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DEVELOPING SUSTAINABLE ENERGY SYSTEMS: POLICIES, BARRIERS AND PROSPECTS FOR DISTRIBUTED ELECTRICITY GENERATION IN BULGARIA

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(signed)

Gergana MILADINOVA

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Abstract

Distributed electricity generation (DG) (i.e. based on small- and medium-scale renewables and combined heat and power (CHP) units (mainly up to 10MW)) can help our society on its way towards achieving sustainable development by contributing to all three of its pillars – social, environmental, and economic. DG can be a viable option for Bulgaria as there is significant potential – though to date has had rather limited utilization sofar. The aim of this research is to assess the existing public policy supporting DG penetration in Bulgaria, to identify the barriers, and to propose a comprehensive policy framework to support its wider penetration.

Due to the interdisciplinary character of the issues related to DG the author uses approaches from various fields (policy analysis, economics and environmental protection). The analysis is qualitative, meso-level and inductive. The research was based on extensive literature review; interviews with a number of experts, investors, and other stakeholders; and a questionnaire for investors in DG. The research was carried out between September 2003 and February 2008, but most of the data have been updated as of May 2007.

The research reveals that although there have been advancements in the setting up of a favourable environment for investments in DG by the Bulgarian Government, there are a number of policy and regulatory barriers that still need to be addressed. Economic limitations, complicated administrative procedures, and corruption further discourage DG investors.

Based on analysis of the existing policy and the barriers, and on a comparison with the experience of other EU Member States, recommendations for improvement of the existing policy framework are made, and five scenarios (present policy, high DG share, high employment and social justice, market-based, and optimal) for possible development pathways, depending on governmental objectives, are outlined.

The research contributes to better understanding of the problems related to wider DG penetration and provides decision-makers in Bulgaria guidance on the needs and alternatives if a higher share of DG is to be sought.

Keywords: Bulgaria, energy policy, distributed generation, renewables, CHP, barriers

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List of abbreviations:

AAU	Assigned Amount Units
B	Billion
IBA	InvestBulgaria Agency
CEE	Central and Eastern Europe
CHP	Combined Heat and Power (or co-generation)
DHC	District Heating Company
DOE	US Department of Energy
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EEA (former SEEA)	Energy Efficiency Agency (former State Energy Efficiency Agency)
EEF	Energy Efficiency Fund
EIA	Environmental Impact Assessment
EU	European Union
EUR	Euro
GDP	Gross Domestic Product
HPP	Hydro Power Plant
IEA	International Energy Agency
JI	Joint Implementation
lsHPP	large-scale Hydro Power Plant (above 10MW)
LE	Law on Energy
LEP	Law on Environmental Protection
LF	Law on Forestry
LPAL	Law for the Preservation of Agricultural Lands
LSpD	Law on Spatial Development
LW	Law on Waters
M	Million
MEER	(former) Ministry of Energy and Energy Resources (now MEE)
MEE	Ministry of Economy and Energy
MOEW	Ministry of Environment and Waters
MRDPW	Ministry of Regional Development and Public Works
NPP	Nuclear Power Plant
NSRF	National Strategic Reference Framework
OP	Operational Programmes
PSHPP	Pumped Storage Hydro Power Plant
PV	Photovoltaic
RIEW	Regional Inspectorate of Environment and Waters
RES	Renewable Energy Sources
SEEA	see EEA
SEWRC	State Energy and Water Regulatory Commission
SG	State Gazette
ssHPP	small-scale Hydro Power Plant (below 10MW)
TFC	Total Final Consumption
TPES	Total Primary Energy Supply
TPP	Thermal Power Plant
UCTE	Union for the Co-ordination of Transmission of Electricity
USAID	United States Agency for International Development
WADE	World Alliance for Decentralized Energy
WB	World Bank

1. INTRODUCTION TO THE RESEARCH

1.1. FOREWORD AND PROBLEM STATEMENT

Global climate change, resource depletion, urban air pollution, acidification, and nuclear waste are only some of the problems associated with energy generation. While some of these can be addressed successfully by technological improvements, others require rethinking the fundamentals of our energy generation industry. One possible approach is that of distributed energy generation, or production of electricity and heat close to consumers or even by consumers themselves, which can help our society on its way towards achieving sustainable development by contributing to all three of its pillars – social, environmental, and economic. Some of the benefits of generating power on a local scale include: security of supply, significant reduction of transmission and distribution losses, utilisation of local sources such as renewables or of less polluting conventional sources such as natural gas, and reduction of energy bills (2003; EC 2003a; IEA 2002; Jorss *et al.* 2002; Koeppel 2003; Ofgem 2002; Pepermans *et al.* 2003; Reisinger *et al.* 2002; Uyterlinde *et al.* 2002; WADE 2002). Further, with support to wider integration of distributed generation (DG), new employment opportunities can be created locally that can lead to help foster regional development (EC 2003a; ESD 2001).

Distributed generation is an old concept of energy generation which nowadays is gaining increasing popularity due to the various benefits it offers. Unfortunately, due to policy, legal and administrative challenges; technical constraints (such as traditional design of power generation systems) (Reisinger *et al.* 2002; Strabac *et al.* 2002); economic limitations (such as up-front costs and long payback times for some DG technologies); and limitations due to people's perceptions, there is no significant penetration of DG technologies in many countries. Apart from all these barriers it should also be mentioned that although DG technologies are considered more environmentally benign than traditional ones, there are still environmental impacts that should be taken into account when planning and constructing DG units (Bradley 2001; Bunge *et al.* 2003; CBD 2004; Jorss *et al.* 2002; WADE 2003). Some DG technologies are also still expensive and their promotion can have very high social costs. In addition, introduction of DG units in some locations might be associated with high costs for electricity systems upgrades (Strabac *et al.* 2002). These and other constraints should be taken into account and the penetration of DG technologies promoted in a cost-effective way. Nevertheless, there has been enormous progress in DG technologies in the last few decades that has led to cost reduction and minimization of the negative impacts (IEA 2003). However, support mechanisms are still needed, and indeed are being adopted by many governments in order to facilitate further deployment of DG technologies and to harvest their benefits.

There is significant potential for power generation from renewable energy sources such as biomass, wind, hydro, and from CHP in Bulgaria (Black & Veatch *et al.* 2003; ESD and Ecotherm - Engineering Ltd. 1997). DG promotion is one of the priorities of the Bulgarian Government, as well as one of the EU's accession requirements, and the Government has included provisions on the support of DG in various legal acts and strategic documents. DG can offer a number of benefits to the country, especially taking into account the high potential for biomass and the opportunities it can offer to local development, high energy dependence (70% of Bulgaria's energy needs are covered by imports mainly from Russia), the need for gradual closure of some conventional units, and the negative consequences of coal use. However, the DG share is still insignificant (with the exception of hydro power).

The present research reveals the limitations to DG in Bulgaria, and proposes policy recommendations for overcoming them. It assesses how the existing DG policy framework functions, and which are the main actors, and barriers. Among the constraints, the policy, regulatory, administrative and economic ones are studied in detail and the environmental and technical evoked briefly. On the basis of this analysis, and of a comparison with the experience of European countries, recommendations for improvement of the existing policy framework are made, and five scenarios (present policy, high DG share, high employment and social justice, market-based, and optimal) for possible development pathways depending on governmental objectives drawn up.

The research contributes to a better understanding of the problems related to wider DG penetration and provides decision-makers in Bulgaria with guidance on the needs and alternatives if wider DG is to be sought. It contributes to the knowledge by providing the first detailed overview of the current penetration of DG in Bulgaria and the available potential. It identifies and analyses DG-related policy and barriers in Bulgaria, combining approaches of internationally well-established scientists, and in this way provides an example of research of problems for a country still undergoing a transition between two fundamentally different systems (i.e. communist to market-based). Further, the research may also be used by investors, as it gives a detailed account of the potentials, problems during the investment process, and administrative procedures.

Due to the fact that the problems of DG penetration have interdisciplinary dimensions the proposed research borrows assumptions and methods from different areas of knowledge such as economics, policy analysis, and environmental protection, as well as from experience of the relevant issues in several European countries.

1.2. DEFINITION OF DISTRIBUTED GENERATION

Various definitions of distributed generation can be found in the literature (for example, ENIRDGnet 2003; IEA 2002; Jenkins *et al.* 1999; Jorss *et al.* 2002; Koeppel 2003; Ofgem 2002; WADE 2004)) some of which are summarised in Table 1. In all of the above-mentioned sources, it is agreed that DG means that energy is generated close to or by the consumer from RES technologies or small-scale CHP (co-generation), and when fed into the system, it is supplied to the distribution rather than to the high-voltage transmission network. However, there are exceptions where wind power plants are included.

Table 1. Difference in the DG definitions used in various publications

Publication (source)	Term used	Connection to the distributed network	Wind	Size limit	CHP efficiency
IEA 'Distributed Generation' book (IEA 2002)	Distributed generation	Not connected or providing support to a distribution network	Generally excluded		
	Dispersed generation	connected to a distribution network or completely independent of the grid.	Yes		
UK Office of Gas and Electricity Markets factsheet (Ofgem 2002)	Distributed generation, embedded generation	Connected	Yes		
Decent project – Final report (Jorss *et al.* 2002)	Decentralised generation	Not always connected or on the consumer side of the meter	Yes	10MW	More than 70%
Report for CIRED workshop (Jenkins *et al.* 1999)	Dispersed generation	Usually connected	Yes	50-100 MW	
WADE Survey of DG (WADE 2004)	Decentralised energy	Not specified Near the point of use	Only onsite wind	Irrespective of size (for CHP 1kW-400MW)	Highly efficient

Based on the review of various definitions used, and on the requirements of the Bulgarian legislation, the working definition of distributed generation used in the present study is the following:

> Distributed Electricity Generation (or DG) comprises all generation installations used for electricity and/or heat (in the case of CHP units) production, are usually connected to the distribution network, and use renewable energy sources (including hydro of up to 10MW) highly-efficient small-scale CHP technologies (with production of electricity up to 50MWh). .

