GRACE

Grants and other incentives for cost and energy efficiency

Summary Evaluation Report for Lower Silesia Region, Free State of Saxony and Emilia Romagna

Sub-Project-Partnership:
Bautzen Innovation Centre
(Saxony, Germany)

Wroclaw Research Center EIT+ Ltd.
(Lower Silesia, Poland)

Energy and Sustainable Development Agency of Modena (Emilia Romagna, Italy)

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Authors of Grace Report:

Marcel Bellmann, Jürgen Besold, Julia Culver,
Alicja Jachimowicz, Lisa Sentimenti, Łukasz Szałata.

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1 Regional Overview

1.1 Lower Silesia

According to the Report of the Energy Regulatory Office of 2010, there are 5 biogas plants in Lower Silesia, two wind farms, 96 hydropower plants and three biomass and fossil fuels cofiring plants. Altogether, we have 109 installations with a capacity of 70,975 MW. Currently, RES in Lower Silesia are used in 64 municipalities.

Development prognosis of RES in Lower Silesia (LS), takes into account the economic, technical and theoretical potential. Municipalities in the LS region have favorable conditions for wind and solar energy development - mainly in the eastern part of the region - on the south of Jelenia Góra, insolation value is about 3800 MJ/m^2/year. Lower Silesia climatic conditions are very similar to Saxony region, where lots of wind farms have been located.

Wzgorza Trzebnickie is an area with advantageous conditions for the wind and solar energy development. Sudecko - Świętokrzyski geothermal region - LS is a part of, is on the third place in Poland in terms of geothermal energy and on the fifth place in terms of geothermal waters capacity. Taking into account the energetic potential, the use of RES on the LS region is not satisfying in comparison to other voivodeships in Poland, the use of the river potential however, is on a quite good level. Additionally, solar energy and energy-efficient construction have been recently supported by the Regional Fund for Environmental Protection, what has been described in this study. It has to be noted, that there are many more opportunities to increase the use of water and wind energy in the LS region. The use of RES in the LS region is a basis of sustainable energy development and it brings us closer to achieve the goal of reducing greenhouse gases emission, i.a. CO2 and ensuring positive economic and social effects.

table 1: Lower Silesia energy potential display in terms of renewable energy sources:

Lower Silesia energy potential	POWER
straw	5,5 PJ
hay	0,3 PJ
wood	5,3 PJ
culture biomass	6,3 PJ
energy crops	0,004 PJ
wastelands	18 PJ
municipal waste	0,6 PJ
total hydropower	ok. 65 MW
wind energy planned power plants with a total capacity up to 2020	ok. 127 MW
geothermal energy geothermal water energy installations power	1 MW
insolation energy use	A few to over a hundred solar energy use

Source: research and analysis of Lower Silesia renewable energy sources use potential, October 2010.

table 2: Summary of Renewable Energy for the Lower Silesia

Type of installation	Installation amount	Power [MW]	Installation amount	Power [MW]	Installation amount	Power [MW]
		Dolny Śląsk		Dolny Śląsk		Poland
production from waste watertreatment plants	5	2,558	14	10,854	199	131,247
agricultural biogas production	4	3,951				
Landfill biogas production	5	4,345				
Mixed biomas production	1	100	1	100	27	820.700
production form solar radiation	1	0,124	1	0,124	9	1,289
wind farms on land	6	62,265	6	62,265	696	2 496,748
Flow kinetic hydropower to 0,3 MW	61	6,528	97	47,154	770	966,103
Flow kinetic hydropower to 1 MW	23	12,347				

Flow kinetic hydropower to 5 MW	**11**	**28,279**				
Flow kinetic hydropower to 10 MW	**2**	**17.305**				
Technology of co-combustion (fosill fuels and biomas)	**3**	**0**	**3**	**0**	**43**	**0.000**

Source: Urząd Regulacji Energetyki – Energy Regulatory Office, 06.04.2013

1.2 Saxony

Germany is divided in 16 federal states. The Free State of Saxony 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
- the Czech Republic in the South

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

Saxony has an area of 18,416 km² and is inhabited by approximately 4,134,000 million people, which means 224 inhabitants per square meter. 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, which were formed during the Ice Age. Around 55 % of the total area of Saxony are areas for agriculture, 27 % are forest areas and 2 % are water areas. Approximately 12 % of the area is constructed as traffic areas and 4 % are mining or other areas.

Saxony has a GDP of approximately 95,100 million EUR (2011). The GDP per capita amounts to 23,000 EUR (2011). The per capita salary per employee amounts to 2,017 EUR per month (2011). The average monthly available income per household is 3,609 €. The monthly expenditures for households amounted to 3,362 € in 2008. 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 %, which means a percentage increase of 43 %.

The unemployment rates decreased from 18.2 % in 2005 to 10.5% in March 2013. One reason for that is the demographic change in Saxony. Other reasons are the good economic situation and more and more part-time-work, which leads to enormously decreasing of unemployed people.

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. In comparison to 1991 the population decreased by 610,000 people. The number of households increased by around 150,000 in the same time. This leads to a shrinking average of people per household. In 1991 there were 2.3 people per household, whereas in 2012 there were only 1.9 people per household. Especially the population under 18 years is faced with that problem, which is shown by a decrease of 31.3 % from 2000 to

2009. It is predicted that the whole population will decrease by 21% up to 2020 in comparison to 1990. This shows that Saxony is really faced by the demographic change.

