

Regional Approach for Policies and Measures Aiming to Sustainable Energy Development

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1. Introduction

It is widely accepted that integrated complex of environmental, social and economic policy measures is easier to implement in towns and regions scale because of “bottom up” approach permit to achieve more than one goal of sustainable development. Municipalities may have significant role in promotion of sustainable development as local authorities have more functions in energy sector, and such opportunities should be used. They may implement policies and measures, such as diversification of energy supply system, using a mix of fuel types from a range of sources and a variety of supply options by using renewable energy sources. The threat of energy supply interruptions can be minimized through the maintenance of energy infrastructure, reliable plant and effective back-up systems. Encouraging energy efficiency among consumers to reduce overall demand, and the effective management of demand to reduce the difference between peak and low energy use assists in reducing the threat of short term interruptions in energy supply that can be caused by high demand.

Prospective organizational and financing forms for sustainable energy development are local/regional energy programs. Integration of energy projects into local development process may create an external positive effect concerning environmental and other national sustainable development goals. The examples of EU-15 countries (United Kingdom, Austria, The Netherlands etc.) implementing their sustainable energy development and climate change mitigation policies on local level can be successfully applied in Lithuania and other countries.

However, integration of sustainable energy projects, e.g. renewable energy sources (RES) technologies may be successful after reliable methodological assessment of positive effect of such projects for solving social, economic, rural development problems in regional development context.

Scientific problem is to define the economic background for policies and measures aiming to sustainable energy development. All support schemes must form single, systematic and blameless economic whole.

Methodology of analysis is devised both for identifying and for quantifying energy market distortions that lead to inefficient resource allocation. Methodology of cost-benefit analysis of the positive or negative effects of increasing energy supply security, social, environmental, economic impacts was applied.

Methodology of municipal energy development has been elaborated which can link National sustainable development policy to local relevant issues. Local energy development scenario starts from a clear strategic idea which establishes links between strategic national and local goals. Municipal energy development enables the municipality to give shape to sustainable, realistic aims within a clearly defined structure. Establishing a local or major regional market rather than separate renewable energy projects could help to ensure a market of a sufficient size and enhance competition. In addition, a regional approach could be an important element in the Kyoto follow-up work.

2. The problems of formation uniform sustainable energy policy

2.1 The problems of redirecting urban areas development towards formation sustainable energy

The need for formation of single energy policy including support system for renewable energy sources (RES) as one of compounds is notified for several years already. It is impossible without single attitude to the perspectives of the use of separate types of fuels and sorts of energy in making strategic decisions as well as in implementing them.

Creation of competitive energy market is favorable for the increase in economic growth, however, security of energy supply, mitigation of environmental impact and energy affordability are the targets of sustainable energy development which can be achieved only by the implementation of wise energy policy by the Government. Therefore, the main role of the Government is reorienting energy policy towards the sustainable development. The problem certainly does not lie with the intrinsic goals being pursued as part of the completion of a competitive market. Development of RES and combined heat and power, implementation of climate change policies, improvement of energy efficiency and security of energy supply are all the necessary elements of sustainable energy future that will not be delivered by market forces alone. "The problem lies with current inconsistencies, lack of market integration and frequent absence of a least-cost approach. A patchwork of policies, burdens and new regulations, keeps building up without sufficient coherence, balance or properly thought-out economic assessment. As a result, the essential aims of regulatory consistency, avoidance of market distortions and use of least cost solutions are far from being met" (EURELECTRIC, 2004).

The concept of sustainable energy development can't be separated from the understanding of additional positive socio-economic effect of sustainable energy projects (energy efficiency measures, use of renewable energy sources). Implementation of sustainable energy projects has positive impact on security of energy supply, provides financial economies and improved comfort and has multiplier effect for new jobs, involving small and medium size enterprises. Therefore integration of sustainable energy projects into regional development process may create external positive effect concerning increased energy security and other regional development goals (reduction of unemployment, reduction of environmental impact etc). The examples of EU-15 countries implementing their sustainable energy development and climate change mitigation policies on local level can be successfully applied in Lithuania. Methodological problems is related with integration of sustainable energy projects into regional development procedures and provide guidelines, ensuring that energy elements may compile integral uniformity in terms of regional goals.

The main issue is that the sustainable energy development would be treated as a set of separate good practice case studies or the quantitative jump would be performed in

organizing the implementation of sustainable energy development process. The exchange of practices, based on sustainable energy aspects, is the key to promote the development of projects at the local level, satisfying the requests of the programme level.