Due to limitations of resources and time, only electricity and electricity and heat (in the case of CHP) generation applications and policy are studied. There are significant opportunities for solar thermal and geothermal heating, but these are not a focus of the research. The size limit is as it is provided in Bulgarian legislation. In some cases, larger projects, such as wind farms of up to 60MW, are studied as there is a very limited number of projects in this area and therefore all possibilities for information gathering are explored. Apart from CHP other technologies using natural gas were not studied, due to their limited application (as is the case of flywheels, fuel cells and micro-turbines) or the fact that they are well established (as in the case of gas turbines).

1.3. BENEFITS FROM WIDER DEPLOYMENT OF DG

DG is promoted by the governments of many countries and at the European Union level (EC 2007) as it can offer a number of economic, social, environmental and technical benefits, some of which are summarized in the following text.

1.3.1. Economic Opportunities

DG can reduce the cost of electricity generation, and due to the small size of units, it bears less financial risks. This reduction of energy bills is possible because by producing close to the consumer several components of the cost can be reduced or avoided, such as transmission and distribution losses and costs (in the EU-15 they are above 30% of the total electricity price (EC 2003a)), and the costs of expansion and/or rehabilitation of the transmission and distribution systems (Datta *et al.* 2004; IEA 2002). DG can also provide electricity to remote areas (Reisinger *et al.* 2002). Another economic benefit of DG is the use of cheap or no-cost fuels (as most renewable sources are) (IEA 2002), and the improvement of fuel use efficiency by using waste heat (Datta *et al.* 2004).

DG units are flexible in their installation and operation, and due to their small size they require lower investments costs than the conventional large-scale power plants, which in turn reduces the overall investment risk (Datta *et al.* 2004). Some of them (especially CHP) can easily be switched on and off, and so can operate at peak hours when the price of electricity is higher (IEA 2002). In this way, they can not only bring financial benefits to their owners, and in addition, according to the EC (2003a), can serve as "a physical 'hedge' against volatile electricity prices" in the liberalised EU electricity markets. Under these conditions DG can also increase the options for consumers to choose their supplier, and can stimulate competition between suppliers (EC 2003a).

DG can produce high-quality power and reduce the costs of unpredicted shut- downs caused by voltage fluctuations by providing back-up power (EC 2003a; IEA 2002; Reisinger *et al.* 2002; WADE 2002). This problem is associated with the increased complexity of modern technologies and is estimated to lead to a significant losses (for example $119 billion in 2000 in the USA alone) (WADE 2002).

1.3.2. Security of Supply

Since the oil crises of the nineteen-seventies, the issues related to the security of energy supply were set as a 'high priority' on the agendas of many governments. In a number of publications (such as EC 2003a; IEA 2002; Jorss *et al.* 2002; Koeppel 2003; Ofgem 2002; Pepermans *et al.* 2003; Reisinger *et al.* 2002; Uyterlinde *et al.* 2002; WADE 2002) the significant role of DG as a more secure and reliable means of energy generation is acknowledged. The most commonly recognised contributions of DG in this respect are: (i) diversification of fuel mix by introducing more energy sources, (ii) decrease fuels imports reliance, (iii) reduction of dependency on the fluctuation of the international prices of fossil fuels and more efficient use of natural gas by simultaneously producing heat and power (CHP), (iv) reduction of vulnerability of electricity systems to terrorist attacks and to faults in their components that can cause blackouts, and (v) offer the option of having one's own backup power to be used in case of shortage or system failures.

1.3.3. Social Opportunities

The social benefits of DG are referred to in many publications (for example: Datta *et al.* 2004; EC 2003a; IEA 2002; Jorss *et al.* 2002; Koeppel 2003; Ofgem 2002). Power generation on local scale can contribute to job creation and regional development. For example in a study by ESD (2001) for Poland it has been calculated that the labour intensity of a traditional coal-fired power plant is 0.01-0.1 jobs/GWh, while the use of renewable energy requires 0.1-0.9 jobs/GWh. Another social benefit is the increase of comfort by improved power quality and reliability in the case of blackouts. DG can also provide electricity to remote areas where it is otherwise extremely costly to connect to the distribution system. By installing DG equipment at their homes, consumers can also benefit from additional income from the exported volumes of electricity to the grid, or at least from reduction in their electricity bills.

1.3.4. Environmental Protection Benefits

The reduction of CO_2 emissions is one of the most significant benefits of DG technologies. Most energy produced from renewable sources is not associated with direct CO_2 emissions. The only exception is biomass, but because the same amount of CO_2 emitted during the burning processes can be considered to have been captured for the plants' growth, it is also considered carbon neutral (UNEP and UNFCCC 2002). Natural gas has lower emission factors than other fossil fuels. Its use in co-generation means that heat waste in the process is minimized, and thus fuel fired more efficiently with less CO_2 emitted. In addition, by the reduction of transmission and distribution losses, and increase share of renewable sources, the resource depletion can be reduced (EC 2003a). By constructing less high-voltage transmission networks, a reduction in habitat destruction and harm wildlife can also be achieved. Pollution can also be decreased by using more environmentally friendly fuels, and more efficient and clean technologies.

1.3.5. Technical Considerations

By feeding electricity into the distribution or supply grid, DG can enhance it and reduce the need for upgrades. DG provides high quality electricity and back-up power. It can offer improved engineering flexibility, including: (i) lower grid costs and losses, (ii) better fault management, (iii) reactive support, (iv) avoidance of distribution grid congestion, and (v) better electricity quality (Datta *et al.* 2004; Reisinger *et al.* 2002). Apart from the auxiliary services related to the improvement of gird and electricity quality, DG can also provide heat for various processes or space heating (CHP).

1.4. AIMS AND OBJECTIVES

The aim of this research is to assess existing public policy supporting DG penetration in Bulgaria, to identify the barriers to its wider penetration, and to propose alternative policy approaches to overcome the later.

The ultimate goal of the research is to contribute to the promotion of sustainable energy generation in Bulgaria and to provide a basis for further research in the area.

The first objective is to describe the present state of DG technologies in Bulgaria, assess their potential, and to identify existing public policies for the promotion of DG in Bulgaria.

The research under the first objective is carried out in order to reveal the present state of play related to the integration and state policy for the promotion of DG in Bulgaria. As far as can be determined this is the first overview of its kind and synthesises information from many sources, not all of which are easily available to interested parties.

The information collected on the penetration of DG technologies and on the energy sector is used as a basis for the analysis related to the other parts of the research. The main characteristics of the Bulgarian energy sector are also studied with the purpose of providing background information and insights on the opportunities for, and limitations on wider penetration of DG technologies in the country. In addition, the most recent statistical data at the time of writing on the state of DG integration have been gathered. Studies on the potentials for DG in Bulgaria are reviewed in order to explore the opportunities for wider DG deployment and to evaluate what part of the available potential is left unexplored.

To achieve the objective, first, the main policies related to DG and the mechanisms for their implementation are identified and studied. Furthermore, the policy instruments for the implementation of DG policies and the way they function are examined. Along with this, the main actors and institutions (including state, social, and international) are identified and their capacity and cooperation briefly studied in order to provide a starting point for the research under the third objective. The analytical approach as to how these issues are studied is described in Section 1.5, below.

The second objective is to reveal and study the barriers that prevent higher penetration of DG.

For various reasons, including that the electricity systems have hitherto been planned in a centralised fashion, but also that some DG technologies are not yet market competitive, there are a number of barriers that prevent higher DG penetration. Their implication for the Bulgarian case is studied. Although information on all possible limitations that occur in Bulgaria is gathered, only the policy, regulatory, administrative and economic ones are studied in det,ail, following the analytical framework suggested in Section 1.5, below. The remaining limitations such as environmental, social and technical ones, are briefly touched upon, mainly at the basis of expert information provided in interviews and personal communications.

The third objective is to propose recommendations for improvement of the existing policy framework and to suggest different scenarios, including one that the author considers optimal, on DG deployment in Bulgaria, depending on governmental priorities.

Measures to overcome the barriers revealed are suggested, based on the research in Bulgaria, and the experience of other EU countries tailored to the current situation in Bulgaria. As a result, a number of recommendations are proposed that are essential to be implemented if the Bulgarian Government wants to achieve increasing contribution of DG. Several scenarios, depending on governmental priorities, are outlined, and the necessary policy for their achievement described, including the social, environmental and technical implications. The author's 'optimal' scenario that takes account of the present integration of DG and combines the benefits of all scenarios at acceptable costs is also outlined.

1.5. ANALYTICAL FRAMEWORK

To achieve the above-described objectives the answers are sought to three research questions. They are:

1. What is the existing policy framework for support to distributed generation in Bulgaria?
2. What are the barriers that prevent higher penetration of distributed generation in Bulgaria?
3. What recommendations can be made for improvement of the existing DG policy framework, and what are the possible scenarios for DG development in Bulgaria?

In the following text, a general overview of the analytical framework for approaching these questions is presented. More detailed explanations of the theoretical approach are provided as an introduction to Sections when applicable.

Due to the interdisciplinary character of the problems related to DG, the author borrows approaches from various fields (mainly policy analysis, economics and environmental protection) as well as frameworks for research developed for several EU-funded research projects on DG. The analysis is qualitative, meso-level and inductive. Based on literature review and results of several EU projects, the barriers and instruments for the promotion of DG are identified, and then their presence in Bulgaria analysed. Other problems typical for the country are also revealed. Although barriers from different fields are identified, an in-depth study is carried out only of those related to policy, regulatory, administrative, and economic limitations. From the field of economics, a theory of market failures is applied in qualitative terms to characterise the market barriers that limit penetration of DG technologies. Administrative barriers are also studied following the framework provided in the ADMIRE REBUS project which was funded under the EU's ALTENER program (Skytte *et al.* 2003; Uyterlinde *et al.* 2003). From policy analysis, the definitions and parts of the approaches developed by Howlett and Ramesh (2003), Salamon (2002), McLaughlin and Jordan (1999), and from economic, research, that of Golove and Eto (1996) are used. In addition, the approach of Hood (1986) guides the research on institutions, actors, instruments, and how these elements combine. Finally, comparison is made with the experience of EU countries in order to reveal how the problems are overcome, and a comprehensive list of recommendations and future scenarios on possible developments is proposed.