The primary energy consumption in Saxony in 2010 amounted to 635,651 TJ. The overall primary energy consumption decreased from 1990 to 1992. Especially the share of the lignite shrank enormously between the years 1990 and 1999. Since 1999 the primary energy consumption grew to a higher level and remains on nearly the same level until the end of 2010. Lignite will remain the most important energy source in the future. There is an enormous mining potential in Saxony. The policy makers of Saxony passed the Saxon Energy and Climate Programme on the 12th March 2013, where the further usage of lignite is laid down.

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.

The renewable energies still have a very low share in 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 MWpeak), 16796 solar plants (504.38 MWpeak), 339 biomass and biogas plants (203.14 MWpeak) and 293 hydroelectric power stations (86.85 MWpeak) in Saxony.

1.3 Emilia Romagna

Emilia-Romagna is located in north-eastern Italy. The main energy source is natural gas (62.6%), now mostly imported, with renewables accounting for 5.3% of the 2008 energy balance. The second *Triennial Implementation Plan 2011-2013* of the Regional Energy Plan calls for a 10% reduction in energy consumption over trend levels by 2020, signifying energy savings of ca. 1.57 Mtoe per year (of which 47% or 0.738 Mtoe/year is in the residential sector). The renewables share is to rise to 17-20% of final consumption, with solar and

biomass playing key roles. By 2011 the share of renewables in *power generation* had risen to 12.3%.

In 2010, the region accounted for 11.7% of applications for the national 55% tax rebate programme for energy-efficiency interventions in buildings; whereas in 2011 this share increased to 12.4%. Subsidies for energy-efficient boilers have been implemented at the provincial level, and new incentives involving rotating funds that subsidise interest payments were introduced (Kyoto Fund supported by the *Cassa Depositi e Prestiti* in 2012; Green Economy funds supported by the Programme ROP ERDF 2007-2013 priority 3 "energy-environmental upgrading and sustainable development" in 2013). Emilia-Romagna is a leader in energy certification requirements for buildings.

In 2011 Italy had an energy dependence rate of 81.29%, down from a high of 87.01% in 2006, thanks to the increase in the share of renewables in gross final energy consumption from 5.3% in 2004 to 10.1% in 2010. Italy was the fourth largest producer of renewable energy in Europe in 2011, with a total installed capacity of 41,399 MW and a new record output of 82,961 GWh, registering an increase of 8% over 2010. Total national inland consumption of primary energy was 172,940 ktoe. Italy's gross inland energy consumption of natural gas in 2011 reached 63,814 ktoe (37% of total consumption), down from 70,651 ktoe in 2005; whereas consumption of petroleum products was 48,485 ktoe (28% of total consumption) in 2011, down from a peak of 59,506 ktoe in 2004.

Emilia-Romagna remains heavily dependent on natural gas imports, though it does have its own declining indigenous production. In 2008, the last year for which comprehensive and validated data are available, the Region required circa 16.4 million tonnes of oil equivalent (Mtoe) of primary energy, of which 62.6% was derived from natural gas (mainly methane), 30.6% from petroleum products, 5.3% from renewable energy sources (RES), 1% from electricity imports and a minimal share of solid combustibles (0.1%).

While there have been major investments in non-combustible renewable energy sources for electricity generation (particularly solar), thermal generation still overwhelmingly represents the main source of power in Emilia-Romagna. In the power production balance as of 31

December 2010, thermal sources (including biomass) represented 94.4% of output, hydro 4.9% and wind 0.1%. Over the past decade there has been a shift from fuel oil to natural gas as well as to biomass and urban wastes in power generation. In 2009 biomass accounted for the largest renewable source for power generation, yet by 2011, as seen below, solar energy became the largest single source of renewable energy in the region—though as a group bio-energies represent a far larger share.

According to the *Triennial Action Plan 2011-2013* of the Regional Energy Plan, production of renewable electricity in Emilia-Romagna in 2009 totalled 779 MW: comprised of wind (16 MW); solar PV (95 MW); biomass (371 MW); and hydro (297 MW). The Objectives for 2020 are to reach a total RES power capacity of 4500-5060 MW or 1,457.1-1,517.4 ktoe with investments of €12,083-13,989 M foreseen. Recent data from the GSE Statistical Report 2011 on renewable energy facilities indicate that in 2011 the region had a total of 31,298 installed renewable energy systems with a combined capacity of 2070.3 MW, the largest share comprised of solar collectors (31,010 systems with 1267 MW capacity, 61.2% of installed RES capacity). The region accounted for 5.0% of Italy's total installed RES capacity, yet its shares are even higher in terms of number of installed solar energy systems (9.4%) and capacity of installed systems in MW (9.9%).

In terms of renewable energy power output, the region produced a total of 3,527.4 GWh in 2011 (solar 31%, hydro 24.7%, biomass 22.1%, biogas 15.4%, etc.), representing 4.3% of total national electricity production. The region was second in Italy in terms of generating solar power--1,092.2 GWh or 10.1% of country solar electricity output. The region is also a major player in bio-energies, accounting for 12.8% of Italy's installations and 16.9% of installed capacity with a total output of 1542.7 GWh, 14.2% of the country total. The RES profile reflects the dramatic increase in investments in solar energy systems benefitting from strong government incentives through 2011. In 2011 RES accounted for 12.3% of power consumption in Emilia-Romagna, up from 9.4% in 2010, though this is far lower than the rate for Italy as a whole, 23.5%.