An INTERREG IIC Programme project RUSE (Redirecting Urban areas development towards Sustainable Energy) has been launched in order to transfer experience of EU15 to the New Member States (NMS) in the field of sustainable energy projects, financed by the Structural Funds. In this project the exchange of experiences represent a very important European Added Value.

Since 2004, the Structural Funds are available in the New Member States and are an opportunity for linking sustainable energy and urban development by creating and stimulating the integration of energy issues in urban development policies, including all its impacts on the environment. Experience has already been gained in the EU15. Sometimes this has been a bad one, for instance when the Structural Funds have not been used in the best way by promoting infrastructure projects, without taking into account their impact on natural resources or climate issues. There are environmental impact assessment (EIA) regulations available in all EU member states, however, standard EIA procedures are not always able to assess all impacts on human health and natural resources provided by infrastructure projects.

On many other occasions it has been a good experience, for example, when energy issues have been considered from the point of view of energy demand and promotion of local renewable resources rather than simply from that of the supply side via investment in grids and trans-national networks. This experience must be used by new Member states to avoid the same mistakes and to integrate these aspects in the preparation of the projects, as requested by the rules of European Regional Development Funds.

However, practices which should be the standard often still are the exception, and a majority of new infrastructure or building projects, as well as major renovation schemes, are still carried out without any consideration being given to their energy impact, in spite of the EU defined priorities for the control of energy demand and for limiting CO₂ emissions.

Energy issues are not the most visible part of local planning, compared to the construction or even to the renovation of infrastructure and buildings. Energy efficiency and energy saving measures are Community priorities, which should be automatically included in the requisites of projects applying to a support from the Structural Funds.

The RUSE operation was aimed at improving the use of Structural Funds and other financial resources by municipalities and other stakeholders in charge of urban development issues in New Member States and candidate countries, thus progressing towards a better integration of sustainable energy issues (energy efficiency, renewable and distributed generation) in their projects.

To achieve the improvement of the use of Structural Funds, the RUSE operation had the following main objectives:

- to make municipalities and related bodies in New Member States and third countries more aware of existing Structural Funds related experience in European countries by disseminating information, promotion good practice and exchanging experience;
- to improve capacity building on energy issues in both individual bodies (municipalities) and collective structures (city networks, agencies, etc.);
- to prepare municipalities so that they can design projects dealing with their powers and responsibilities in a sustainable manner and to enable them to submit successful

proposals under European Regional Development Fund programmes (incl. INTERREG IIIA, URBAN, etc.). In other words, to help them integrate the concept of sustainable energy in urban plans and put them into practice;

- to influence national decision makers regarding the integration of energy issues in their programmes from the point of view of energy demand and the promotion of renewable energy, both of which are good methods for promoting local development.

“The new legislation allowed the integration of energy efficiency as eligible measure in the Structural Funds 2007-2013. Because of co-financing requirements, it is important to convince those behind the Community Support Frameworks in the NMS that energy efficiency and RES go hand-in-hand with traditional structural and cohesion targets, such as increased employment, improved competitiveness, improved local environments, and improved infrastructures. Investments in energy efficiency in buildings, for example, are extremely cost effective. They are often cost-free because the cash flow from reduced energy consumption pays off the investment long before the technical lifetime of the investment. This cash can then be re-invested locally and regionally. These investments use much unskilled as well as semi-skilled, and skilled labour. There are similar examples in industry and transport.” (RUSE Newsletter, No.1, 2005).

2.2 The possibilities to solve the problem of increasing RES demand

The main trends of investigations related to RES economic support policy are as follows:

- Analysis of various financing related risks and barriers which suspends wider development of RES sector.
- Assessment of external costs and including them into costs price, caused by use of traditional energy sources – oil and oil products, natural gas, coal.
- Analysis of the problem exhaustibility of resources, which participate in economic process and reflection of this feature in economic estimations.
- Investigating of issues, related to the use of developed technologies of RES, e.g. hybrid wind-hydrogen plants, tri-generation and many others.
- Creating of organizational management forms, which permit assessment and financing in wider scale.
- Creating of innovative financial tools and mechanisms, enabling RES financing

Our research was based on general hypothesis that it is possible to give correct justification to projections of the use of energy resources in economic expression of various aspects. This would be the background on one hand to evaluate various types of fuel and energy, and on the other hand to define social benefit of types of fuel and energy. The need to support RES is defined by the shortcomings of the market, which make not equal conditions for comparability and competitiveness of various types of fuel and energy.

It is necessary to separate two main support groups concerning RES:

- a. Energy producers and suppliers, which must integrate into operating energy system to compete with main types of fuel – natural gas, oil (heavy oil fuel), coal.
- b. Energy consumers to whom RES without additional support and establishment of infrastructure cannot afford most demand defining factors – acceptable price and security of supply.

