saxony is

located in the tri-border region together with the other two European countries Poland and the Czech Republic, which is a locational advantage for companies (cf. 8).

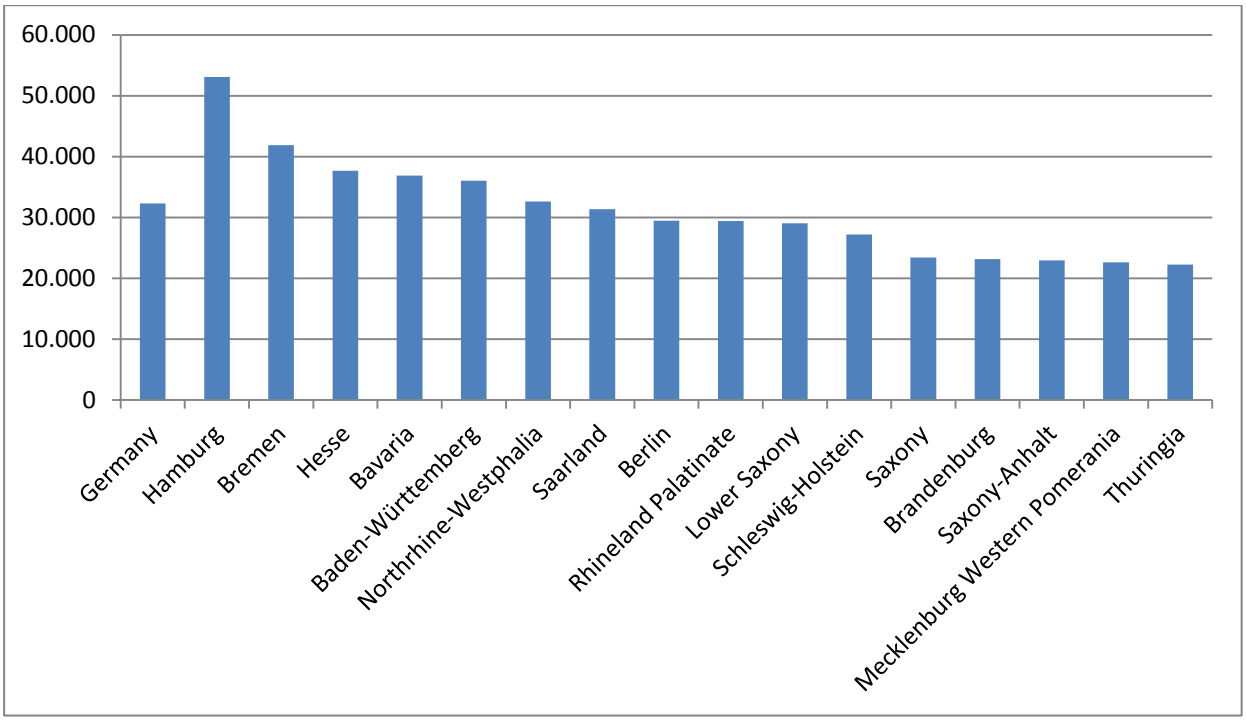

figure 10: GDP per capita in the federal states of Germany (cf.7)

Society

Moreover there is a high quality in school education in Saxony, which becomes clear by the aspect that Saxony reaches place one within the PISA-E 2006 (comparison of all German federal states) and within the German INSM Bildungsmonitor (cf. 8). More than 45 municipalities and 4 districts in Saxony take part on the European Energy Award® programme. That programme is funded by the SAB concerning the funding guideline energy efficiency and climate protection from 2007.

Infrastructure

The conurbations Leipzig-Halle, Chemnitz-Zwickau and Dresden are part of the metropolitan region Central Germany. Moreover the main motorway A4/E40 links the eastern part of Europe with the Western part of Europe. The European route E40 connects Calais in France with Ridder

in Kazakhstan and is the longest European route (8,000 km). Two important international airports, the airport Leipzig-Halle and the airport Dresden are based in Saxony. The Saxon Energy Agency is located in Dresden and supports the Saxon energy and climate policies.