Natural gas remains the most important energy resource for households, both for direct use in domestic heating and cooking and for indirect use by generating electricity in thermal

power plants. Data provided by the Ministry for Economic Development (MiSE) show that in 2010 Emilia-Romagna accounted for 11,896.7 million m3 or 14.9% of the natural gas distributed in Italy, second after Lombardy. This amount is slightly less than the 11,990.19 million m3 distributed in 2007, when the region represented 14.7% of the total. While the amount of gas distributed in the region has declined since 2007, the share that went to secondary networks, which includes residences and tertiary customers as well as smaller industrial and thermoelectric users, increased from 4,589.97 million m3 in 2007 to 5,053.30 million m3 in 2010—reflecting a decline in major industrial and thermoelectric power plant consumption during the period under observation and higher demand of households and the service sector.

Natural gas accounts for close to 62% of the consumption in the residential sector—used primarily for space heating, hot water and cooking. Given that in 2009 94.2% of the families in the region were connected to the natural gas network (versus 77.7% in Italy), energy efficiency incentives in the residential sector particularly concern the energy savings of families associated with the reduced consumption of natural gas—or with the substitution of oil-fuelled boilers with more efficient gas boilers. In urban areas, most residences are heated by natural gas, whereas in rural areas and in the mountains, biomass or fuel oil might also be used. The use of wood pellets has become more popular. In 2008, the residential sector was responsible for nearly 20% of final regional energy consumption.

The 2001 Census indicated that the majority of heating systems were autonomous systems for individual home use as opposed to centralised heating systems. While the 2011 census has been completed, the results for types of housing and heating systems have not yet been published as of March 2013.

In terms of gas consumption per capita, Parma province has the highest level, and far higher than the neighbouring Piacenza province. By 2010 there were district heating programmes present in all provinces of the region. Gas consumption for heating has declined since the regional peak in 2003, though in some provinces gas consumption increased in 2011. Most of the Emilia-Romagna region is in climate zone E, while some mountainous areas are in climate zone F. While winters are cold and snow is common in many parts of the region, the

provinces on or near the coast tend to have a milder climate (Ravenna, Forlì and Rimini), though Ravenna has the second highest level of gas consumption per inhabitant.

2 Summary of SWOT Analysis

2.1 Lower Silesia

As a result of the SWOT analysis of Lower Silesia energy efficiency, basic parameters have been characterized in following ranges:

- economy and market, society, infrastructure, environment and agriculture:

Key strenghts on economy and market:

- Increasing innovativeness of existing enterprises, including energy producers
- Border regions supported from EU and regional funds
- Small impact of the economic crisis,

Weaknesses include complicated procedures of National Fund for Environmental Protection and Water Management.

Key **strengths** on society are:

- High concentration of highly qualified personnel and fast increase of number of well trained workers
- Strong academic Centre in Wroclaw with high R&D potential supported by developing higher education institutions in other LS cities
- Increasing ecological awareness and interest in environmental and energy issues
- Weaknesses include parameters such as low awareness on energy efficiency issues.

Key **strengths** on infrastructure are:

- Beneficial geographic location in Polish-German border area
- High urbanization index: 71% (60% average in Poland)
- Big investments in innovation technical infrastructure
- Weaknesses - insufficient use of RES.

Key **strengths** on environment and agriculture are:

- Large forest areas and agricultural ecosystems
- Low level of chemical pollution in farm production
- Favorable soil and climate conditions for diverse agricultural production
- Increasing number of individual farms
- Increasing enterprise initiative and education level of rural areas
- Ecological production

and Weaknesses:

- Low ecological awareness of rural area society
- High concentration of dusts and gaseous atmospheric pollutions .

Internal and external environment analysis allowed also to estimate opportunities and threats for this study -> Key **opportunities** on economy and market:

- Diverse existing industry gives the potential for sustainable development
- Governmental and regional restructuration programs for traditional industry branches

- Implementation of innovative technologies in industry and development of service sector

, the threat is, e.g. insufficient coordination and linking between existing informational systems and media.

In the case of infrastructure parameters analysis:

RES energy potential use

Intensification of cooperation between industry and R&D sector in area of environmental protection and energy, for which potential conflict with NATURA 2000 would be a threat.

Opportunities for environment and agriculture:

- Ongoing restructuring and modernization programs
- Possibility of develop activities close to agriculture based on structural funds,

Threats are: complicated and bureaucratized system of grants and incentives for agriculture and environment.

Strengths, weaknesses, opportunities and threats parameters analyzed above, indicate that Lower Silesia has a large potential for further use of renewable energy sources. To sum up, LS has a large potential for renewable energy development in its area. An appropriate climate policy and providing financial support for this type of investments will ensure the success of achieving the environmental effect, which is CO_2 emission reduction to the atmosphere.

2.2 Saxony

Strengths

Economy and market

Saxony's economy is the strongest economy of the East German individual federal states. 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. This was identified by the Enquete commission of the Free State of Saxony. Moreover the Free State of Saxony is located in the tri-border region together with the other two European countries Poland and the Czech Republic.

Society

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". More than 36 municipalities and 2 districts in Saxony take part on the European Energy Award® programme. That programme is funded by the Saxon State Ministry for Environment and Agriculture concerning the funding guideline energy efficiency and climate protection from 2007 to push municipalities and cities to take part on that programme.

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. Moreover in Leipzig an environmental zone was established.

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. 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. 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 to 48.8 years until 2020.

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. 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. The share of the pupils without school-leaving qualification amounts to 9.5 %. The whole German average amounts to 6.5 %.

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

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. The conditions in Saxony are great. The Sächsische Aufbaubank offers a lot of incentives and grant programmes to the companies. Another fact is that the acquisition costs of renewable energies will decrease in the next years based on generated experiences with the renewable energies. 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. The more using of renewable energies for the personal consumption can lead to decreasing value for the grid expansion.