However, the use of RES is related to additional public benefit, which is not evaluated in individual business decision making. RES accumulates the following main qualities:

- RES means that the problem of the exhaustibility of their use doesn't exist, which means possibility to supply future generations with energy sources;
- Technological progress is directed towards harmony of human activity with natural processes;

Scientific problem is to define the economic background for support. It is necessary to analyze economic support forms for creation and mastering of RES technologies to make them competitive with technologies of traditional fuels and make them sensible according to actual purpose, need and possible effect. All support schemes must form uniform, systematic and blameless economic whole. In principle meaning this support scheme must make RES demand conditions the same but not protect them against other sorts of energy and technologies. Finally they all must have one or another uniform systematic whole.

From the attitude of RES supply support tools for technology creators and suppliers means compensation of social RES production costs as traditional resources are not evaluated correctly because of market errors.

From the attitude of RES demand one should investigate correct evaluation of social benefits, which may show those advantages, which are not seen in investment solutions, e.g. inexhaustibility and possibility to ensure energy resources for future generations. As some RES technologies, e.g. use of biogas in animal farms, also solve environmental problems, thus can be additionally funded from other sources.

The background of the research is the following conceptual statements:

- prices of all energy resources must be based on social costs with assumption that methodologically possible to justify all aspects in the use of fuel and energy – security, environmental, social and renewability;
- RES benefit can be assessed according to real benefit now and in future, which is not fixed in investment efficiency with assumption that various sustainability criteria may have single denominator on single methodological background;
- justification of RES support measures is based on comparison of fuel and energy resources used by energy system, on competitiveness while assessing various sustainable development aspects by single criterion;
- RES competitiveness is evaluated in specific territorial environment till certain optimal level, where marginal costs and marginal benefit of all types of energy become equal;
- the support to RES business is considered as correction of market shortcomings to solve sustainable development problems;

With regard to define the guidelines for sustainable energy development in economic understanding, first we should clearly evaluate current or necessary infrastructure, related to the used type of fuel.

The most suitable tool for redirecting urban areas towards sustainable energy could be local programs. Municipalities have policy instruments and means to implement them and, moreover, they are in direct contact with citizens and business. Sustainable energy policy linked to specific national measures could contribute to reducing and managing energy and environmental problems in general and greenhouse gases in particular. A very interesting example is the experience of Netherlands. Municipal climate policy has been operating since 2001 in Netherlands. Since then, more than 150 municipalities have made a start. Dutch municipal climate policy is based on a covenant between central government and representative bodies from the municipalities and provinces. The tasks are clearly defined: broadly speaking, central government focuses on identifying the climate objectives, including basic standards, furthermore, acts as a facilitator, while the municipalities will be

the ones that actually do the work. The Ministry of Housing, Special Planning and the Environment makes subsidies available so that municipalities can release an extra capacity for implementing the policy. The level of these subsidies is linked to the degree of ambition and the actual results achieved. A total of 37 million euro has been made available for the coming years.

The underlying principle for climate policy implementation is therefore that municipalities decide for themselves the topics on which they will focus their policy. They, better than anyone else, know where the best chances of success lie. They can build on previously developed environmental and other measures. And they understand how to make the policy fit local circumstances and needs. Each municipality chooses its own theme(s): municipal buildings and installations, sustainable energy. Before a municipality can get to work on one or more themes, it attaches a level of ambition to it. This serves to indicate how far the municipality wants to take this theme. Distinctions are made between an active policy, a leading policy and an innovative policy. Based on the outcome, the municipality establishes its policy for the next five years. This policy is then implemented by means of a phased plan, which is also provided by the municipal climate policy program.

RES are a wide group of energy resources and the assessment of those resources is one-to-many depending on the potential, secure and sufficient supply, environmental and renewable character and impact to solving of social problems.

3. Methodological approach of investigations

The classical approach to solving methodological problems above presents applied welfare analysis. Efficient resource allocation occurs in the way energy is priced. At any time, the price of the energy resource should reflect its marginal social cost. This implies that any divergence between social and private cost arising as a consequence of the market failures (for example, public goods or externalities) should be corrected by internalizing such external costs. To assure the equivalence of price and marginal costs, a competitive market framework is required. Monopoly elements are to be eliminated if prices are not equal to marginal costs. Applied welfare analysis allows to quantify the welfare loss associated with any given market failure. This enables policy makers to focus on the market distortions. But even though a policy change leads to an aggregate welfare gain, certain groups may suffer deleterious income distribution loss. Again this implies need to create welfare system to redress burdens on the poor as a consequence of an efficiency generating policy change.