Environment and Agriculture

In Saxony there are many funding programmes which support the energy and climate policy of the Free State. The most programmes support the use of renewable energy sources and the increase of the energy efficiency. Moreover the Saxon cabinet passed the Energy and Climate Programme of Saxony on 12th March 2013. This Programme can be seen as roadmap for the next 10 years.

Weaknesses

Economy and market

The East German federal states, including the Free State of Saxony suffered from the economical breakdown in 1990. The gross domestic product per employee amounts to only 77.5 % of the total German average. The catching up process to the West German federal states progressed only slowly in the past 15 years (cf. 7, 8). The unemployment rate in Saxony is higher than the German average. In March 2013 the unemployment rate of the whole Germany amounted to 7.3 % and 10.5 % in Saxony. The Innovation Strategy of the Free State of Saxony pointed out that the German companies do an insufficient innovation management.

Society

The demographic development is critical in Saxony. The young generation (people under 18 years) decreased from 2000 to 2009 by approximately 230,000 people (cf. 4). This led to an increasing age average from 1990 (39.4) to 2007 (45.7). It is estimated by the Statistical Office of the Free State of Saxony that the average age will increase until 2020 to 48.8 years. The birth rate in 2011 amounted to 8.3 per 1,000 inhabitants and the death rate amounted to 12.2 per 1,000 inhabitants. This means that there is a birth deficit of 3.9 per 1,000 inhabitants (cf. 4). A further weakness of Saxony is the low annual income compared to the total average of Germany. The Saxon employees earn 81 % of the German average in 2012 (cf. 7). The share of the pupils without school-leaving qualification amounts to 9.5 %. The whole German average amounts to 6.5 % (cf. 8).

Infrastructure

The share of the buildings, which were built between 1918 and 1948 in comparison to the total existing buildings in Saxony amounts to 52 %, which is the highest in Germany.

Environment and Agriculture

The most investments have to paid in advance by the beneficiaries. Often the private persons and municipalities cannot do this. There are a lot of bureaucratic hurdles in Saxony, which slow down the process of the extension of the renewable energies and energy efficiency measures. The process time of the grant application is too long and a lot of investments have to be paid in advance. Another weak fact is the controversial discussion regarding the renewable energies in Saxony and Germany.

Opportunities

Economy and market

With the use of renewable energies and the implementation of energy efficiency measures the Saxon economy could be strengthened. Due to the growing experience with renewable energies the acquisition costs will decrease in the next years. The proximity to the other European countries Poland and the Czech Republic opens new markets for Saxon companies and leads to transnational cooperation and to a growing economy.

Infrastructure

There is a great energy saving potential for households due to old housing stocks in Saxony.

Environment and Agriculture

The Energy and Climate Programme of the Free State of Saxony includes an action plan, which lays down the priority of supporting municipalities, SME's and citizens with funding programmes in renewable energies and energy efficiency measures.

Threats

Economy and Market

Beyond the demographic change, Saxony is also faced by the emigration of well trained staff, due to the low salaries in comparison with the West German federal states. Through the demographic change there could be a future lack of high qualified staff.

Infrastructure

The well status of the infrastructure in Saxony may lead to increasing traffic streams from East Europe to West Europe and the other way around. This may lead to environmental damages as e. g. higher traffic means higher local CO_2 emissions.

Environment and Agriculture

Without the incentive and grant programmes the renewable energies are sometimes not economical at the moment. When funding programmes will be cancelled the demand on the respective renewable energy source will decrease. The climatologists are expecting less and less precipitation in springs and summers, but also the possibility of heavy rainfalls from May to August especially in the eastern part of Saxony. This may lead to high damages in the agricultural sector.