Environment and Agriculture

Knowing the fact that the wish of Saxony is to reduce the annual CO_2 emissions by 6.5 million tons by 2020 and to increase the share of the renewable energies to 28 % until 2023 the future funding policy is clear. The incentive and grant programmes will continue, but maybe with other conditions. 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.

Risks

Economy and Market

The demographic change will lead to a further emigration of well trained employees, especially due to the low salaries in comparison with the West German federal states. Another consequence from the demographic change is the future lack of high qualified staff. Moreover the purchasing power of the consumers will shrink, which leads to decreasing turnovers for the companies and dismissals of the employees.

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. forests will be cut due to the extension of the streets or higher traffic means higher local CO2 emissions.

Environment and Agriculture

Without the incentive and grant programmes the renewable energies are not economical at the moment. When funding programmes will be cancelled the demand on the respective renewable energy source will decrease and companies will get insolvent. 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.

2.3 Emilia Romagna

The main SWOT analysis patterns of the Emilia Romagna region with regard to energy-efficiency investments are as follow:

Strengths

- High level of per capita income and spending capacity and relatively low unemployment;
- Well developed business structure—mechanical, motor and metalworking industries, ceramic tiles, ICT, construction as well as “green businesses”
- Strong public interest in EE and environment--Increasing acceptance of green concepts, use of bicycles
- Important Universities and research institutes
- Favourably located for access to natural gas—new LNG regassifier (Rovigo) and gas pipelines

Weaknesses

- Government budget crisis has reduced public propensity for spending
- Difficulty in enforcing standards—use of "auto-certification"
- Difficulty for companies and individuals to get bank loans
- High propensity for purchasing electronics and new items (for Italy) like air conditioners and clothes dryers
- Large share of older energy-inefficient housing, particularly buildings with centralised heating and/or old boilers
- Rigid winters require increased heating, hotter summers have led to rising use of air conditioners

Opportunities

- Business opportunities for local companies providing EE products and services
- Opportunity to improve the value and energy performance of residential property
- Chance to realise greener lifestyle and change attitudes toward energy consumption
- sustainable effects of EE interventions in residential sector on income, comfort and employment

Threats

- Budget cuts set limits to the tax rebate programme from 2013
- Economic crisis erodes financial resources of citizens and propensity for investment
- Banks no longer provide small loans for EE to homeowners
- Time required for effects of EE intervention to be felt.
- Serious air pollution problems of the region may only be partially addressed by interventions in the residential sector
- Tax increases on energy have masked effects of greater energy efficiency

3 Analysis of funding programmes

3.1 Lower Silesia

a) Solar Thermal Collector Incentives

Description:

The offer of the National Fund, directed to individual households, still grows in popularity. In the RES sector, the credit co-financing programme for solar collectors, brings very good results. Ca. 25 thousand households joined the programme. In 2011 the National Fund, as the only Polish institution, was awarded a prestigious prize – the Best Practice Certificate EPSA 2011. In the same year, the offer for households (by the intermediary of territorial self-government units) was extended by grants and loans for home wastewater treatment plants and connecting households to the central sewage system. In cooperation with some banks, in 2013 the National Fund will launch a programme of co-financing credits for purchase or construction of energy-efficient buildings. By 2015 the National Fund will support individual investors with the amount of PLN 450 million PLN, co-financing purchase or construction of the planned 12 thousand energy-efficient houses and apartments.

Effects:

The programme mentioned above, have a big potential to support the pursuance to reduce CO2 emission. Funding programmes also bring Lower Silesia closer to the aim of being more energy efficient..

b) Thermomodernization and Renovation Fund

Description:

The thermomodernization bonus is a form of state help for an investor who carries out thermomodernization enterprise. It is paid out by Bank Gospodarstwa Krajowego at 25% of the loan used for such an enterprise. An investor who carries out a thermomodernization

enterprise only pays off 75% of the amount used for the loan. The thermomodaernization bonus only partakes to investors who benefit from a loan granted by banks co-operating with BGK, it cannot be used by enterprises that carry out thermomodernization enterprise with their own funds. The clients can be council, housing co-operatives, commercial law partnerships, housing associations, as well as natural persons, detached family house owners.

Effects:

The programme mentioned above, have a big potential to support the pursuance to reduce CO2 emission. It will help to reduce energy consumption for heating and water heating, reduce costs of heat delivery to buildings and reduce primary energy losses in local heating networks and local heat sources supplying them.Funding programmes also bring Lower Silesia closer to the aim of being more energy efficient..

c) Regional Operational Programme for Lower Silesia Voivodeship

Description:

The implementation of 6 measures in Lower Silesia Region in the area of highly efficient energy production, efficient distribution of energy, thermomodernization of public buildings, production of energy from renewable energy sources, production of energy from renewable energy sources and networks facilitating energy collection from renewable energy sources.

Effects:

The programme have a potential to support CO2 emission reduction in Poland and in Lower Silesia Region. Still, it requires more legal and administrative procedures and easier access to data. In the future, the facilitation of the evaluation process of implemented measures in the Region should be considered.

3.2 Saxony

a) Saxon Passive House Programme

Description:

In that programme new passive house buildings and the refurbishment with passive house components is funded. Natural as well as corporate entities 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. Effects:

The Saxon Cabinet passed the Saxon Energy and Climate Programme on 12th March 2013. In that concept it is laid down that the construction of the low energy buildings is planned to increase by 2023. Thus the funding programme for Passive houses supports the aim of Saxony to reach a high share of low energy buildings by 2023.

b) Energy efficient interior and street lights

Description:

The funding of interior or street lights is part of the Saxon funding guideline energy and climate protection.