All market based mechanisms provide possibility for efficient resource allocation just under perfect competition which is not available in reality. "An urge for a liberalization of global trade has been sweeping anonymous over the world without any public debate and without even asking what are the benefits. Indeed a market economy is excellent on a certain scale. But when it leads to ever larger production and trade companies it is a threat to the environment as well as to democracy. It is no longer a free market. From a democratically controlled market we have then moved to a market controlled by the big market forces themselves. The criteria behind the economic theories of the advantages of a free market no longer exist" (Norgard, 2001).

Even worse that the negative effects of decreasing energy supply security, social, environmental, economic impacts are treated not as externalities but as normal commodities. The following theoretical considerations reflect this problem: "A common logical error is to identify a source of pollution and automatically conclude the existence of a

market failure and thus a welfare loss. Recall that externalities exist when private valuations of costs or benefits differ from social valuation of costs and benefits. Voluntary agreements between the polluters and affected parties can achieve the socially optimal outcome. Even when private transactions are not capable of equilibrating private and social valuations, governmental policies may. Critical policy question is not whether pollution exists but rather whether it occurs at socially optimal level. The economic approach to pollution control is to view clean air and water as commodities like gasoline and air conditioning, to be provided according to the Standard criteria applied to all goods. The last unit of clean air or water should confer a marginal social benefit just equal to the marginal social cost of providing it" (Griffin & Steele, 1986).

This problem is transferred into problem of national accounting. Growth of GDP indicates the constant progress. However the investigation of economic growth and valuation of environment corrects the optimistic result provided by constant national income and GDP growth in developed economies (Van Ireland et al, 2001). Environmental accounting is still in development stage, and its concepts, tools, processes and the potential benefits to both Lithuanian industry and government are not clearly recognized. Close collaboration of academic, research institutions and environmental organizations will be an important factor in environmental accounting development and implementation. International organizations such as the United Nations and the European Union perform increasingly important role in international exchange of information and experience, and establishment of guidelines and standards (Gouldson&Roberts, 2000).

For formation of economic policy at state scale one needs to used non-standard approaches, which allow to synthesize various researches, which test theoretical hypotheses and define assumptions for various RES development scenarios for long term perspective of several decades. This will be performed using quantitative and analytic tools, which will define best future technologies, enabling implementation of EU environmental and energy policies. Technologies sustainability assessment, which will be performed during the project, will help to define future energy generation technologies.

The movement of sustainable development means balance of all resources or optimization. Such attitude requires guidelines of economic theory, how and why it is possible. Practical idea has created the approach, which is called Integrated Resources Planning (IRP). This approach permits to avoid partial optimization. The main idea of IRP is that the whole systems and not separate units are to be optimized.

The main problem is avoiding shortcomings of partial optimization via using integrated resource planning approach. To certain extend energy system is rather efficient as any investment must give economic pay-back. This does not mean a separate investment project, no matter how large it is, it may be insufficiently optimized or have some shortcomings. However, optimization is possible from the attitude of total costs, including external costs, such as environmental and correction of market errors.

The main methodological tool for economic assessment of specific energy resource is the price of energy resource, based on social marginal costs. Price value is market signal for consumers to react, i.e. to choose more or less energy consuming technologies, appliances, less heat consuming households or, etc. This is also the most important expression of social aspect in energy consumption.

With regard to evaluate the project efficiency for any type of RES, for separate project or on national scale, extended economic analysis is applied, supplemented with environmental

indicators, which define project implementation impact to environment or evaluate external energy generation costs. Emissions of pollutants into atmosphere have the most important impact to the value of external electricity generation costs (Markandya & Longo, 2005). Evaluating the monetary expression of the value of main emissions, external energy generation costs are achieved, which enable to supplement classic cost-benefit analysis with environmental indicators. Environmental indicator would allow showing that RES projects are more efficient comparing to traditional sources without regard to high capital investment necessary to implementation of such projects.

For assessment of various economic aspects we use universal approach, enabling reliable estimation of various aspects with single denominator in comparable and clear form, which has direct link to pricing. This is the approach used for levelised energy costs estimation via extended economic analysis. Levelised energy costs are not just guideline for prospective planning, but also a good tool for consumers, which will define the demand.