3 Programme data and analysis

Availability of data and source of data

The data gathering process was difficult, due to the data protection. The German Reconstruction Loan Coorperation (KfW) could only deliver published data, which was not detailed enough for the analysis. The Saxon Development Bank (SAB) could deliver a good quality of data. That's why there was the decision to only analyse programmes of the SAB, concerning the funding guideline "Energy and Climate Protection, 2007". To control the data we used the ERDF beneficiary list (http://web1.extranet.sachsen.de/beguenstigtenverzeichnis). The analysed data are reliable.

3.1 Saxon Passive House Programme

3.1.1 Analysed programme details

Programme type (range):

The programme is available for Saxony only.

Programme name:

Saxon Passive House Programme

Budget (in €): 3,200,520.88

Timeframe:

Start: March 2008,

Finish: probably, when the funding period 2007-2013 ends (December 2013)

Beneficiaries:

Natural and legal persons of public and private law

3.1.2 Programme description:

In that programme passive house new buildings and the refurbishment with passive house components gets funded. Natural as well as legal persons of public and private law can use the programme. The maximum energy consumption of a new build passive house must not exceed 15 kWh/m²a. The passive house must be built according the regulation "Passive house planning package (PHPP)". The one who builds a passive house will get a non-repayable grant of 100 €/m² energetic area. For the refurbishment with passive house components the beneficiaries will get 130 €/m².

3.1.3 Benchmark assessment

Soft benchmarks:

Table 1: soft benchmarks

		Select level
	public involvement in environmental projects	2 - Medium
	environmental awareness improvement	3 - High
	determining the ability to participate in environmental projects	2 - Medium
	determining the ability to achieve positive ecological and economic effects of planned / realised investments	3 - High

Hard benchmarks

Table 2: hard benchmarks

	Item	numbers during analysis period
1	analysis period	03/2008 - 07/2012
2	Total investment cost	€ 5,574,901.63
3	grant/funding (cost to Saxony)	€ 2,760,499.85
4	n° of approved applications	125
5	share of beneficiaries on total households	0.006%
6	average total cost	€ 44,599.21
7	average cost to Saxony	€ 22,084.00
8	Total energy saved (GWh/year)	3.34578
9	Total energy saved (MWh/year)	3345.78
10	CO2 not emitted into atmosphere (kt/year)	0.9214
11	CO2 not emitted into atmosphere (t/year)	921.40
12	total cost per 1 MWh/year energy saved	€ 1,666.25
13	total cost per 1 kWh/year energy saved	€ 1.67
14	Cost to Saxony per 1 MWh/year energy saved	€ 825.07
15	Cost to Saxony per 1 kWh/year energy saved	€ 0.83
16	total cost per 1 kt CO2 saved	€ 6,050,468.45
17	total cost Saxony per 1 t CO2 saved	€ 6,050.47
18	total cost per kg CO2 saved	€ 6.05
19	Cost to Saxony per 1 kt CO2 saved	€ 2,995,984.21
20	Cost to Saxony per 1 t CO2 saved	€ 2,995.98
21	Cost to Saxony per 1 kg CO2 saved	€ 3.00
22	Cost of natural gas (annual average) in €/kWh (without taxes)	€ 0.0466
23	total cost of energy saved by consumers (assuming nat. Gas and without taxes)	€ 155,913.35

averages
totals

3.1.4 Conclusions

In comparison to the other analysed Saxon funding programmes the Saxon Passive house programme is very cost intensive for the Free State of Saxony. The conservation of 1 MWh energy results in costs of 825.07 € (125 % of the average) for Saxony. The costs per saved kg CO_2 amounts to 3.00 €, which is much higher than the average of the other analysed programmes (155 %). With the carried out measures during the analysis period a lot of energy could be saved. The total energy savings amount to 3,345.78 MWh/a. The energy saving per beneficiary amounts to 26.77 MWh per year, which means 242 % of the average of all analysed programmes.

3.2 Exchange of central heating boilers

3.2.1 Analysed programme details

Programme type (range):

The programme is available for Saxony only.