4. Research question 1: What is the existing policy framework for support to distributed generation in Bulgaria?

To answer this question, the governmental or public policy promoting DG in Bulgaria is studied. There are different definitions of public policy which have been developed over the years. In this research, the definition of Jenkins (1978, cited in Howlett and Ramesh 2003) is used, which states that public policy is "a set of interrelated decisions taken by a political actor or group of actors concerning the selection of goals and means of achieving them within a specified situation where those decisions should, in principle, be within the power of those actors to achieve". Therefore, three elements are studied consequently.

First, the goals, targets, and objectives that are set up by the Government are revealed. These are studied based on a review of various public policy documents such as strategies, programmes, and action plans. As DG is relevant to different areas, documents from energy, environment, economy, regional development, and employment are analysed. EU accession is a major factor, and thus the provisions on renewables and CHP in the Accession Treaty of 2005 are also included, as well as various elements from informal discussions with officials of the Directorate-General for Energy and Transport of the European Commission, and experts in Bulgaria, on how the Bulgarian Government adopted its targets relevant to the promotion of renewables are carried out.

Secondly, once the governmental objectives are studied, the instruments for their achievement are identified and analysed, based on document review and interviews with stakeholders. The instrument of public action is considered as ‘an identifiable method through which collective action is structured to address a public problem” (Salamon 2002). The classification of instruments by Hood (1986) is used to study the instruments applied in DG field in Bulgaria. Hood proposes a simple classification of the possible instruments into only four groups. It provides a good synthesis of the possible instruments for realisation of government policies, facilitates research, and can possibly prevent omission of some key elements. The four types of instruments are nodality (information), authority, treasury, and organisation (or if abbreviated NATO) according to the resources government uses to implement its policies.

Once the instruments determined, a brief overview of how they function is given following the main assumptions suggested by Salamon (2002) and some suggestions for analysis described by McLaughlin and Jordan (1999). The analysis is guided by review of several elements: identification of the goals of the instrument and the resources or inputs for its achievement; study of the design, activities, delivery system and outcomes, and the mechanisms for non-compliance (Salamon 2002, McLaughlin and Jordan 1999)

Thirdly, the main actors and institutions which participate in the policy formation and implementation in Bulgaria are identified, and their main characteristics described. However, the aim of the research is not detailed institutional analysis. Study of the actors and institutions is carried out to support policy and barriers analysis. The analysis framework of Howlett and Ramesh (2003) is used. They suggest that individuals or groups of individuals (or actors) are as important as the institutional setting within which they operate, and which is why both are researched. The institution is defined by the narrow meaning of the ‘actual structures’ (Howlett and Ramesh 2003). The actors and institutions are classified in three main groups: state, social, and international.

Research question 2: What are the barriers that prevent higher penetration of distributed generation in Bulgaria?

There are a number of barriers that limit the penetration of DG worldwide. Based on the existing studies of DG penetration in Europe (for example: Jorss *et al.* 2002; Pepermans *et al.* 2003; Reisinger *et al.* 2002; Skytte *et al.* 2003; Strabac *et al.* 2002; Uyterlinde *et al.* 2002;

Uyterlinde *et al.* 2003) a list of barriers (regulatory, policy, and administrative; economic; technical; environmental; and social) have been prepared. The research investigates whether these barriers also exist in Bulgaria and searches for limitations which appear typical for the country. Due to time constraints, the technical and social limitations are not studied in detail, but for completeness brief information on them is provided.

The problems related to investments in DG throughout the whole investment process (including planning, implementation and production phases) are analysed using the framework suggested in the ADMIRE REBUS project (Skytte *et al.* 2003; Uyterlinde *et al.* 2003). Analysis of the investment process, administrative procedures, and lead times is carried out through review of legislative acts, regulations and procedures, and interviews with investors for which a questionnaire was dawn up (see Section 1.7.3, page 15).

Furthermore, an analysis of the policy and regulatory barriers is carried out. The main barriers are identified, based on a literature review of international experience. Those researched in detail are: policy targeted at large-scale generation based on a long- and well- established tradition; lack of long-term and consistent DG policies that increases the investment risk; lack of inclusion of DG consideration in the planning process; long and complicated administrative procedures; powerful lobbies supporting fossil fuels and nuclear industries (Cole *et al.* 1995; Datta *et al.* 2004; EC 2003a; ENIRDGnet 2003; ESD *et al.* 2001b; ESD and Ecotherm - Engineering Ltd. 1997; Strabac *et al.* 2002; Urge-Vorsatz *et al.* 2003; Uyterlinde *et al.* 2002). Based on interviews, several problems typical for Bulgaria, such as contradicting primary and secondary legislation, lack of implementation, inexistent microgeneration support policy, were also identified and researched. Although powerful lobbies exist in Bulgaria, and the problem is significant, it is not investigated here in detail due to time constraints.

The economic limitations are studied as barriers related to the existence of an imperfect market as suggested by Golove and Eto (1996). Relevant to DG in Bulgaria are three market failures, namely: failure to internalise externalities, imperfect competition, and imperfect information. These are studied in qualitative terms based on document review and interviews. The problem of externalities is researched by analysis of the cost of electricity generation from conventional sources, and the failure of the Government to reward DG. The latter is approached through a review of the issues, such as limited investment support, problems with the reward scheme (i.e. the feed-in tariffs), and limited state funding for research and development. The imperfect competition in the energy sector is recognised to be a considerable barrier for small electricity producers (Jorss *et al.* 2002). To reveal the problems, the role of the distribution- and transmission- system operators (DSO and TSO) in providing access to the networks and to the markets for DG producers is studied (Jorss *et al.* 2002; van Sambeek and Scheepers 2004). The problem of imperfect information emerges in different forms such as: lack of information, high cost of information, low accuracy of information, and limited ability of the actors to use or act upon this information (Golove and Eto 1996). It is revealed through review of available information sources and interviews.

DG is considered more environmentally benign than traditional energy sources but it can also lead to environmental degradation, i.e. there are also environmental barriers for the penetration of DG. Studies on possible environmental degradation caused by DG units in Bulgaria have not been identified, and it is not possible to carry out such a study within the limits of this research. Therefore it is very difficult to draw conclusions on possible impacts. Thus only problems related to the EIA procedure and the concerns of various environmental NGOs about wind and hydro power development are summarized in the text. The technical limitations are also not studied in detail, but the information mentioned by some interviewees is included.

DG policies do not stand alone and are influenced by decisions and developments in other sectors or issues. It is not be possible to study all relevant limiting factors but a brief overview of the most important ones, e.g. the plans for construction of a new nuclear power plant and its impact on the Bulgarian energy system, and the problems of corruption, is included.

Research question 3: What recommendations can be made for improvement of existing DG policy framework, and what are the possible scenarios for DG developments in Bulgaria?

Based on the analysis of the existing DG policy framework in Bulgaria, of the barriers, and on comparison with the experience of other EU countries, a comprehensive list of recommendations for the improvement of DG policies in Bulgaria is proposed. Information on international experience, especially in the UK, was collected during a nine-month research period at the Environmental Change Institute (ECI) at Oxford University. Different scenarios are developed that describe possible policy alternatives, depending on the Government priorities, and their repercussions analysed. The scenarios have been developed at the ECI.

1.6. RESEARCH LIMITATIONS

The most significant challenge during the research has been that DG is a new field with a growing importance at EU and national level, and thus policy for its promotion is constantly changing. The author did her best to keep the information as updated as possible as of the May 2007. However, the PhD course start date is October 2003, and information in some sections refers to even earlier dates. An indication of when the information was collected is included in the text when considered necessary.

From theoretical point of view it has been very challenging to choose one framework that explains the situation in Bulgaria. This is due to the fact that the country had undergone a very significant transition between two completely different systems, i.e. centrally planned communist one to democratic and market based one, which makes the application of the theories that have been developed in well-established 'Western' democracies, very difficult. In addition, the subject is rather new and required interdisciplinary approach. That is why a combination of different approaches was used.

Due to limitations of time and resources several aspects are not studied. First, the heating-only applications of DG were left out of the study as they present rather different problems (i.e. there is no legislation to promote them) and the potential is mainly for very small-scale applications. Secondly, only the state policy is studied and not those of various organizations. Thirdly, the opportunities under the EU Structural, Cohesion and other Funds are not explored as Bulgaria aceeded only in January 2007, there were problems with setting up the operational structures for these funds, and therefore there is not sufficient experience or information to date which can be analysed within the limited time-frame of the research. Fourthly, analysis of the readiness of the banking sector to provide credits for DG projects was not performed. However, information on the possibilities for obtaining bank credits has been collected from interviews with investors. Fifthly, the environmental and technical aspects are not studied in detail. These issues require separate comprehensive research.

For the section on administrative procedures, the author has tried to review all relevant permits and authorizations, but as they are a considerable number, it is possible that some are omitted. However, the author believes that most required steps and authorizations needed have been duly presented.

Although some issues could not be discussed in detail, or were omitted the author believes that the research draws a very comprehensive picture of the state of play, problems and opportunities for DG in Bulgaria.

At the beginning of the research it was perceived that a serious limitation might be lack of cooperation, and reluctance by stakeholders to give interviews. However, with some minor exceptions, this did not transpire; indeed on the contrary throughout the research there was much understanding and support from the various experts and stakeholders who were approached, for which the author remains most grateful.

1.7. METHODOLOGY

1.7.1. Phases of the Research

The research was conducted in three phases and an initial or preparatory one, as summarised in Figure 1. The diverse nature of the problems discussed and analysed in each part of the study called for different approaches to their analysis. The initial phase was descriptive, which is why document review was the main research technique. The first and the second phases of the research (or the analyses of the existing policy and study of barriers) are on the border between descriptive and explanatory study and a combination of document review and interviews was used. The research is mainly qualitative in nature, although some quantitative data was gathered to support the arguments.