4. Integration of sustainable energy projects into regional development process

4.1 Implementation of National sustainable development strategy via local energy development program

The main long-term planning document - Long-term Lithuanian Economy Development Strategy was approved in 2002. It comprises 15 branch strategies (MoE, 2002). The main principles of sustainable development are integrated in these strategies. Some of these branch strategies are directly aimed at interaction between sectors (the factors of social development and economic factors of employment, economic factors of environmental protection, tourism development, etc.). Despite a great integrity of the certain strategies, there is a lack of clear relations between the aforementioned 15 strategies. In order to solve this problem the National Strategy of Sustainable Development was adopted in 2003. This strategy includes 6 branches of economy (transport, industry, energy, agriculture, household, tourism), 4 environmental sectors (air, water, biodiversity and waste), 4 main social aspects (employment, poverty and health, education, cultural identity) and regional development issues. All these economic, social, environmental and regional development issues are presented in close integrity. Sustainable development indicators for economic, social and regional development and state of environment are selected in the strategy for the monitoring of sustainable development however this system of indicators were not applied for the analysis of trends and only some targets of sustainable development were set using these indicators (Ciegis & Streimikiene, 2005).

Energy is the priority sector in economic development because energy is closely connected with social, economic development, quality of life. Production and consumption of energy has the significant impact on environment.

Methodology of integration of sustainable energy projects into local/regional development programs has been elaborated as a key to integrate sustainable energy projects into the regional deployment level (Klevas & Antinucci, 2004). Methodological approach is suitable for sustainability assessment using regional social-economic-environmental indicators, as increasing of security of energy supply, new jobs, new enterprises, additional economic product, greenhouse gas reduction.

It must be taken into account that each country has its own problems, which are to be solved according to the situation in a particular country. Following the Netherlands' experience of

climate policy management, an overall framework of the sustainable energy strategy could be presented as follows:

- municipal sustainable energy policy should be based on a covenant between government and representative bodies.
- local sustainable energy plans must be based on the National sustainable development strategy.

Implementation of National sustainable development strategy should be supported by sharing the tasks on the increased share of RES and energy efficiency improvements between regions and authorities (Kleivas & Minkstimas, 2004). Moreover, the Structural Funds programming period 2007-2013 is crucial for the implementation of sustainable energy into practice. It should be focused on the regional and local sustainable energy programmes

The fact that municipalities can link their climate policy to their own local problems, makes climate policy to be defined as vivid. This removes the risk of vagueness and the feeling that it has no relevance to local issues. Improved traffic situations, sustainable business parks, healthier houses and less pollution: these are the points that enter the picture thanks to climate policy. Municipal climate policy is then easy to sell and it continues to working because of its supporting base and image. Climate policy brings benefits for a municipality. Municipal climate policy works according to a model of policy options. This enables the municipality to give shape to sustainable, realistic aims within a clearly defined structure.

Establishing a regional market rather than local renewable energy market could help to ensure a market of a sufficient size and enhance the competition.

In the Netherlands, wind energy parks and biomass power plants are often implemented on a regional scale. For individual municipalities, however, local opportunities also present themselves. The purchase of green power for their own buildings, constructing new buildings with an optimum sun-facing position, supporting the marketing of solar energy: all these things are within the reach of every municipality and contribute substantially to reducing CO₂ in built-up areas.

Municipalities occupy a key role when it comes to energy saving in existing housing. They are involved right from the beginning in renovation and restructuring plans and have a decisive contribution to make to energy saving and energy provision. They can make agreements with housing associations about the quality of energy in the rental sector. The municipality can also exert its influence on individual homeowners. This will enable homeowners to make responsible choices from the available measures to both save energy and increase their own comfort.

However, there is a need to support this process, and the most feasible solution could be based on the local programming approach.

The main methodological problem is to integrate energy efficiency and RES projects into regional/local development procedures, so that energy elements may compile an integral uniformity in terms of regional/ local goals. The most difficult problem is to have municipal officials that are willing and cooperative. A very important issue is to define a possible external positive effect of energy project in the framework of local/regional policy directions (financed by SF), and summarize these effects as a total input of energy projects' implementation.

An additional positive effect on energy saving, energy efficiency measures and RES most often compile with the local and regional development objectives:

- RES, being indigenous sources of energy improve the security of energy supply and diversity of the fuel mix.
- RES have advantages for regions, in which power and heat supply costs are considerably higher than average costs in the country. Thus the use of RES – electricity and heat in small isolated systems can also help to avoid or delay expensive extensions to the grid.
- Some RES are a labour intensive form of industry and create jobs especially at location sites in rural areas.

Method of evaluation of the above named advantages to be included into the evaluation process in feasibility studies is under elaboration. The methodological approach for solving this problem and consequently integrating energy projects into a regional/local development process has been drafted by (Klevas & Antinucci, 2004).

Therefore, the preparation of financial perspectives for 2007-2013 is crucial, and regional development must be energy sustainable. Many resources of Structural Funds (SF) resources are to be used in a most sustainable way, which means that economic, social and environmental aspects should be accounted for. The tools (multi-criteria decision aiding based on sustainable value added etc.) for the selection of the best sustainable energy projects should be applied in decision making.