Programme name:

Exchange of the central heating boilers

Budget (in €): 23,971,913.00

Timeframe:

Start: March 2009,

Finish: February 2010, from April 2012 to September 2013 there was a special funding for pellet driven heating boilers (not observed in that report)

Beneficiaries:

Natural and legal persons of public and private law

3.2.2 Programme description:

In that programme the exchange of boilers is funded, which were operated with natural gas, heating oil or liquid gas. Natural and legal persons of public and private law can use the programme. The programme can be only used when the boiler must not be removed by law and when the existing boiler does not already use the condensing heating technology. The new boiler has to use that technology. The amount of the grant is 1,250 € per intervention.

3.2.3 Benchmark assessment

Soft benchmarks:

Table 3: soft benchmarks

		Select level
	public involvement in environmental projects	3 - High
	environmental awareness improvement	2 - Medium
	determining the ability to participate in environmental projects	2 - Medium
	determining the ability to achieve positive ecological and economic effects of planned / realised investments	3 - High

Hard benchmarks

Table 4: hard benchmarks

	Item	numbers during analysis period
1	analysis period	03/2008 - 07/2012
2	Total investment cost	€ 100.937.183,59
3	grant/funding (cost to Saxony)	€ 23.971.913,00
4	n° of approved applications	18549
5	share of beneficiaries	0,838%
6	average total cost	€ 5.441,65
7	average cost to Saxony	€ 1.292,36
8	Total energy saved (GWh/year)	86,89298
9	Total energy saved (MWh/year)	86.892,98

10	CO2 not emitted into atmosphere (kt/year)	22,42236
11	CO2 not emitted into atmosphere (t/year)	22.422,36
12	total cost per 1 MWh/year energy saved	€ 1.161,63
13	total cost per 1 kWh/year energy saved	€ 1,16
14	Cost to Saxony per 1 MWh/year energy saved	€ 275,88
15	Cost to Saxony per 1 kWh/year energy saved	€ 0,28
16	total cost per 1 kt CO2 saved	€ 4.501.630,68
17	total cost Saxony per 1 t CO2 saved	€ 4.501,63
18	total cost per kg CO2 saved	€ 4,50
19	Cost to Saxony per 1 kt CO2 saved	€ 1.069.107,49
20	Cost to Saxony per 1 t CO2 saved	€ 1.069,11
21	Cost to Saxony per 1 kg CO2 saved	€ 1,07
22	Cost of natural gas (annual average) in €/kWh (without taxes)	€ 0,0466
23	total cost of energy saved by consumers (assuming nat. Gas and without taxes)	€ 4.049.212,87

averages
totals

3.2.4 Conclusions

In comparison to the other analysed Saxon funding programmes Programme the exchange of the central heating boilers is cost efficient for Saxony. To save 1 MWh energy, there are costs for Saxony of 275.88 €, which means 42 % of the average of the four analysed Saxon programmes. The costs to save 1 kg CO_2 are the lowest of the analysed Saxon programmes. They amount to 1.07 € (55 % of the average). Due to the high number of beneficiaries, the energy saved in total is higher than the average. 18.549 beneficiaries, saved 86.892,98 MWh energy. The average energy saving per beneficiary amounts to 4.68 MWh/a.

3.3 Installation of solar thermal plants

3.3.1 Analysed programme details

Programme type (range):

The programme is available for Saxony only.

Programme name:

Installation of solar thermal plants

Budget (in €): 3,647,640.28

Timeframe:

Start: July 2009

Finish: December 2009

Beneficiaries:

Natural persons

3.3.2 Programme description:

The funding of solar thermal plants is offered for the refurbishment of existing residential buildings with a grant of 100 €/m². Precondition for using the programme is that the beneficiary has to do an energetic evaluation of the building or the heating system.