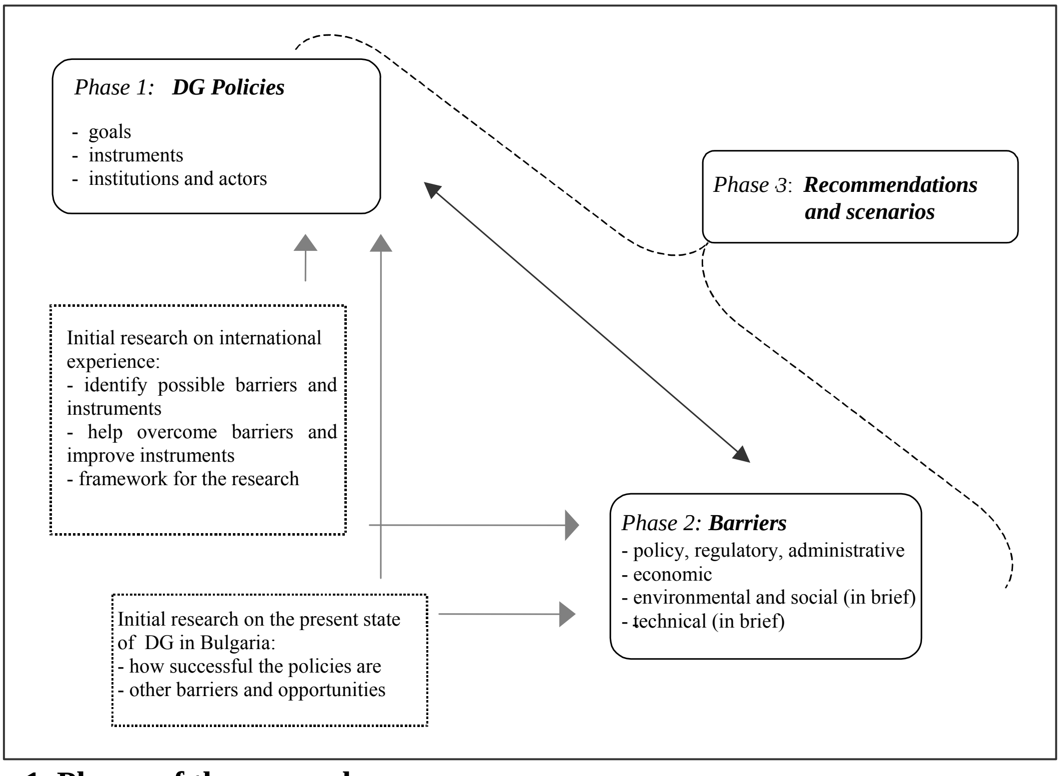


Figure 1. Phases of the research

1.7.2. Research Techniques

The units of research (or the cases to be studied) were different in the various parts of the research. In the first, the policy related to DG was the unit studied through identification of policy goals, actors and institutions that participate in their achievement, and the instruments which have been chosen for their implementation. The other units of analysis represented each of the barriers that prevent DG penetration.

From the range of possible general sampling techniques described by Miles and Huberman (1994) in the research snowball or chain, a typical case, and opportunistic ones were used. The snowball technique relies on the fact that the experts or documents in the area can suggest further references to other documents and persons therefore thanks to the chain reaction a good overview of the whole field is achieved. When the typical case technique is used, then the average or the normal case is studied. In opportunistic sampling, the researcher takes advantage of the opportunities that emerge unexpectedly or by following new leads. In addition to these sampling techniques for the research on the usage of instruments and the barriers to DG in Bulgaria and other European countries, the technique of comparable case selection was used.

1.7.3. Data Collection

Two techniques of data collection were used: document review and interviews. The study of documents was an integral part of each phase of the research. In order to reveal the problems in more detail, interviews were used. Simultaneously to data collection they were converted into electronic form. Careful management of the information collected from documents, interviews, and field notes is one of the key elements of management of the research data. In this section an overview is given of the strategies used to gather, systematise and facilitate the process of data collection.

Document review

The study relies on extensive review of documents (for example various legislative acts, policy documents, studies and reports, position papers, publications) from various DG areas. To systematise and summarise the information in these documents, a summary of the main details important for the research was made for each of them, following the prescriptions of Miles (1994).

Interviews

Two interviewing strategies were applied: semi-structured interviews with revolving protocols, and interviews for which a questionnaire was developed (Mintrom 2003). The first type of interviews were carried out mainly in the form of informal discussion with experts and stakeholders. The researcher had the opportunity to participate in a number of conferences, and to work on DG-related projects with various organizations, such as the Black Sea Regional Energy Centre (intergovernmental organization of the countries of the Black Sea Region), CEE Bankwatch (international NGO), the Environmental Change Institute at Oxford University, and the European Commission. During these valuable experiences, the author had the opportunity informally to discuss issues on DG deployment, policy and futures.

The second type of interviews was with investors who were requested to answer a questionnaire (included in Annex III). The aim was to collect comparable information on investment opportunities and barriers and problems during the obtaining of various authorizations. Most investors were interviewed in person but some of the questionnaires were sent by e-mail after prior communication with the respondents. Seventeen organizations were asked to provide data for the questionnaires. Thanks to the approach of contacting people directly, only two of those contacted did not provide information.

The first type of interviews started from the planning phase of the research, i.e. autumn 2003 and continued until the completion of the first draft (August 2007). Most second type interviews that required completion of the questionnaire were carried between August 1, 2006 and September 30, 2006. They were digitally recorded unless the respondents objected and the files were kept for further reference.

For confidentiality reasons when data were collected in interviews with stakeholders, thier identities are not disclosed. There is reference only to the position, or to which group the interviewee belongs (i.e. investor, project developer, expert, official, etc.) and the year in which the discussion took place.

1.7.4. Data Analysis

In order to avoid accumulation of considerable amount of data, its analysis started once the data were obtained. Singleton and Straits (1999) suggest three stages in data analysis which were used in the analysis and include: organising information, developing ideas, and drawing and verifying conclusions to be used.

In order to analyse the extensive amount of research data they were first organised in a 'meaningful and analysable way' (Singleton and Straits 1999). This was achieved by organising them in categories and subcategories that correspond to the objectives of the research. *Memoing* was used to capture various ideas during the analysis. Lofland and Lofland (1995) describe memos as a "small pieces of analysis, usually a paragraph or two, that capture emergent ideas that help make sense of the reality one is encountering". *Diagramming* or the "visual representation of relationships between concepts" (Strauss and Corbin 1990) was another strategy that was used for the analysis of data gathered.

Lofland and Lofland (1995) suggest several useful hints that facilitated drawing up and verifying conclusions. They are: rephrasing the researcher's writings in order to catch the meaning better, changing diagrams, constantly comparing; thinking of extremes and opposites, talking with and listening to fellow analysts, drawing back in a search for a more holistic picture, and withholding judgements as long as possible.

To check the validity of the information gathered and of the conclusions, several approaches were used, as suggested by Singleton and Straits (1999). One of them was to look at the data from different perspectives (i.e. "data triangulation"), which in the research was achieved by using different sources of data collection such as public documents, studies and interviews. When written accounts of the events or issues did not exist, then various stakeholders were interviewed (Marshall and Rossman 1989). This was particularly important as various stakeholders with economic interests were interviewed. That was why the author had always tried to check the information provided by the interviewees against observations, data, and other stakeholders' accounts. When inconsistencies in the account of different actors were identified, the reasons were also explored.

1.8. STRUCTURE OF THE DISSERTATION

After this brief introduction to the research approach, in the following chapters a detailed analysis current state of DG, opportunities, and challenges is presented. In Chapter 2, a summary of the main characteristics of the Bulgarian energy system relevant to DG integration is presented. This is followed by an overview of potential for renewable and CHP technologies for the country as a whole and for the different regions. In Chapter 3, the policy for the promotion of DG is studied, including the goals and objectives set in different governmental documents, and the individual measures applied in order to meet them. The analysis includes not only description of the main characteristics of the instruments, but also, discussion of the problems associated with their functioning. A brief overview and analysis of the role and capacity of the various actors and institutions which shape, implement, and are affected by the public DG policy is included in Chapter 4. The steps and the limitations during the DG investment process are described in Chapter 5 along with the administrative procedures, and authorizations to be obtained during this process and the related limitations are revealed. The constraints are analyzed in Chapter 6 where the more overarching barriers related to gaps in the policy and legislative framework, economic constraints, environmental, social and technical limitations are included. The identified opportunities and barriers, and best examples from international experience, are a basis for the conclusions presented in the final Chapter 7, where recommendations for improvement of the policy and various alternatives for DG development under the five scenarios chosen are discussed. Chapters 1 to 5 are more descriptive in their essence, although elements of discussion are included together with the description of the main findings revealed during the literature review and communications with stakeholders, while the summary of research results, analysis, and recommendations features in Chapters 6 and 7.

2. OVERVIEW OF THE BULGARIAN ENERGY SECTOR, CURRENT SHARE AND POTENTIAL FOR DISTRIBUTED GENERATION

The development of a decentralized electricity generation system is dependent, among others, on the possibilities for the existing energy system to accommodate such technologies, and on the available potential. To provide background information on the environment in which DG technologies are to be developed, an overview of the energy sector in Bulgaria and the potential for various distributed technologies are presented in this Chapter.

2.1. BASIC CHARACTERISTICS OF SUPPLY AND CONSUMPTION

For its primary energy needs, the country is heavily dependent on fossil fuels and nuclear energy, which account for about 80% of the fuel mix (for more information see Table 14, Appendix I). The country is also highly dependent on the Russian Federation for energy imports, which represent about 60 to 70% of its needs (MEER 2004a).

Coal represents a significant share of the fuel mix (about 35% in primary energy needs) and is widely used for electricity generation (about 40% of total electricity generation in 2005), for space heating, and in industrial processes (EC and Eurostat 2007). About 90% of coal consumed in Bulgaria is lignite with a very low calorific value and high ash and sulphur content (E.V.A. 2004). However, further increase in the share of coal is seen as one of the means for achieving independence of the country from fuel imports.

The heavy emphasis on development of nuclear and coal power generation, and small natural gas reserves has left the country with a low share of natural gas in electricity generation (5.2% in 2005) and relatively low share in the final energy consumption (10.8% in 2005) (EC and Eurostat 2007). Nowadays, licences for natural gas distribution have been given to several firms which can afford to install new plants, as well as for introduction of more efficient natural gas-fuelled CHP in the industrial sector.