The concept of sustainable energy development can't be separated from the understanding of additional negative and positive social - economic effect of energy efficiency measures, energy savings, implementation of renewable energy sources. For example, projects on energy efficiency improvements allow to save energy costs and have the multiple effects on new jobs places creation, disperse across the community both socially and spatially, involving small and medium size enterprises. The indicators to be used describe the contribution of energy projects to a sustainable economic development, the medium- and long-term trends and the inter-relationship between them and the typical energy indicators (saved toe, improved energy efficiency, percentage of RES).

The energy service level is here used to indicate the aspects of economic development, which are relevant to the energy system. This service level can be indicated by different physical parameters like the dwelling size available per capita or the amount of cement produced per year. For a country as a whole is often used the GDP, which has earlier been described as quite insufficient to indicate the development of people's well-being.

4.2 Framework of regional energy programs

Sustainable development requires that economic growth contributes to social progress and respects the environment, that energy policy shores up economic performance and that environmental policy makes economic sense. There are lot of good practice case studies developed in European cities however the use of these examples projects is complicated in New Member States. The additional measures are necessary which would allow to strengthen the role of cities by implementing sustainable energy development strategy and to create methodological framework for this (Bacchus guidelines, 2003).

Sharing the tasks between regional (countries) and local authorities are to be solved as well. Implementation of National sustainable energy strategy should be supported by energy efficiency policy.

The main economic policies and fiscal measures having impact on renewable energy sources are: pollution taxes, fuel taxes, value added tax and excise tax allowances for RES, feed-in prices for electricity produced from renewable energy sources, greenhouse gas emission and

green certificate trading schemes which can be voluntary or obligatory. However these fiscal measures do not provide sufficient initiatives for the sustainable energy development because deal just with one market failure – negative externalities of pollution however other market failures (positive externalities of innovations and diffusion of environmentally friendly technologies and asymmetry of information) are also need to be dealt. Therefore it is necessary to develop and implement policies aiming directly at encouraging the development and diffusion of environmentally friendly technologies. Public support is necessary for technology innovation and diffusion.

The most applicable approach is implementation of RES in frame of climate policy (United Nations Environment Program, 2005). The fact that municipalities can link their climate policy to their own local themes makes climate policy by definition vivid. This removes the risk of vagueness and the feeling that it has no relevance to local issues. Improved traffic situations, sustainable business parks, healthier houses and less pollution- these are points that enter the picture thanks to climate policy. Municipal climate policy is then easy to sell and continues to work because of its supporting base and image. Climate policy brings benefits for the municipality. Municipal climate policy works according to a model of policy options. This enables the municipality to give shape to sustainable, realistic aims within a clearly defined structure.

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Some of RES are a labour intensive form of industry and create jobs especially at location sites in rural areas.

Above named advantages are to be included into evaluation process in feasibility studies.

Sustainable energy investment projects, characterised by a positive local environmental development impact, can be brought up to the level of implementation, using contribution from Structural Funds or other regional public resources. However SF resources are to be used in a most sustainable way, which means that economic, social and environmental aspects should be accounted for.

The main problem is concerned to financing of RES implementation. Different risks and barriers disturb development of RES implementation in different stages. In the point of view of financial risk in the short and medium period RES are not competitive as compared with traditional energy sources. Moreover RES demand increases investment costs and takes lower income rate. This is reason why most investors are not ready to finance RES implementation or makes investments in unfavourable conditions. Such a situation is often observable in developing countries where financial sources are hardly available and amount of financing depends on purposive subsidies.

The process of financing promotion of technological innovations comprises the stages as follows research and development (*R&D*), demonstration activities, pre-commercial and commercial stages. Two main forces "Technology push" and "Market pull" are involved in this process.

We may state that financing gap in the process arises in the middle of demonstration phase and continues all the pre-commercial phase. New innovative financing mechanisms are being created for efficient financing RES.

4.3 Examples of integration sustainable energy projects into regional development programs

Integration of energy projects into regional development process may create external positive effect concerning environmental and other regional development goals. The examples of EU-15 countries (United Kingdom, Austria, Netherlands) implementing their sustainable energy development and climate change mitigation policies on local level can be successfully applied in Lithuania and other countries.

The Energy vision of Murau

In the district of Murau (Austria), the regional energy program was established through a bottom-up process. The participation process was started in 2002 when regional energy actors defined an energy strategy for the district of Murau, and called it "Energievision Murau" the energy vision of Murau.