3.3.3 Benchmark assessment

Soft benchmarks:

Table 5: soft benchmarks

		Select level
	public involvement in environmental projects	3 - High
	environmental awareness improvement	2 - Medium
	determining the ability to participate in environmental projects	2 - Medium
	determining the ability to achieve positive ecological and economic effects of planned / realised investments	3 - High

Hard benchmarks

Table 6: hard benchmarks

	Item	numbers during analysis period
1	analysis period	03/2008 - 07/2012
2	Total investment cost	€ 23.032.028,79
3	grant/funding (cost to Saxony)	€ 3.647.640,28
4	n° of approved applications	2346
5	share of beneficiaries	0,106%
6	average total cost	€ 9.817,57
7	average cost to Saxony	€ 1.554,83
8	Total energy saved (GWh/year)	4,15078

9	Total energy saved (MWh/year)	4.150,78
10	CO2 not emitted into atmosphere (kt/year)	2,08795
11	CO2 not emitted into atmosphere (t/year)	2.087,95
12	total cost per 1 MWh/year energy saved	€ 5.548,84
13	total cost per 1 kWh/year energy saved	€ 5,55
14	Cost to Saxony per 1 MWh/year energy saved	€ 878,78
15	Cost to Saxony per 1 kWh/year energy saved	€ 0,88
16	total cost per 1 kt CO2 saved	€ 11.030.929,28
17	total cost Saxony per 1 t CO2 saved	€ 11.030,93
18	total cost per kg CO2 saved	€ 11,03
19	Cost to Saxony per 1 kt CO2 saved	€ 1.746.995,99
20	Cost to Saxony per 1 t CO2 saved	€ 1.747,00
21	Cost to Saxony per 1 kg CO2 saved	€ 1,75
22	Cost of natural gas (annual average) in €/kWh (without taxes)	€ 0,0466
23	total cost of energy saved by consumers (assuming nat. Gas and without taxes)	€ 193.426,35

averages
totals

3.3.4 Conclusions

In comparison to the other analysed Saxon funding programmes Programme the installation of solar thermal plants is cost intensive for the Free State of Saxony. For saving 1 MWh energy the Saxon state there are costs of 878.78 €, due to the funding, which means 133 % of the average of the four analysed Saxon programmes. To save 1 kg CO_2 the costs are amounting to 1.75 € (90 % of the average). The energy saved per beneficiary is the lowest value of all analysed programmes. 2,346 beneficiaries saved in total 4,150.78 MWh, which means 1,76 MWh/a energy saved per beneficiary. In comparison to the average energy saved per beneficiary this is only 16 % of the average.

The programme was stopped in 2009.

3.4 Energy efficient interior and street lights

3.4.1 Analysed programme details

Programme type (range):

The programme is available for Saxony only.

Programme name:

Energy efficient interior and street lights

Budget (in €): 4,885,100.92

Timeframe:

Start: June 2008,

Finish: probably, when the funding period 2007-2013 ends (December 2013)

Beneficiaries:

Natural and legal persons of public and private law and SME's

3.4.2 Programme description:

The funding of interior or street lights supports among others the following measures:

- substitution of lamps, usage of high efficient lamps,
- substitution of electronic control gear,
- devices for lighting control

Only owners of non-residential buildings have the opportunity to get a fund for interior lights.. Private households are excluded from the usage of that programme. The standard funding rate amounts to 35 % for the exchange of interior lights and 60 % for the exchange of street lights. The funding will be increased by 10 %, if municipalities take part in the programme European Energy Award® or if SME's can present the Saxon Energy Performance Certificate ("Sächsischer Gewerbeenergiepass").

3.4.3 Benchmark assessment

Soft benchmarks:

Table 7: soft benchmarks

		Select level
	public involvement in environmental projects	2 - Medium
	environmental awareness improvement	3 - High
	determining the ability to participate in environmental projects	2 - Medium
	determining the ability to achieve positive ecological and economic effects of planned / realised investments	3 - High

Hard benchmarks

Table 8: hard benchmarks

	Item	numbers during analysis period
1	analysis period	03/2008 - 07/2012
2	Total investment cost	€ 7.085.207,57
3	grant/funding (cost to Saxony)	€ 4.885.100,92
4	n° of approved applications	166 (61 municipalities)
5	share of beneficiaries on total sum of municipalities	13,927%
6	average total cost	€ 42.681,97
7	average cost to Saxony	€ 29.428,32
8	Total energy saved (GWh/year)	4,99093