The share of renewables in gross inland consumption (or primary energy needs) was only 5.6 % in 2005 (EC and Eurostat 2007), represented mainly by biomass (which after the increases fuel and electricity prices is starting to be widely used for heating and cooking purposes) and by hydro energy (mainly by the large hydro power plants). The share of renewables in electricity generation was about 10% in 2005 (EC and Eurostat 2007).

The energy intensity of the Bulgarian economy is still lagging behind EU-15 averages, being in fact two times higher, if measured as TPES at purchasing power parities in 2002 (IEA

2004a, b). Some of the factors behind this phenomenon are inefficient end-use consumption, inefficient fuel firing, and high transmission losses.

In the light of the high share of coal (and especially the associated harmful and climate change-inducing emissions, and the need for the recultivation of mines after coal extraction), the high share of nuclear (and the lack of permanent storage for nuclear waste), and the strong dependence an energy imports, wider introduction of DG should be the solution to many of the problems related to energy generation in Bulgaria.

2.2. OVERVIEW OF ELECTRICITY GENERATION SECTOR

Electricity generation is dominated by nuclear and coal (see Figure 2, below). The development of electricity generation, and demand by sector and export/import balance is presented in Table 15, Appendix I. The share of nuclear power has decreased since 2002 and 2006 due to the closure of the four VVER 440 units at Kozloduy nuclear power plant (NPP), and the share of thermal and hydro power has thus increased. Although there are some improvements, transmission and distribution losses are still very high.

Bulgaria used to be the biggest net exporter of electricity in the Balkan region, exporting up to 15% of electricity generated in the country to Greece, Serbia & Montenegro, FYROM, and Albania. However, with the closure of the other units at Kozloduy NPP, export opportunities have significantly decreased. At present the country has enough capacity to meet its domestic needs without imports, but with the planned closure of several thermal power plants there might be problems in the medium- and long-term.

Therefore, increasing DG share along with end-use reduction can be very beneficial for the economy. However, the option currently considered by the Government for solving possible electricity shortages is the construction of a second NPP at Belene. The remaining two units of 1 GW each at Kozloduy NPP contribute to a significant share of electricity generation in Bulgaria. The tensions and political debate regarding the construction of a new nuclear power plant reveal strong support for large-scale electricity generators in Bulgaria. This also explains to some extent why, although there is potential for distributed generation in Bulgaria, its use hitherto is very limited. For thisreason, the issues on Belene NPP are discussed in a separate Section 6.5, page 132.

Total electricity generation in 2006 was 42 TWh. The fuel mix is presented below.

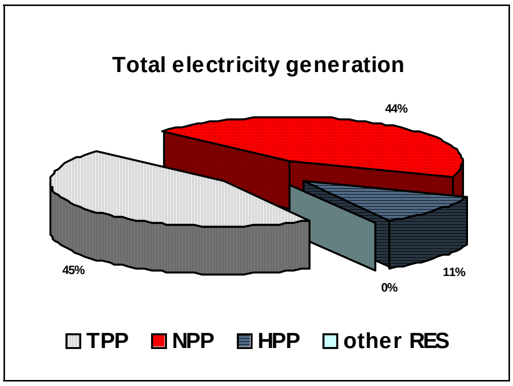


Figure 2. Total electricity generation by power plant in Bulgaria in 2006

Source: Papazian 2007

2.3. THE ELECTRICITY AND NATURAL GAS MARKETS

Among the obligations incumbant on the Bulgarian overnment in the process of EU accession negotiations was the transposition and implementation of Directives 2003/54/EC and 2003/55/EC on the liberalization of electricity and gas markets. Following the requirements, the direct subsidies distorting the energy markets were phased out, and the liberalization of the electricity markets achieved over several stages and completed by July 1, 2007. An independent regulator the State Energy and Water Regulatory Commission was created, which has a significant role in DG development, as it is setting up energy prices and is responsible for several permits (as discussed in Section 4.1and 5.2). Generation, transmission, and distribution were unbundled, but there are still difficulties for small energy producers (see Section 6.2.2). The structure of the energy market is presented in Figure 3.

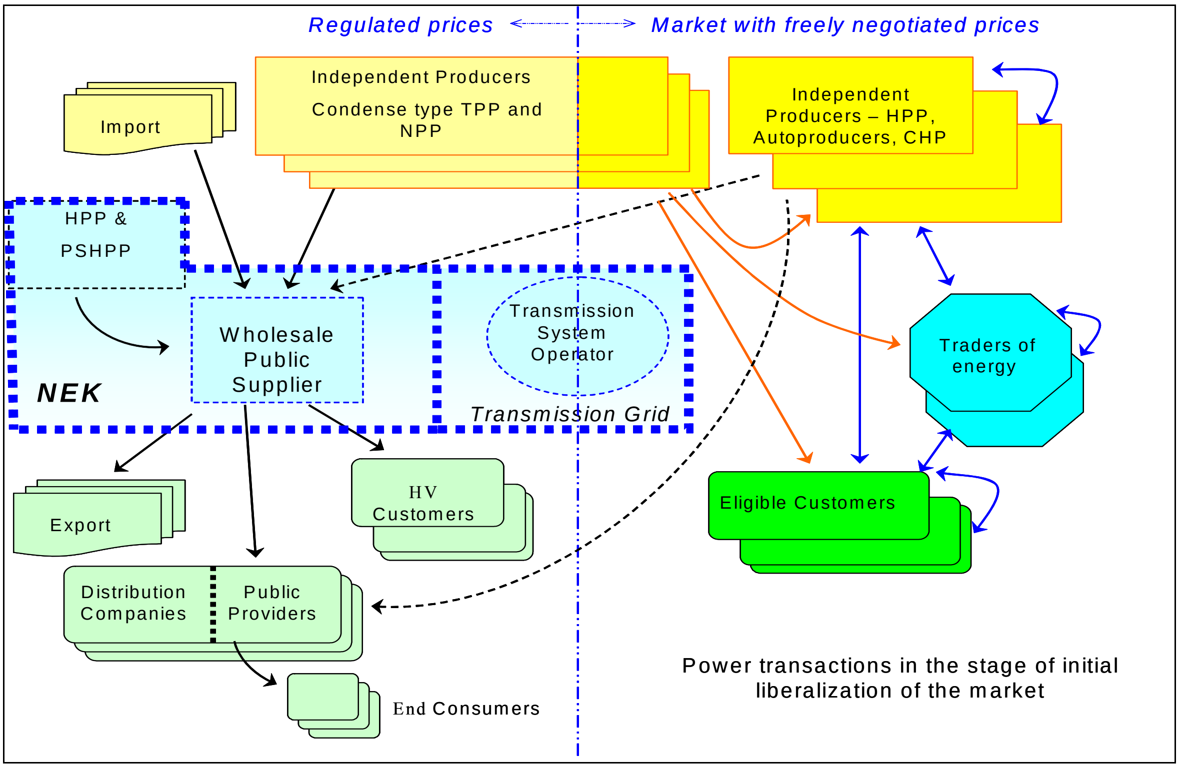


Figure 3. Structure and participating entities in the electricity market in Bulgaria
Source: MEER 2005

2.4. PRIVATIZATION IN THE BULGARIAN ENERGY SECTOR

Privatization in the energy sector is advancing. On the generation side, most power plants have been privatized, including 34 HPP, or undergoing the process of privatization with the exception of Kozloduy NPP and the biggest TPP - Maritza East 2 TPP. The later might be privatized in years to come. The eight electricity distribution companies have been grouped in three packages and 67% of their shares sold in 2004 to CEZ a.s., E.ON Energie AG, and EVN AG (MEER 2004a).

Privatisation of the district heating companies (DHCs) is also underway. Most of them have already been privatised through auctions and public tenders. This change to private owners provided impetus for improvements in energy efficiency, incl. introduction of new CHP units.

2.5. COST OF ELECTRICITY GENERATION FROM DIFFERENT FUEL SOURCES IN BULGARIA

The generation costs at which Bulgarian power plants generate their electricity varied, with only very few exceptions, between 2.5 and 4 €cents/kWh in 2006 (Expert 2006). But these figures in many cases do not include the externalities of electricity generation. The costs at which power plants sell their electricity are kept low by the Regulator not allowing for them to carry out major investments in modernization.

On the other hand the high prices of some fuels for DG, e.g. natural gas and some biomass products, and the low cost of domestic fuels (such as lignite) are a significant limitation for DG in Bulgaria. For example, wholesale lignite for energy generation has a specific price of EUR 5 lv/Gcal while briquettes and pellets from wood are about EUR 21/Gcal (for further details see Table 16, Annex I). From renewable energy sources, only solar and wind energy can be used without payment of fees or concessions. There is a fee for water use but it is not a serious constraint. Biomass is relatively cheap and there is significant potential as shown in Section 2.7.1.1, below, but the effect of construction of several biomass-fuelled power plants has not been studied. For instance, there is a risk of rapid exhaustion of biomass from close locations, which might lead to high fuel costs due to scarcity on the market, and thus a significant sudden increase of the price of biomass (as happened in Hungary upon construction of two biomass-fuelled units). That is why an evaluation of the likely scenarios should be prepared.

The biggest challenge for increase of natural gas-fuelled CHP is the high price of natural gas. The Bulgarian economy had benefited from lower than the EU - average natural gas prices due to the fact that according to a long-term agreement with Gazprom transit though Bulgaria used to be paid by fuel supplies. However, the agreement was subsequently cancelled, and a new long-term one signed shortly before Bulgaria's EU accession. Its clauses are secret, but in 2007 there were regular demands by Bulgargas – the natural gas importer – for price increases. This situation can obviously be very negative for CHP development in Bulgaria.

In addition, because of the low price of domestically mined coal it is much cheaper to produce only heat from it rather than to use the heat produced byr electricity generation in natural gas-fuelled CHP units. This is why without governmental support in forms of preferential tariffs or certificates for electricity generated, future development of natural gas-fuelled CHP will be significantly restricted.