The following measures can be financed by the programme:

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

The interior lights will be only funded for non-residential buildings. Private households are excluded from the usage of that programme. The funding programme is part of the Saxon action plan energy and climate from 2007. This action plan will implemented with funding programmes like the above described programme. The basis for that action plan are several German and international regulations.

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, if municipalities take part in the programme European Energy Award® or if SME's can present the Saxon Energy Performance Certificate ("Sächsischer Gewerbeenergiepass").

Effects:

This funding programme also influences the Saxon aim of being more energy efficient by 2023.

c) Exchange of central heating boilers

Description:

In that programme the exchange of boilers is funded which are operated with natural gas, heating oil or liquid gas. Natural as well as corporate entities can use the programme. The programme can only be 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 must use that technology. The amount of the grant is 1,250 € per intervention.

Effects:

The funding programme aims to exchange the old and high energy consuming heating boilers with new boilers with combined heat and power. This lead to a decreasing energy consumption for a household and to lower energy costs per year. With the help of this programme, the energy consumption of the beneficiaries decreased by 86,892.98 MWh per year.

d) Installation of solar thermal plants

Description:

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

Effects:

The funding programme also supports the aim of Saxony to be more energy efficient in 2023.

3.3 Emilia-Romagna

a) 55% tax rebate programme for energy-efficiency interventions in buildings

Description:

The main energy efficiency measure used in the region is the 55% tax rebate programme introduced in 2007. As a result of this programme, participants in Emilia-Romagna accounted for a total of 146,719 interventions aimed at energy efficiency in the period 2007-2011. In

2010, a record number of 47,317 interventions (in anticipation of the ending of the tax rebates in 2011) was undertaken in 2010, with total investment reaching around €552 million (suggesting an average investment of €13,418). Yet in 2011, only 34,803 interventions with a total investment of €402,532,282 were undertaken. This represents a 26.4% drop in the number of interventions and a 27% drop in total investment as the participation in the incentive dipped below the 2008 level. In late 2012, the incentive was extended to 30 June 2013.

Effects:

- Business opportunities for local companies providing EE products and services
- Opportunity to improve the value and energy performance of residential property
- Chance to realise greener lifestyle and change attitudes toward energy consumption
- sustainable effects of EE interventions in residential sector

b) Grants by the Province of Modena for solar-thermal systems

Description:

Between 2003 and 2005 the Province of Modena operated a call for grants for solar-thermal systems, covering 25% of overall system costs.

Effects:

- Stimulus to the local economy
- Contribution in the spread of renewable energy use at the local level.

c) Grants by the Province of Modena for new high-efficiency boilers

Description:

The Province of Modena in 2003 launched a call for grants for replacing old boilers with new high efficiency boilers, covering 25% of the overall costs.

Effects:

- Stimulus to local economy
- Reduction of air pollution.

4 General conclusions

4.1 Lower Silesia

In line with the 'climate and energy package', passed in 2009, Member States are required to reduce their CO_2 emissions below 1990 levels by 20%, reduce primary energy use compared to projected levels by 20%, and meet a target of 20% contribution of renewable energy to total energy consumption by 2020.

At present, energy demand is sourced nearly entirely from fossil fuels, in particular from coal. With economic growth projections indicating energy demand will grow by 45% from 2006 to 2030, stabilization of CO_2 concentrations will require an almost complete dismantling of existing energy systems and tremendous growth of new technological systems.

In order to meet EU obligations, the expansion of renewable energy has placed high on the public agenda. Renewable energy can improve energy security by decreasing dependence on imported fossil fuels and diversifying energy supplies. Indeed, renewable energy is generated domestically and the economy would be less exposed to supply disruption and price shocks that might result from the concentration of supply in a limited number of countries. In addition, by shifting reliance from fossil fuels, renewable energy should lead to absolute emission reductions and is therefore central to the fight against climate change.
At present, Polish energy regulation established the requirement for Certificates of Origin to guarantee energy comes from renewable sources and established a quota system for renewable energy. This financial support scheme, while offering a cost-effective means of

introducing renewable energy sources into the electricity sector, has favored big renewable energy projects, and has resulted in little to non-locally owned renewable energy generation. This is concerning for the following two reasons. First, analysis of final energy use trends shows that households comprise 30% of demand for electricity. Second, local investment in renewable sources results in significantly more renewable energy capacity being deployed than would otherwise be the case, in particular because it stimulates support for the new technologies. Therefore, there has been a need for the Certificates of Origin scheme to be complemented with an initiative aimed at increasing local ownership and simultaneously aiming to sustain a variety of new technologies and reducing the risk of premature lock-in to a single renewable energy source.

The European Union imposed a duty to fulfill the so-called 3x20% package up to year 2020 (that is to increase energy efficiency by 20% up to year 2020, increase the share of energy from renewable sources by 20% and to reduce greenhouse gas emissions by at least 20%, also up to year 2020).

Energy efficiency topic, developing and investing in renewable energy sources in recent years (especially in recent five years) is one of the cornerstones of the European Union's climate policy. RES development is the basis for increased energy security, energy efficiency and, consequently, a significant reduction of greenhouse gas emissions, including CO_2.

EU legislation, including Directive 2009/28/EC on the promotion of energy from renewable sources, sets a target for Poland of a 15% share of renewable energy in total energy use, up to 2020.