9	Total energy saved (MWh/year)	4.990,93
10	CO2 not emitted into atmosphere (kt/year)	3,16579
11	CO2 not emitted into atmosphere (t/year)	3.165,79
12	total cost per 1 MWh/year energy saved	€ 1.419,62
13	total cost per 1 kWh/year energy saved	€ 1,42
14	Cost to Saxony per 1 MWh/year energy saved	€ 978,80
15	Cost to Saxony per 1 kWh/year energy saved	€ 0,98
16	total cost per 1 kt CO2 saved	€ 2.238.053,56
17	total cost Saxony per 1 t CO2 saved	€ 2.238,05
18	total cost per kg CO2 saved	€ 2,24
19	Cost to Saxony per 1 kt CO2 saved	€ 1.543.090,64
20	Cost to Saxony per 1 t CO2 saved	€ 1.543,09
21	Cost to Saxony per 1 kg CO2 saved	€ 1,54
22	Cost of natural gas (annual average) in €/kWh (without taxes)	€ 0,0466
23	total cost of energy saved by consumers (assuming nat. Gas and without taxes)	€ 232.577,34

averages
totals

3.4.4 Conclusions

In comparison to the other analysed Saxon funding programmes the costs for saving 1 MWh energy are very high. They amount to 978.80 €, which means 148 % of the average of all analysed programmes. The costs to save 1 kg CO2 are lower than the average. They amount to 1.54 € (80 % of the average). The participating municipalities saved in total 4,990.93 MWh of energy. Each municipality saved 81.82 MWh of energy.

4 Programme analysis

The analysed funding programmes are all part of the funding guideline Energy and Climate protection from 2007. The guideline was passed by the Saxon State Ministry for Environment and Agriculture and the Saxon State Ministry for Economic Affairs, Labour and Transportation. The analysis only observes natural persons and municipalities as beneficiary, because these are the target groups of EnercitEE. Three of the analysed programmes were mainly used by natural persons:

- The passive house programme,
- the exchange of the central heating boilers and
- the programme for the installation of solar thermal plants

The funding programme for the exchange of interior and street lights was used by 61 municipalities of the Free State of Saxony. Beyond the municipalities, also the SME's used this programme, but this is not observed in this report.

In total there were 21,020 approved applications for citizens. 61 municipalities of Saxony applied for the interior and street lights programme and the Saxon Development Bank funded 166 approved applications of them (some municipalities did more than one application). The total energy saved per year amounts to 99,380.47 MWh per year. Moreover 28,597.50 tons of CO_2 were saved with the use of the analysed programmes within that analysis period. Table 9 shows the most important indicators of the analysis and each funding programme, which were analysed.

Table 9: overview of the analysed funding programmes of Saxony

	Citizens			Municipality
item	passive house	heating boilers	solar thermal plants	street lights
n° of approved applications	125	18.549	2.346	166 (61 municipalities)
share of beneficiaries on total households/ total municipalities	0,006%	0,838%	0,106%	13,927%

Total Energy saved (MWh/year)	3.345,78	86.892,98	4.150,78	4.990,93
CO_2 not emitted into atmosphere (t/year)	921,40	22422,36	2087,95	3165,79
Cost to Saxony per 1 MWh/year energy saved	€ 825,07	€ 275,88	€ 878,78	€ 978,80
total energy saved per beneficiary in MWh/year	26,77	4,68	1,77	81,82
Cost to Saxony per 1 t CO_2 saved	€ 2.995,98	€ 1.069,11	€ 1.747,00	€ 1.543,09

After knowing the single key figures of each analysed programme, an assessment of the funding programmes referring to the most crucial indicators, took place to show the cost-benefit-ratio of the programmes. Therefor the project partnership set up a calculation tool. The soft key figures (green marked) received the weight 1 and the hard key figures (yellow marked) received the weight 3. Then every programme was assessed with the numbers 1, 2 or 3, which at the same time shows the ranking of the single programme in comparison to the other ones. The result of the calculation is that the exchange of the central heating boilers has the best cost-benefit ratio of the analysed funding programmes, followed by the passive house and the solar thermal plants programmes. The funding programme for the exchange of the interior and street lights was not calculated with the tool, because it was used by municipalities, whereas the calculated programmes were used by natural persons.