The main goal of the energy vision is to establish an energy self sufficient district where the energy supply is based on 100 % renewable energy sources in thermal energy and electric energy sector. During the last years the energy vision became a strong guideline for the whole district and for the people living there.

To reach of the common objectives and the main goal, the energy self sufficiency by 2015, ideas for implementing a strategy were developed by the participants themselves in moderated energy conferences. After summarizing the project ideas; 5 main focuses emerged - wooden biomass, thermal solar systems, thermal sanitation, passive houses and green electricity production. By intensive work programme, innovative new projects and products within these four main focuses, the energy self sufficiency should be reached.

An important topic that becomes visible in all four focuses is the awareness creation for renewable energies in common and especially for regional available energy sources.

The sustainability of renewable energy for commercial and industrial buildings in Cornwall

The project aims to develop three interlocking initiatives to significantly speed up the introduction of renewable energy installations in Cornish industrial buildings, through:

1. Helping develop planning guidelines in all local planning authorities for R E in all new industrial buildings;
2. Developing a grant scheme to assist with the capital costs of installation;
3. Development of training courses for R.E installers.

As some new industrial 50 buildings are developed in Cornwall each year, the proposed programme would save some 443,000 MWh p/a of oil, gas and electricity, saving around 175,000 t p/a CO₂.

This part of the programme is evaluating the overall sustainability of the technical and organisational solutions.

Municipal climate policy in the Netherlands

Municipal climate policy in the Netherlands has been operational since 2001. Since then, more than 150 municipalities have made a start. We are in no doubt that there is a long way to go before we achieve our goals, but neither are we in any doubt about the major contribution the efforts of local authorities can make to achieving the Kyoto objectives.

Municipal climate policy in the Netherlands is based on a covenant between central government and representative bodies from the municipalities and the provinces. The tasks are clearly defined: broadly speaking, central government focuses on identifying the climate objectives - including basic standards and furthermore acts as a facilitator, while the municipalities will be the ones to actually do the work. The Ministry of Housing, Spatial Planning and the Environment makes subsidies available so that municipalities can release extra capacity for implementing the policy. The level of these subsidies is linked to the degree of ambition and the actual results achieved. A total of 37 million euro has been made available for the coming years.

The strict environmental requirements have conditioned the development of biogas production in all EU countries. The biogas received during anaerobic decomposition of the organic waste can be utilized as energy source for electricity and heat generation or as gas fuel. The one of the main raw material sources for biogas production in Lithuania may be organic waste in stockbreeding sector. Therefore the development of the biogas energy sector is related to the current conditions and future of the country's stockbreeding.

In frame of IEE(Intelligent Energy Europe) project SEIPLD (Sustainable energy investments promoting local economic development) the study of biogas utilization in stockbreeding sector was performed. The study has analysed the possibilities to produce energy from live stock waste and food industry. Based on feasibility studies performed for farm complexes in Vilnius, Jonava and Silute districts the recommendations for the further biogas utilization for energy purposes in Lithuanian were developed in the study.

The huge amounts of waste at the stockbreeding farms must be properly handled and usefully utilized. The organic waste can be used for feeding, digesting. Also the waste can be burned or ploughed in the fields or processed into bio-fuel or bio-gas. The study in frame of SEIPLD has analysed the possibility to process the organic waste from pig farms and butchery to the bio-gas.

The Lithuanian case study analyses the possibilities to produce energy from live stock manure and food industry. The different biogas studies indicate considerable theoretic potential. It should be possible to generate more than 3000 GWh of energy if overall amount of organic waste is processed. However according assessment of the real possibilities of processing and economical indicators the potential, by using 30% of livestock manure, corresponds to the production of 50 mln m³ biogas, with calorific value of 300 - 400 GWh of energy. Currently 4 biogas plants are processing live stock manure and waste from food industry with total energy production of 7.4 GWh.

It is important to ensure that these farms would dispose manure and use for fertilization according to the requirements of Nitrates directive. Presently the pig farms face severe problems regarding the environmental requirements for developing farms operation, limiting the increase of the number of pigs. Following the requirements of EU directives and Lithuanian Republic laws, the pig farms must have appropriate area of farmland, depending on the number of pigs at farm, where the slurry could be watered. This demand is related with the nitrogen amount and concentration limit to the piece of land area.

The biogas production partly shall solve this problem because, after the anaerobic process in the biogas reactor, the liquid fraction of the waste is separated from the solid and the nitrogen amount is reduced. Such processed slurry can be watered in larger amounts to the same area of the land, comparing with the slurry coming directly from the pig farms. Therefore there appears to be a possibility to increase the number of the pigs at the farm. The farm will receive an additional income if it utilizes the waste collected from internal or external butchereries.