November 10, 2009, legal regulations in the field of energy efficiency of buildings have been adopted, in the form of the Energy Efficiency Act of 15 April 2011 – Journal of Laws from 2011, No. 94, item 551.

These documents discuss RES topics, but so far there is no clearly defined action strategy at the national, regional and local levels. This is why energy efficiency analysis and listing key actions for the future, plays an important role in the three partner regions. These activities will contribute an intensive development of renewable energy.

4.2 Saxony

The analysed funding programmes were all contributing to the strategy of Saxony to reduce the energy consumption of private households by 15 % by 2023 in comparison to 2015. On the way to a more energy efficient and more on renewable energies based Saxony it is necessary to follow or even to exceed the goals of the Saxon Energy and Climate Programme.

The analysed funding programmes within the EnercitEE project contributed to an energy saving of nearly 100 GWh per year for Saxony. The total CO_2 not emitted into the atmosphere amounts to 28,597.50 t/year. The average costs for the government 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 €) was the most cost efficient programme for the Saxon government to save 1 MWh energy per year. This programme was also the most cost efficient one for saving 1 t CO_2/year. The funding costs for the exchange of the central heating boiler amounts 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.

4.3 Emilia Romagna

At the end of March 2013, the directions of the energy policy of the new Government were not yet clear (in part, because a Government still had to be formed), the current incentives coincide with the priorities underlined in various strategy documents aimed at the national or regional/local level, such as:

- the National Energy Strategy of 2012
- the Regional Operational Energy Plan 2011-2013
- the Provincial Energy Programme Plan of Modena

Meetings with regional and provincial representatives will be held even after the GRACE project is completed in order to ensure that all relevant stakeholders are informed and can take the GRACE recommendations into account in their policies.

5 Summary of findings for Lower Silesia Region, Free State of Saxony and Emilia Romagna

As in Emilia Romagna in Lower Silesia Region we had the same problem with data collection. The future should bring changes in the tracking procedures for the applications presented to Municipal offices in order to develop a standardised database, reflecting the parameters that are most useful in assessing the effectiveness of the measures. Essential parameters are:

- specific technology or building process,
- investment amount,
- energy/environmental benefits (KWh or toe of energy saved and CO2 avoided),
- phase reached by the application in the construction or renovation implementation.

The Region allows to use various forms of retrofitting as well openness to new projects in the energy efficiency of renewable energy sources in Poland, either from national resources or within the Community is significantly limited for entrepreneurs. Most grants are available to individuals and charity institutions. Businesses can rely only on technology loans and loan funds awarded on preferential terms.

- For Lower Silesia Region the Implementation at national level 'three-pack energy' containing the Energy Law, the Gas Law and the Law on Renewable Energy Sources has significantly improved procedures and reduced administrative and legislative barriers for renewable energy, including facilitating access of renewable energy to the grid, stimulate the creation of support mechanisms between Member States and impose greater access to information and training in a RES;
- Development of Lower Silesia and Partner Regions requires an operating model of pro-environmental investments implementation, taking into account financial, legal, economic and social parameters and correlated activities of all involved individuals;
- The support of projects in the area of financing for the construction of passive houses, energy-saving and energy-efficient housing in Lower Silesia should be continued.
- The region has the potential to establish a transport/automotive industry cluster, but to a large extent its establishment is determined by involving representatives of local government in the project.

The analysed funding programmes of Saxony are all contributing to a more energy efficient Saxony. Saxony has a broad range of funding programmes that can be used, which shows the ambitions of the federal state. During the analysis period (March 2008 – July 2012) the analysed funding programmes contributed to energy savings in the amount of around 100 GWh per year. But the programme for the solar thermal plants is already stopped since December 2009. One reason may be the high costs to the government, because that programme has the highest costs to government of all analysed programmes among the partnership. Moreover the German Federal Office of Economics and Export Control (BAFA) supports the investment in solar thermal plants since 2009 with a similar amount of grant per m^2.

More than 18,000 people used the programme for the exchange of the central heating boilers between May 2009 and February 2010. There was an additional fund for exchanging old boilers with pellet driven boilers from April 2012 to September 2012, but this was not analysed.

The other 2 analysed programmes can still be used by the target groups. Regarding to the action plan from the Energy and Climate Programme of Saxony the programme for the passive houses will continue during the next funding period 2014-2020.

In Emilia Romagna the 55% tax rebate incentive promoted by the central Government has proved to be quite effective, both economically and in relation to energy efficiency impacts.

The main weakness is represented by the uncertainty about the incentive's continuation from year to year, which caused overall uncertainties in the market and in employment in the so called "green economy" enterprises.

Considerations about PMO grants in Emilia Romagna

While the number of measures undertaken within the framework of the 55% tax rebate incentive was so much higher that a comparison with the grant schemes implemented by the Province of Modena seems even not possible, some positive aspects of those initiatives deserve to be pointed out:

- the cost to the public body supporting the energy efficiency/renewable measures was very limited, thus showing that theoretically every local authority could promote such an incentive in its territory.
- The generated impacts – in terms of energy, CO2 emissions and cost savings - of such small initiatives are, however, not irrelevant. For example, the indicator expressing the *total cost of energy saved by consumers* was around 1/3 of that saved under the 55% tax rebate, for which far greater financial resources were applied. This result could therefore be considered as significant, and such a model could be promoted to stimulate other local authorities to follow the lead of Modena in this field.