Table 10: evaluation of the funding programmes for natural persons

		Citizens					
funding programme		**passive house**		**heating boilers**		**solar thermal plants**	
item	**weight**	**points**	**total**	**points**	**total**	**points**	**total**
n° of approved applications	1	3	3	1	1	2	2
share of beneficiaries	1	3	3	1	1	2	2
Total Energy saved (MWh/year)	1	3	3	1	1	2	2
CO_2 not emitted into atmosphere (t/year)	1	3	3	1	1	2	2
Cost to Saxony per 1 MWh/year energy saved	3	2	6	1	3	3	9
total energy saved per beneficiary in MWh/year	3	1	3	2	6	3	9
Cost to Saxony per 1 t CO_2 saved	3	3	9	1	3	2	6
sum			**30**		**16**		**32**

5 General conclusions

The analysed funding programmes do all contribute to the strategy of Saxony to reduce the energy consumption and to increase the energy efficiency. The analysed funding programmes within the EnercitEE project contributed to an energy saving of nearly 100,000 MWh per year for Saxony. The total CO_2 not emitted into the atmosphere amounts to 28,597.50 t/year. The average costs for Saxony to save 1 MWh energy per year amounts to 659.61 €. The most expensive analysed funding programme is the programme for the exchange of the interior and street lights (978.80 €) followed by the fund for the installation of solar thermal plants (878.78 €) and the passive house programme (825.07 €). The exchange of the central heating boilers (275.88 €) is the most cost efficient programme for the Saxon government to save 1 MWh energy per year. This programme is also the most cost efficient one for saving 1 t CO2/year. The funding costs for the exchange of the central heating boiler are amounting to 1,069.11 € followed by the exchange of the interior and street lights programme (1,543.09 €), the fund for the installation of solar thermal plants (1,747.00 €) and the passive house programme (2,995.98 €). The highest energy saving per beneficiary was reached by the funding programme for the passive house (27.77 MWh/year and beneficiary) followed by programme for the exchange of the central heating boilers (4.68 MWh/year and beneficiary) and the funding programme for the installation of solar thermal plants (1.77 MWh/year and beneficiary). The grant for the exchange of the interior and street lights saved 81.82 MWh/year and beneficiary, but the beneficiaries are the individual participating municipalities and therefore it is not comparable to the other programmes.

6 Lessons learned

The interregional comparison of the funding programmes in the 3 participating EnercitEE regions showed the different approach of the countries, concerning the increase of energy efficiency and renewable energies. Originally the project partners wanted to observe funding programmes, which support equal investments. This goal was reached only partly. This has several reasons. One reason is the different number of funding programmes in the regions. While there are a lot of available funding programmes in Saxony, which support the increase of renewable energies and energy efficiency, the inhabitants and municipalities of Lower Silesia can only use a few programmes. The region Emilia-Romagna is well provided with funding programmes and is mostly influenced by the 55 % tax rebate programme, where a lot of single and combined measures are funded. A further reason is the different quality of available data. Due to the data protection, the funding institutions cannot deliver the best quality data. The Saxon Development Bank delivered well prepared and current data to Bautzen Innovation Centre. In the region Emilia-Romagna national and regional statics were evaluated. Moreover on provincial level the city Modena delivered well prepared data. The data gathering process in Lower Silesia was a bit difficult. That's why the result of the Lower Silesian analysis is only partly meaningful.

Nevertheless, the partnership found a way for comparing the programmes. In all 3 participating regions programmes for solar thermal plants were analysed. Moreover a funding programme for the exchange of the central heating boiler could be compared between Saxony and Emilia Romagna.