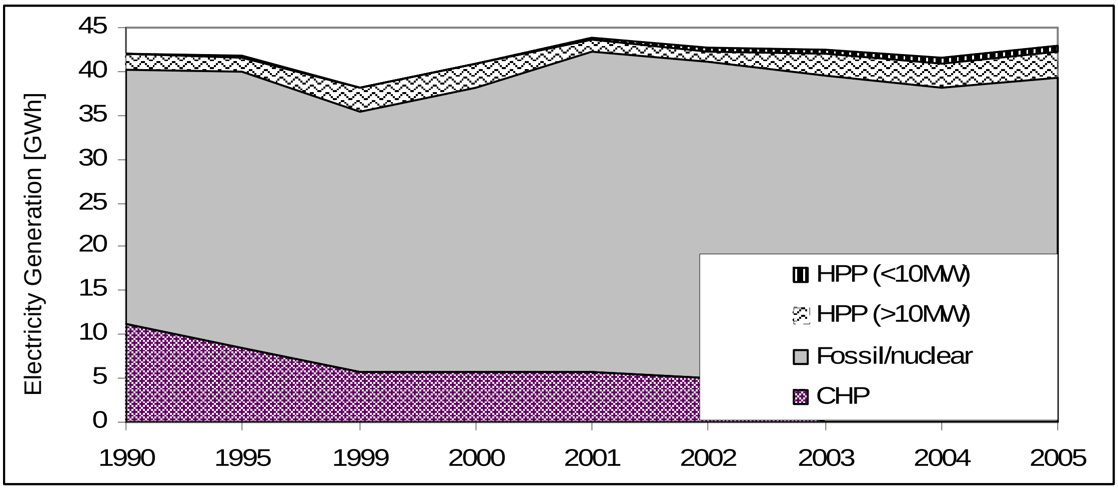
2.6. CURRENT PENETRATION OF DISTRIBUTED GENERATION IN BULGARIA

The share of renewables units below 10 MW and small-scale CHP in electricity generation in Bulgaria is negligible. If the WADE (2004) definition of DG is followed, i.e. CHP units with capacity of 1kW up to 400 MW are included, then the share of DG increases thanks to the large-scale CHP units, some of which are coal-fuelled.

Large-scale CHP units have been installed for some of the district heating companies, which amount to 880 MW and in large industrial enterprises for 993 MW in total installed capacity (MEER 2005). However, considering that they are in many cases obsolete, and their environmental performance therefore questionable, they are not included in this research. There were about 22 gas turbines in 2003 with a power of 6 MW to 10 MW, were not connected to the grid but used to provide electricity for compressors (ENIRDGnet 2003).

Although the country has significant potential for renewables, as already mentioned their share in electricity generation is very low (see Figure 4, and Table 17 in Annex I). Presently, large-scale hydro power plants are the main renewable electricity source in Bulgaria. The installed capacity of all HPP in 2005 was about 2 GW, and of pumped storage units - 0.9 GW (MEER 2005). Small hydro power plants below 10 MW totaled 0.2 GW in 2004, and there was about 1 MW installed capacity of wind turbines. There were only 33 kW photovoltaic systems installed.

Figure 4. Share of DG in electricity generation in Bulgaria



Sources of data: For renewables - calculations of BSREC; for CHP - IEA 2004c; for electricity generation - IEA 2004c and MEER 2005

Note: no data could be identified on the share of CHP after 2002

2.7. POTENTIAL FOR DISTRIBUTED GENERATION IN BULGARIA

2.7.1. Potential for Renewable Energy Sources

There are several studies on renewables potential which show that it is considerable (see Table 2). However, in the *National Long-term Program for the Promotion of Renewable Energy Sources (2005-2015)* (EEA 2006) the evaluation of the accessible potential for energy generation from renewables is less optimistic. The authors of the program found out that the total accessible potential for energy generation of all renewables in the country is about 6 Mtoe which according to them in 2015 will be only 38% of the total final consumption, if all the accessible potential is used. This will come mainly from hydro energy and biomass.

EBRD study (Black & Veatch *et al.* 2003) presents much more optimistic estimations on the theoretical potential for renewables in Bulgaria. It shows that renewable energy capacity (excluding solar) can be 8 GWe by 2020 if the whole mid-term technical potential is utilized. Although this is technical potential and not economic or market it is still significant compared to the total installed electricity generation capacities in 2002 which were around 12 GWe. As for the different renewable technologies types, "Bulgaria has very promising renewable energy resources development opportunities across all technologies", being one of the countries with highest identified in the study wind potentials (3.4 GWe in 2020). Additionally, taking into account that 90% of the countries territory is arable (35% forests and

45% agricultural lands), the potential for biomass is considered as very promising or 3,4 GWe. The EBRD study evaluated that the mid-term potential of hydro power is 1 GWe (including large hydro power plants) although other experts are more sceptical about large-scale hydro potential arguing that it has already been exploited.

In the following text more detailed data of potentials for renewable electricity are provided. If in some studies there is no separate evaluation for ‘electricity’ but only for ‘energy’ they are also included with a clear reference that data refers to energy (i.e. both heat and electricity).

Table 2. Comparison of the estimated potential in Mtoe for renewable energy generation in Bulgaria in various studies

Indicator	Solar [Mtoe]	Wind [Mtoe]	Biomass [Mtoe]	ssHPP [Mtoe]	lsHPP [Mtoe]	Geothermal [Mtoe]	Total [Mtoe]	Source
Total resource available (1993)	13 000	75	1159	371		336	**14 941**	(ESD and Ecotherm - Engineering Ltd. 1997)
Theoretical potential (1993)	0.0	75 (?)	3.6	0.1	2.0	0.3	**81**	
Total potential	14 703	10 748	5-5.3	1.8	N/A	-	**25 458**	(Simeonova et al. 1996)[1]
Accessible potential	8 169	5 357	-	-	N/A	-	**13 526**	
Reserve potential	18.4	1.8-2	0.4	1	N/A	0.0	**22**	
Accessible potential	0.4	0.283	2.70	2.3		0.4	**6**	(EEA 2006)

[1] cited in (Novem and Eneffect 2000)

Note: This table is only with illustrative purposes and demonstrates the significant potential, but also, the differences of the outcomes in some of the available studies.

2.7.1.1.Biomass Energy

Biomass is considered to be the source with highest potential from renewables for heat and electricity generation in Bulgaria (EEA 2006). It is largely used for heating, mainly as firewood, and represented about 4% of the TPES. Its applications for electricity generation are insignificant limited only to several CHP installations that utilize waste by-products in the pulp and paper industry. With 35% of Bulgarian territory covered by forests there is significant potential for wood use - data shows that there is a theoretical potential for the use of 547 ktoe of firewood for energy needs (ESD and Ecotherm - Engineering Ltd. 1997). However this potential is limited by the possibility of concurrent uses of timber and nature conservation objectives. At present the most sustainable use of biomass can come from the use of biomass waste from different sectors and the planting of wood energy crops to use the deserted arable areas (which are about 8.5% of agricultural land) or those that are poorly managed. That is why these two uses will be discussed in detail along with the spatial distribution of their potential.

Biomass from waste products

According to EEA (2006) biomass waste can contribute with 2.7 Mtoe which for comparison was 13% of TPES in 2005. The highest potential is for forestry residues and for agricultural plants' waste (see Table 18, Annex I). It is interesting that most waste, with the exception of forest residues and industrial waste, is not utilized which on its own provides good opportunities for further development in the sector.

Biomass pellets, Photo: Erato

Energy crops

Another possibility for higher biomass use is through the creation of plantations with fast growing species. Some of the species suitable for electricity generation purposes are trees grown on short rotation coppice (willow, poplar etc) or different grasses, such as giant reed, switchgrass, miscanthus, cardoon, Spanish thistle artichoke (CRES report 2003). There are no data on such species being used for electricity generation and there are no detailed studies on the potential for these energy crops. Regarding the wood and liquid biofuels, it has been evaluated that they altogether can theoretically contribute with 843 ktoe (ESD and Ecotherm - Engineering Ltd. 1997). Further research on the most suitable species for the Bulgarian climatic, geomorphologic, and ecological conditions is needed.

About 50% of Bulgarian territory is for agricultural purposes and out of these about 8% are not in use. During the communist era the agricultural land was state owned and managed but after the fall of the system it was returned to its owners from before the World War II and their ancestors. Due to these changes and the lack of financial resources, knowledge, or the small size of some parcels some of the land is left uncultivated or is poorly managed. These lands can be used for the plantation of energy crops if there is proper policy and financial support. The EU structural and cohesion funds and agricultural subsidies targeted at this direction can be a suitable mechanism for the use of this potential.

Biomass potential by regions

The transport of biomass is a major limiting factor to its wider penetration and that is why biomass power plants should be situated close to the source. In Bulgaria the potential for the different types of biomass is not evenly distributed (See Table 19, Annex I) with the highest in the North-East region. There the potential for urban and biological wastes is also the largest (REC 2004). On the opposite - with smallest potential is in the North West region.

2.7.1.2.Hydro Energy

Hydro energy is the only renewable source that has been already utilized to a considerable extent in Bulgaria. The country has a long tradition of hydro power generation with the first small HPP constructed at the first decade of the 20th century and some units from the 1930s still in operation. Data for 2005 show that the output of about 125 hydro power plants (including large, small and pumped storage) was 7.2% of the total electricity generation while the total installed capacity was 23% of the installed capacity (MEER 2005). Therefore the load factor for most HPP is very low which is because the units, especially the large ones, were designed and constructed to cover mainly peak loads and in this way to complement the large NPP and TPPs which are used to cover base loads. In this case it is not possible to increase their load factor as there are not sufficient water quantities. Most large and medium size units are renovated or are in the process of modernization but still there is possibility for the rehabilitation of small-scale units.

There are variations of the annual electric output due to climatic reasons and over 1997-2005 period the share was between 6.7% and 7.2% (EEA 2006). Although this contribution is considerable most of it comes from large HPP (above 10 MW). The small HPP contributed only with 1.6% of the total generated electricity or 22% of the hydro electricity generation in 2004.