The main environmental problems related with manure and animal products waste accumulations are the increase in GHG (mainly N₂O and CH₄) emissions and NH₃ emissions. The share of ammonia is 88 % ammonia and the one of methane 22%. The likely evolution of GHG emissions without implementation of biogas plants is based on the forecast of the number of cattle from 2004 to 2013 made by the Lithuanian Institute of Agricultural Economics.

The biogas plant development switches from fossil fuel to renewable energy sources and reduces GHG emissions from fuel combustion and CH₄ and N₂O.

Seeking to reduce the negative impact of pollution from stationary pollution sources and to avoid the transferring of pollution from one environment to another the IPCC system encompassing water, air and land protection and waste disposal measures is implemented. The Directive 96/61/EC requires to avoid waste accumulation and if such waste is generated it should be used if technically possible and economically efficient.

Based on IPCC directive requirement the stockbreeding and poultry farms, butchereries and food industry enterprises of certain size should obtain IPCC permits. This group of enterprises includes various enterprises of agriculture, food industry and waste disposal.

In Best Available Technologies (BAT) bureau information bulletins there are recommendations the biologically degradable waste to reprocess in biogas plants. The Directive 96/61/EC require member states to prepare the BAT information bulletins presenting the technologies and practices technically and economically acceptable for the specific country conditions. The preparation of such information bulletins would promote pollution reduction and rational use of local energy resources and development of new biogas plants.

The nature and composition of raw materials determines the utilization possibilities of reprocessed mass. Microbiologically dirty waste needs to be processed before utilization. Various technologies for raw materials necessary reprocessing increase the costs of technology for biogas utilization for energy purposes and biogas plant becomes not economically attractive for energy production. Therefore in this case the biogas plant can increase its value because of anaerobic utilization of waste and environmental pollution reduction and enhanced quality of fertilized land.

5. Conclusions

- The interplay of new technologies and the environment involves the interaction of two sets of market failures. The result of these interactions is that the rate of investments in environmentally friendly technologies including use of RES is below the socially optimal level because of absence of the public policy. Environmentally friendly technologies are doubly underpowered by markets: non integrated external costs of pollution and non integrated external benefits of innovation and diffusion of new technologies.
- Emission fees or caps on total pollution, with tradable emission permits, are examples of ways to internalize the costs of pollution, increasing competitiveness of RES. However environmental policies restricting pollution and implementing economic tools do not overcome all market failures hampering development of RES and additional measures to promote investments in environmentally friendly technologies are needed.
- Integration of energy projects into regional development process may create external positive effect concerning environmental and other regional development goals. The examples of EU-15 countries (Austria, UK, Netherlands) implementing their sustainable energy development and climate change mitigation policies on local level can be successfully applied in Lithuania.
- Regional/local programmes have to start from a clear strategic idea, avoiding the simple distribution of money rain-like, by open calls for projects, which typically satisfy the political aspirations but do not achieve any stable development change
- Environmental accounting is still in development stage, and its concepts, tools, processes and the potential benefits to both Lithuanian industry and government are not clearly recognized. Close collaboration of academic, research institutions and environmental organizations will be an important factor in environmental accounting development and implementation. International organizations such as the United Nations and the European Union perform increasingly important role in international exchange of information and experience, and establishment of guidelines and standards.
- The data of research will provide background for long-term economic state policy for RES mastering in wide scale from the attitude of security of supply, regional energy development
- The originality of the research is the development of the attitude to RES mastering as organically linked to economic, social, environmental public development
- The research will enable:
 - to assess energy problems on the basis of single economic theory and is the input into development of Lithuanian's economic science.

- evaluate the statements of currently dominating economic theory in the context of energy economics and possibilities to measure adequately the quality of inexhaustibility of energy resources;
- to justify state organizational and financial support role by whole positive effect (positive shift of foreign trade balance, improvement of purchasing power of population, etc.), which would be provided by practical use of defined and available to implement energy conservation potential

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The world's reliance on existing sources of energy and their associated detrimental impacts on the environment- whether related to poor air or water quality or scarcity, impacts on sensitive ecosystems and forests and land use - have been well documented and articulated over the last three decades. What is needed by the world is a set of credible energy solutions that would lead us to a balance between economic growth and a sustainable environment. This book provides an open platform to establish and share knowledge developed by scholars, scientists and engineers from all over the world about various viable paths to a future of sustainable energy. It has collected a number of intellectually stimulating articles that address issues ranging from public policy formulation to technological innovations for enhancing the development of sustainable energy systems. It will appeal to stakeholders seeking guidance to pursue the paths to sustainable energy.

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