The conditions, the number of beneficiaries and the reduced energy consumption and reduced CO_2-emissions were the most interesting part of the analysis. The programme with the most approved applications was the 55 % tax rebate programme from the region Emilia-Romagna.. This programme can be used to carry out very different interventions, for example to exchange the windows or the heating, to install solar thermal plants, to refurbish horizontal opaque structures as floors or roofs and vertical opaque structures as walls and to do combined or other interventions. In total there were 1,839 billion € disbursed among the beneficiaries between 2007 and 2011 in Emilia Romagna, which shows the importance of that programme in Emilia Romagna and the whole Italy as well. The beneficiary of that programme will get back 55 % of the investment costs within 10 years after carrying out the measure in form of a tax rebate. Precondition is that people will do the annual tax declaration.

Moreover the region Emilia Romagna has some funding programmes on the level of the province of Modena, which is similar to the German districts. One programme can be used for the exchange of old boilers with high efficiency boilers. A further programme for citizens aimed to install solar thermal systems. The programmes were in progress from 2003 to 2005 and they cover 25 % of the investment costs. This was paid beyond the 55 % tax rebate.

In Lower Silesia 3 programmes were selected. The Solar Thermal Collective Incentive funds 45 % of the investment costs are funded. The minimum subvention amounts to 1,750 €. In comparison to the Saxon and Emilia Romagna region programmes the amount of fund is higher.

A further programme in the voivodeship Lower Silesia is the Thermo-Modernisation and Renovation Fund, which can be used by private households and also municipalities. This programme supports for example investments for refurbishing the houses or to exchange windows. The fund is paid after an energy audit. Moreover there is the regional operational programme for the Lower Silesian voivodeship, where several measures were funded in the period 2007-2013. The focus was especially put on the Thermomodernisation of public buildings. The programme supports up to 75 % of the investment costs.

7 Policy Recommendations

General recommendations for framework conditions for increasing energy efficiency and the share of renewable energies

- Advertising campaign for renewable energies and energy efficiency measures
- Funding programmes for new technologies, e. g. energy storages
- Percental funding rates instead of area-specific funding conditions
- Precalculation of the cost-benefit ratio of the funding programmes
- Funding programmes for multi-family buildings
- More simple application procedure and faster approval of a fund (reducing bureaucracy)
- Pre-financing of investments

Recommendations for the funding programmes

(1) Saxon Passive House Programme

- The funding programme supports the Saxon goal of the implementation of low energy buildings.
- A continuation of the funding programme to compensate the higher building costs in comparison to a standard building is desirable.
- Beyond the funding of 100 € m² energetic area, also a percental funding of 10 %-15 % is imaginable.

(2) Exchange of the central heating boilers

- There is a high amount of energy saving for the beneficiaries.
- The costs for Saxony are low.

- The percental funding rate would support the installation of more efficient systems, e. g. which are operated by renewable raw materials. More expensive systems could be amortized earlier.
- There is no desperately necessity to relaunch the programme in Saxony, because the KfW and BAFA are also granting it.

(3) Installation of solar thermal plants

- The programme generated only a low energy savings, although there were a high number of approved applications.
- The costs to save 1 MWh energy are very high.
- The BAFA also grants investments in solar thermal plants.
- There is no necessity to relaunch the programme in Saxony

(4) Exchange of the interior and street lights

- - continuation of the funding programme due to high energy savings for the municipalities (approx. 81.82 MWh per year) and saved energy costs of around 20,000 € with assuming the average energy savings of 81.82 MWh per year
- This funding programme generated very high energy saving effects in the participating municipalities.
- The opportunity of the use of the programme by natural persons for the exchange of the interior lights in their flats could establish low energy consuming lights.
- The stimulus of an additional fund of 10 %, when participating in the programme European Energy Award, should be part of future programmes, too.
- The funding programme should be continued in the future funding period, too.

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