6 Recommendations for Local Authorities for all Regions and for European Union:

6.1 Lower Silesia

- Implementation at national level **in Poland** 'three-pack energy' containing the Energy Law, the Gas Law and the Law on Renewable Energy Sources has significantly improved procedures and reduce administrative and legislative barriers for renewable energy, including facilitating access of renewable energy to the grid, stimulate the creation of support mechanisms between Member States and impose greater access to information and training in a RES;
- Development of Lower Silesia and Partner Regions requires an operating model of pro-environmental investments implementation, taking into account financial, legal, economic and social parameters and correlated activities of all involved individuals;

in Lower Silesia.

- The region has the potential to establish a transport/automotive industry cluster, but to a large extent, its establishment is determined by involving representatives of local government in the project.

6.2 Saxony

<u>General recommendations for framework conditions regarding funding programmes for energy efficiency:</u>

- The cost-benefit ratio should be calculated before launching new funding programmes
- New Funding programmes for the latest renewable energy devices, like energy storages could be set up.

- The list of beneficiaries should be added by one column. The used funding programme of the carried out intervention should be listed in the list of beneficiaries regarding the Commission Regulation (EC) No 1828/2006 of 8 December 2006.
- Regional energy advisors suggested introducing new funding conditions. They suggested changing funding conditions, like grant / m² to percentage grants, like 35 % of the investment costs.
- The bureaucratic hurdles are too high. Especially the process between application and confirmation of the grant or incentive takes a long time.

A lot of German funding programmes can be only used for single or double-family houses. The regional energy advisors wish for programmes, which support for multi-family houses.

Funding programme specific recommendations

Saxon Passive House Programme

- The funding programme supports the Saxon goal of the implementation of low energy buildings.
- The funding programme has the highest amount of energy saved per beneficiary within the analysed funding programmes
- The grant programme should be continued to compensate the higher building costs in comparison to a standard building

Exchange of the central heating boilers

- There are high energy savings for the beneficiaries, but also high costs for the government.
- KfW and BAFA are also granting the heat exchange.
- At the moment there is no necessity to relaunch the programme in Saxony.
- There is an opportunity for an additional grant beyond the KfW or BAFA grant, which is already done in some other funding programmes. For example it is possible to grant new heating systems, as pellet heatings (already done from April 2012 to September 2012).

Installation of solar thermal plants

- There is no necessity to relaunch the programme, because BAFA is also granting the solar thermal plants.

Installation of interior and street lights

- The funding programme should be continued due to high energy savings for the municipalities (approx. 81.82 MWh per year).

6.3 Emilia Romagna

First, and specifically linked to the data problem, one of the most important conclusions is that there needs to be a change in the tracking procedures for the applications presented to Municipal offices in order to develop a standardised database, reflecting the parameters that are most useful in assessing the effectiveness of the measures. Essential parameters are:

- specific technology or building process,
- investment amount,
- energy/environmental benefits (KWh or toe of energy saved and CO2 avoided),
- phase reached by the application in the construction or renovation implementation.

Second, it is of the utmost importance, in order to ensure the success of the incentive measures, to establish a participatory process involving the main market actors before introducing regulations which may alter market conditions and distort competition. Moreover, training sessions are essential in preparing the project planners and Municipal staff to understand sophisticated building technologies, regulatory requirements and new calculation methods.

Third, sometimes it is the case that a building owner is not sufficiently interested in building refurbishment, but that a tenant is, in order to save on energy costs. This situation may

affect not only a residential tenant of an apartment, but also the manager of a commercial business, especially if

the refurbishment could result in a reduction of the tax burden and lower energy expenditures. Thus, the overall impact of such incentives could be improved by extending current measures to provide benefits to tenants.

Finally, on average, gathering data from national public/bodies in charge of them is quite challenging. In future data which should be easily made available/public should be delivered in a smooth way.

6.4 summary

- Cooperation between research and business, also in terms of eco-innovation activities, continues to grow;
- At European level RES Directive 2009/28/EC from 23 April 2009 is the legal act regulating the promotion of the use of energy from renewable energy;
- It is necessary to enhance cooperation between science and business in terms of eco-innovation and its commercialization on national and international markets;
- Through the analysis of good practices, all partner regions have the ability to implement best available technologies and solutions and expect positive effects of environmental, economic and social development;
- Joint implementation of projects, encourages the know-how exchange between experts, research units and companies involved in the project, thus building a competitive advantage of partner regions through jointly conducted innovative environmental activities;
- It is important to strengthen interdisciplinary of activities and synergies of projects and financial procedures;
- It is important to continue fruitful, supra-regional cooperation and implement optimal ecological, social and economic solutions in the region, leading to CO2 emission reduction and improvement of life and air quality.

- Engaging scientists to cooperate on projects implemented in the region and partner regions;
- Establishing long-term cooperation with relevant offices, research units and NGOs;
- Close cooperation with selected business institutions and companies directly involved in implementing innovative environmental solutions.
- Experience acquired in the implementation of this project, exchange and analysis of best practices in the partner regions to be implemented in the near term, with EU funding under the EU Framework Program for Research and Innovation for Horizon 2014-2020.
- Supporting projects financing construction of passive houses, energy-saving and energy-efficient housing should be continued.