In the recent years there is a growing interest in construction of small hydro power plants due to the preferential feed-in tariffs. Over the period 2001-2003 26 new small HPP were constructed with cumulative capacity of 23 MW (EEA 2006). Some sources report that by 2007 several hundreds investment proposals were filled at the Regional Environmental Inspectorates for approval. They cover virtually all rivers in Bulgaria which inevitably will in some instances lead to conflicts with environmental protection objectives.

Typical high mountainous river, West Rhodopi (photo: G. Miladinova)

The total potential for hydro energy in Bulgaria is estimated to be 26.5 TWh - theoretical potential and 15 TWh - technical potential (EEA 2006). However, its use is much more limited due to seasonal variations and environmental considerations. The potential for large HPP is considered to be almost fully exploited and only two projects, both of which are very much criticized by NGOs because of the possibility of rare ecosystems destruction, are planned (completion of Tzankov Kamak HPP by 2009 and construction of Gorna Arda Cascade by 2020). Regarding the small HPP their potential is evaluated to be 0.8 GWh/year (EEA 2006). In a publication of the National Electric Company (2004b) it was concluded that there are possibilities for construction of more than 800 small HPP. The possible sites for these units are identified to be: (i) 700 sites for run-of-river units on rivers in mountainous areas where the water flow is more limited but there are opportunities for higher hydraulic head, (ii) at least 35 units can be installed on lowland areas with higher water flow but with low heads, and (iii) about 100 attractive sites for the construction of units on existing dams (NEK 2004b). However, the environmental impact is not well integrated in the evaluation and if taken into account might lead to a decrease of the number of possible sites.

In an unpublished study for the Ministry of Regional Development and Public Works the potential for the installation of supplemental micro hydropower units, i.e. turbines installed on existing pipelines or facilities that have other functions than power generation (such as irrigation and drinking water supply) is studied. The installation of such units can usually be done at very low cost as there is no need of additional water collection or derivation system. In the study in total 34 possible sites for the installation of microHPP are identified with total installed capacity of 18 MW and annual electricity output of 82 GWh.

As for the regional distribution of the potential for small-scale HPP it lies in the regions of Montana, Sofia and Plovdiv (Energoproekt 1994, cited in EEA 2006) (see Table 20, Annex I).

2.7.1.3. Wind energy

The first wind turbine in Bulgaria Photo: G. Miladinova

The contribution of wind energy to electricity fuel mix of Bulgaria is very limited but increasing. In 2003 only 63 MWh were generated by the few operational wind turbines (EEA 2006). For the first nine months of 2005 already 2.3 GWh were generated by eight turbines situated at various sites throughout the country with total installed capacity of 3.7 MW. The coefficient for their working load was between 15 and 25%, depending on their sitting. Seven of these eight operating wind turbines are connected to Stara Zagora Distribution EAD. It was predicted that in 2006 the electricity generation from wind power plants in the region of Varna (that includes the Northern part of the Black Sea Cost) is to increase ten fold. The installed capacity of wind turbines in this region was expected to reach 300 MW but due to many limitations the progress was much more limitted.

There are several studies on wind power potential in Bulgaria. However, none of them is based on wind speed measurements at turbine hub's height but on Wind Atlas of Bulgaria for which the wind speed is measured at 10 m above the surface. This makes the conclusions of the studies questionable. Maps of the wind speed are presented on Figure 5. In a study for the EBRD Bulgaria is considered to be "one of the top countries for wind energy development" (Black & Veatch *et al.* 2003, p.7) and the mid-term technical potential by 2020 is evaluated to be between 2.2 and 3.4 GWe installed capacity. Much less optimistic are the conclusions of the PHARE study from 1997 according to which theoretically there is a possibility for the installation of 0.5 GWe (ESD and Ecotherm - Engineering Ltd. 1997). There is significant interest in individual wind turbines and wind farms development across the country and a number of ongoing projects.

Energy density of the wind **Wind speed zones and potential**

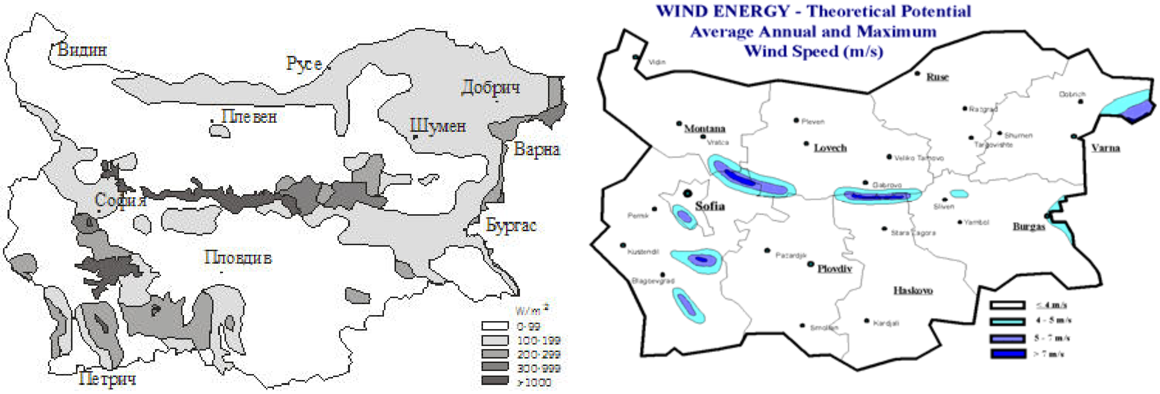


Figure 5. Maps of wind energy density, zones, and potential in Bulgaria

Note: The wind speed is measures at 10 m above the earth surface, Source: EEA 2006

The most promising regions for the installation of wind turbines are the Northern Black Sea coast, the Central mountain range, and the Rhodopi Mountains in the Southwest (see Table 21, Annex I). The fact that part of the potential lies in mountainous areas can be considered as a serious limitation as in many cases there is no proper infrastructure. Further, the nature and landscape impacts of wind turbines still have to be investigated and assessed for the areas with high potential.

2.7.1.4. Solar Photovoltaic Energy

Bulgaria is favourably located between the 41st and the 43rd parallel in the so-called "sunny belt" of the planet. Data supplied by the National Institute for Meteorology and Hydrology show a sunshine duration of 2 200 – 2 500 hours a year and that is akin to the values for Athens, Greece. A PV system could efficiently function for over 200 days a year in the southern parts and for 170 – 180 days in the rest of the territory of Bulgaria (Scientist 2006).

In 2006 there were only few PV systems installed with total capacity of 21.5 kW gird connected and 11.5 kW off-grid, incl. seven installed at sites of universities or research institutions, two on residential and social care buildings, one used for telecommunication needs and one for meteorological station situated close to the highest peak in Bulgaria (2300 m high). In addition, to this in a charity project of Denima Ltd. street lightning based on solar energy was provided for Bulgarian village that was still off-grid.

Solar potential by regions

The energy from sun that is falling on Bulgarian territory is about 13 Gtoe annually. In a PHARE study (ESD and Ecotherm - Engineering Ltd. 1997) the country was divided in three zones based on theoretical solar energy potential i.e. zone I: 41% solar radiation (1.45 MWh/m2/year), zone II 52% - 1.55 MWh/m2/year, and zone III: 7% - 1.65 MWh/m2/year.

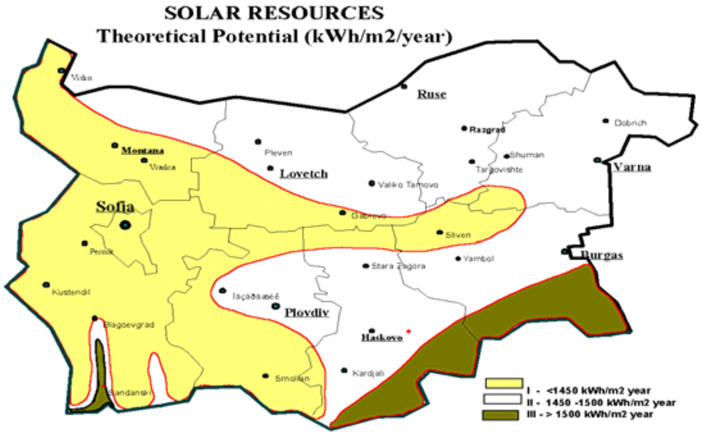


Figure 6. Map of theoretical solar energy potential in Bulgaria

Source: EEA 2006

2.7.2. Potential for Small-scale Combined Heat and Power

2.7.2.1. General Overview

The potential for CHP lies mainly in industrial and district heating sectors. There are also possibilities for the installation of CHP units at greenhouse houses, hotels or other sites of the tourist and recreational sector. There is a potential both for natural gas and biomass-fuelled co-generation.

2.7.2.2. Potential for Small-scale Natural Gas-fuelled Co-generation

There are no studies on the potential in the different branches of Bulgarian economy and it is difficult to make estimations as detailed study for each sector is needed. Still, there are some examples of successful projects and several natural gas-fuelled CHP units were installed in different industrial sectors, including 515 kWe unit in Vratitsa textile factory in the town of Vratza; 150 kWe unit in Bankja Palace Hotel situated close to Sofia; 150 kWe and 100 kWe in buildings of Bulgarian Telecommunication Company in the city of Blagoevgrad.

More information is available on the small-scale natural gas potential in the district heating sector. In 2007 there were 21 district heating companies (DHC) in Bulgaria. Natural gas is the most commonly used fuel (about 81%) followed by coal (14%) and by heavy fuel oil (5.3 %) (data are for 2000 - 2002). CHP units are installed in 9 of them with total capacity of about 730 MW. Because of the preferential tariffs at which the co-generated electricity below 50

MWh is bought, the installation of CHP units becomes an economically viable and profitable option. Still, the main limiting factor is the heat demand during the period of the year when there is no need for space heating. There is economic analysis for introduction of CHP units in nine DHC which will result in 330 MWe new installed capacities.

2.7.2.2.1. Potential for Biomass-fuelled Co-generation

At present there is no information of existing biomass-fuelled CHP plants. The potential for biomass co-generation was evaluated in a FP5 project, entitled Biomass Cogeneration Network (BIOCOGEN) (CRES *et al.* 2003) (see Table 22, Annex I) The figures for possible installed capacity are impressive: 1 GW electric and 2 GW thermal - especially taking into account that none of this has been realized[1]. Although this is a theoretical potential it gives some indication that biomass-fuelled CHP can be an option for Bulgaria and that there are still considerable barriers. There is no information on the spatial distribution of this potential.