Annex 1: comparative table for all regions

item	SAX passive house	SAX heating boilers	SAX solar thermal plants	SAX street lights	ER 55% all interventions	ER 55% all intervention	ER 55% heating (boilers etc)	ER 55% solar thermal	ER- PMO heating boilers	ER- PMO solar thermal	LS Solar Thermal Collector Incentives	LS Thermomodernization and Renovation Found	LS - Regional Operation Program me
conditions of fund													
analysis period	03/2008 - 07/2012	05/2009 - 02/2010	03/2008 - 07/2012	03/2008 - 07/2012	2007-2011	2011 only	2011 only	2011 only	2003-2005	2003-2005	2010-2012	2009-2012	2009-2013
Total investment cost	5 574 901,63	100 937 183,59	23 032 028,79	7 085 207,57	€ 1 839 352 387	€ 402 532 282,00	€ 142 247 483,00	€ 25 449 616,00	€ 3 769 712,00	€ 2 091 288,00	€ 8 229 946,55	€ 11 933 187,62	€ 269 184 815,89
grant/funding (cost to Government)	2 760 499,85	23 971 913,00	3 647 640,28	4 885 100,92	€ 1 011 644 803	€ 221 392 755	€ 78 236 115,63	€ 13 997 289,01	€ 942 428,00	€ 522 822,00	3 649 641, 895		€ 47 614 232,55
n° of approved applications	125	18549	2346	166 (61 municipalities)	146 719	34 803	9 446	3428	1 388	319	2 316 Solar Thermal Collector / 14 948,25m2		
share of beneficiaries	0,006%	0,838%	0,106%	13,927%									
average total cost	€ 44 599,21	€ 5 441,65	€ 9 817,57	€ 42 681,97	€ 12 536,57	€ 11 566,00	€ 15 059,00	€ 7 423,00	€ 2 715,93	€ 6 555,76	1 101,12 € / MWh		
average cost to Government	€ 22 084,00	€ 1 292,36	€ 1 554,83	€ 29 428,32	€ 6 895,12	€ 6 361,31	€ 8 282,45	€ 4 082,65	€ 678,98	€ 1 638,94			
Total Energy saved (GWh/year)	3,35	86,89	4,15	4,99	951	182,98	73,71	17,40	2,16	1,84			
Total Energy saved (MWh/year)	3 346	86 892,98	4 150,78	4 990,93	951 000,00	182 984	73 711,18	17 400,86	2 160,34	1 839,66			
CO_2 not emitted into atmosphere (kt/year)	0,92	22,42	2,09	3,17	202,56	38,98	15,70	3,71	0,51	0,44			409 231,00
CO_2 not emitted into atmosphere (t/year)	921,40	22 422,36	2 087,95	3 165,79	202 560,00	38 980	15 700,48	3 706,38	512,00	436,00			
total cost per 1 MWh/year energy saved	€ 1 666,25	€ 1 161,63	€ 5 548,84	€ 1 419,62	€ 1 934,12	€ 2 199,87	€ 1 929,80	€ 1 462,55	€ 1 744,96	€ 1 136,78	1 101,12 € / MWh		1565028
total cost per 1 kWh/year energy saved	€ 1,67	€ 1,16	€ 5,55	€ 1,42	€ 1,93	€ 2,20	€ 1,93	€ 1,46	€ 1,74	€ 1,14	1,101 PLN / KWh / year		
Cost to Government per 1 MWh/year energy saved	€ 825,07	€ 275,88	€ 878,78	€ 978,80	1 063,77 €	1 209,93 €	€ 1 061,39	€ 804,40	€ 436,24	€ 284,19	€ 488,10		
Cost to Government per 1 kWh/year energy saved	€ 0,83	€ 0,28	€ 0,88	€ 0,98	€ 1,06	€ 1,21	€ 1,06	€ 0,80	€ 0,44	€ 0,28	€ 0,49		
total cost per 1kt CO_2 saved	€ 6 050 468,45	€ 4 501 630,68	€ 11 030 929,28	€ 2 238 053,56	€ 9 080 531,14	€ 10 326 636,28	9 060 071,84	6 866 429,14	1 930 092,54	911 801,57	917.60 €		
total cost per 1t CO_2 saved	€ 6 050,47	€ 4 501,63	€ 11 030,93	€ 2 238,05	€ 9 080,53	€ 10 326,64	€ 9 060,07	€ 6 866,43	€ 1 930,09	€ 911,80	€ 406,86		
total cost per kg CO_2 saved	€ 6,05	€ 4,50	€ 11,03	€ 2,24	€ 9,08	€ 10,33	9,06	6,87	€ 1,93	€ 0,91	€ 0,49		
Cost to Government per 1 kt CO2 saved	€ 2 995 984,21	€ 1 069 107,49	€ 1 746 995,99	€ 1 543 090,64	€ 4 994 297,01	€ 5 679 649,94	€ 4 983 039,51	€ 3 776 536,08	€ 1 840 679,69	€ 1 199 133,03			
Cost to Government per 1 t CO2 saved	€ 2 995,98	€ 1 069,11	€ 1 747,00	€ 1 543,09	€ 4 994,30	€ 5 679,65	€ 4 983,04	€ 3 776,54	€ 1 840,68	€ 1 199,13			
Cost to Government per kg CO2 avoided	€ 3,00	€ 1,07	€ 1,75	€ 1,54	€ 4,99	€ 5,68	4,98	3,78	€ 1,84	€ 1,20	0,000488 €		
Cost of natural gas (annual average) in €/kWh (without taxes)	€ 0,0466	€ 0,0466	€ 0,0466	€ 0,0466	€ 0,0446	€ 0,0502	0,0502	0,0502	0,0342	0,0342			
total cost of energy saved by consumers (assuming nat. Gas and without taxes)	€ 155 913,35	€ 4 049 212,87	€ 193 426,35	€ 232 577,34	€ 42 778 747,00	€ 9 185 596,00	€ 3 700 301,09	€ 873 523,12	€ 73 883,54	€ 62 916,46			