2.8. BULGARIA ON THE EUROPEAN MAP – COMPARISON OF POTENTIALS

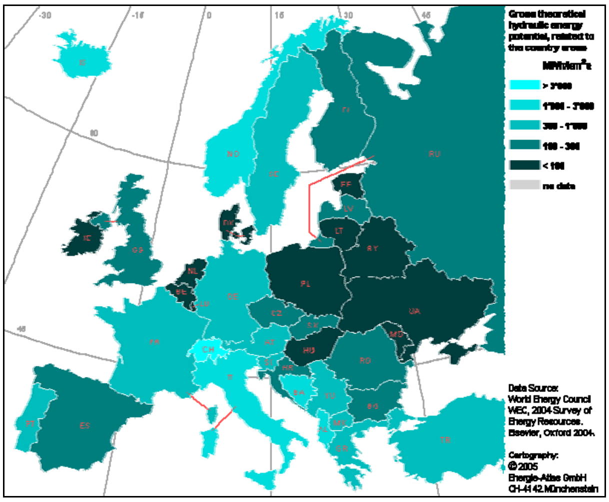
Bulgaria has favourable geographic situation and is relatively rich in renewable sources if compared to the other European countries which is shown in the maps below (see Figure 7). It is among the countries with high hydro and solar energy potential and high productive forest area to country surface coefficient. Data on wind potential are from points measurements and insufficient but still it shows that it is much lower in Bulgaria compared to the countries situated on the Atlantic Ocean but is comparable with countries from Central Europe, i.e. Austria.

The maps show that the country has higher potential than some European ones for a number of renewable sources. However, in practice the utilization of the potential is much lower. For example, solar energy is much better developed in Germany, Austria, and Denmark although there geographic situation in Europe is less favourable. The same is true for the other technologies and points to the fact that other limiting factors, such as policy, administrative and financial settings, are crucial for DG development.

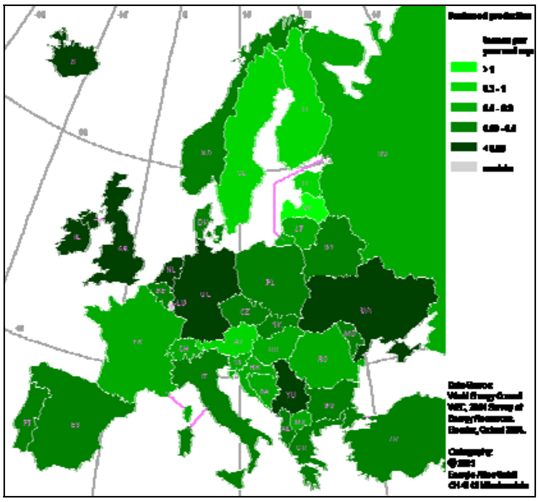
[1] Data are obtained based on estimations of the possibility for co-generation assuming that the available biomass resources are fully utilized and assuming that the plants are operating 6000 hours per year, with 75% efficiency and that the power to heat ratio is 1:2. The heat demand is not taken into account as a limiting factor which posses a question on the correctness of these evaluations.

Figure 7. Potential for renewable energy sources in Europe

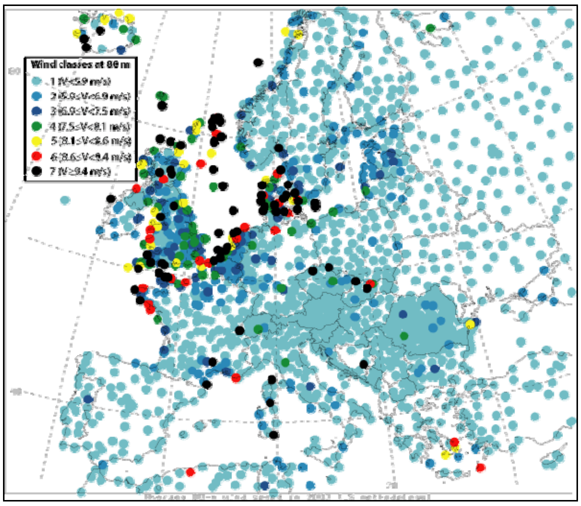
Gross Theoretical Hydraulic Energy Potential



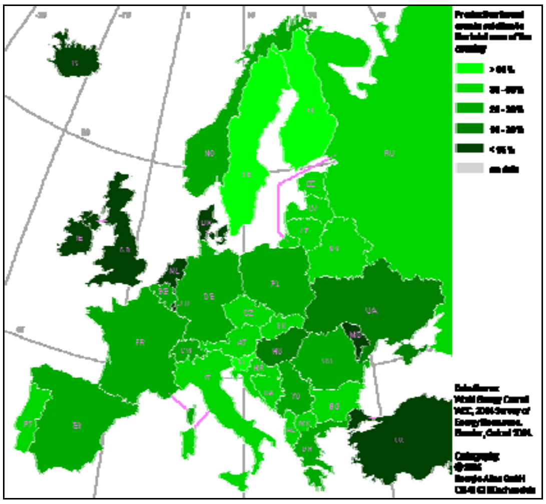
Fuel wood Production



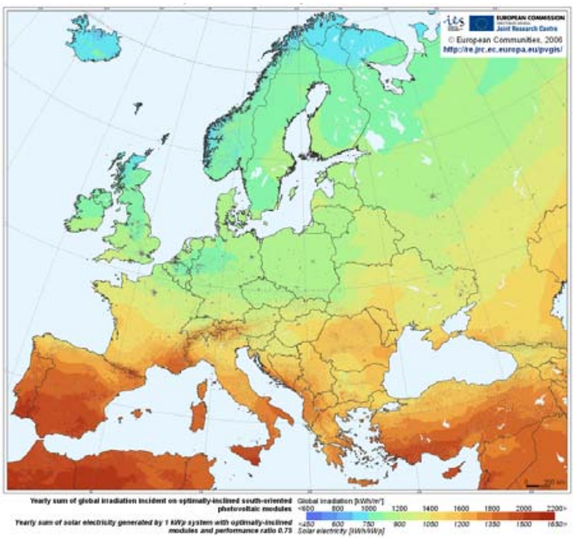
Wind Energy Potential - mean wind speeds at 80m for 2000



Productive Forest Area in Relation to the Country Area



Photovoltaic Solar Electricity Potential



Sources of the maps:

For photovoltaic potential: EC, DG JRC 2006

For all other: GENI 2007 (based on data from WEC 2004)

2.9. RECOMMENDED DISTRIBUTED GENERATION TECHNOLOGIES FOR BULGARIA

At this stage of development the likelihood of the penetration of different type of DG technologies in Bulgaria is as follows:

Hydro-power plants: The potential for hydro power has been traditionally exploited but there are still possibilities for new small-hydro power plants in mountainous, and in lowland areas, on existing dams and supplemental to irrigation and drinking waters pipelines. As the units can be constructed in very different areas various types of turbines can be installed.

Biomass for electricity generation and/or for co-generation: Although at present biomass is used mainly for heating proposes there is a significant possibility for the use of biomass waste, energy crops, and timber by introduction of CHP units on biomass or construction of biomass-fuelled power plants. Also economically viable option can be the replacement of existing natural gas or heavy oil -fuelled units by biomass ones. Under the present conditions the fuel switch from coal to biomass is not a cost-effective, although more sustainable, option as the price of coal is too low.

Wind turbines: The number of wind turbines constructed in Bulgaria is still very low but growing. Although there is no proper evaluation of the potential based on the present development it is expected that there will be a rapid increase in the installed capacity.

Photovoltaic elements: Because of the high investment costs at present they are viable only for remote and unconnected to the grid sites, such as mountain huts, telecommunication, or other monitoring units situated far from the grid. Due to the high investment costs and lack of investment support building integrated photovoltaics for new build are still not possible. For commercial point of view polycrystalline or amorphous silicon elements are recommended.

Small-scale natural gas-fuelled CHP: There are opportunities for the installation of such units in various industries, in residential and tourist sectors, and for the replacement of some of the heavy oil-fuelled heating-only boilers in district heating sector. However, due to the high price of natural gas and its expected increase in the future and the artificially kept low heat prices for private consumers it is not very likely that these technologies will gain high market shares.

3. PUBLIC POLICIES SUPPORTING DISTRIBUTED GENERATION IN BULGARIA

In Section 2 the current penetration of distributed electricity generation technologies in Bulgaria was revealed along with their potential. The analysis showed that although there is significant potential for a wider DG introduction their present share is negligible. There are many reasons behind this phenomenon. Partially, it can be explained by the historical development of energy sector in Bulgaria which has been the backbone of communist economy and was planned and developed in highly centralized and subsidized way with preference of large-scale coal-fired power plants which were providing cheap electricity, job opportunities for the working class, and high-tech NPP which were showing the achievements of the Soviet technology. Another reason is the DG technologies were not well-known and some of them were, and still are, very expensive means of energy generation.

To meet EU accession requirements, to diversity fuel mix, and to decrease the negative impact of energy sector over environment Bulgarian government started slowly to introduce policy and measures for the promotion of renewables and co-generation from the late 90s.

In this section an analysis of public policy related to DG in Bulgaria that was adopted by May 2007 will be presented.

There are different definitions of public policy. In general terms it is ‘anything a government chooses to do or not to do’ (Dye 1972) and more specifically ‘a set of interrelated decisions taken by a political actor or group of actors concerning the selection of goals and means of achieving them within a specified situation where those decisions should, in principle, be within the power of those actors to achieve’ (Jenkins 1978, cited in Howlett and Ramesh 2003). There are several characteristics of public policy that emerge from these definitions (Howlett and Ramesh 2003). First, the government is the agent of public policy-making and that is why governmental decisions are studied. Second, public policy is goal-oriented; is limited by resource availability; and nondecision can also be the outcome of the policy process. Third, various actors and groups of actors participate in the process. Fourth, specific means or instruments for achieving of the goals are chosen in the process of policy formation.

In the following text the main governmental objectives and instruments are presented based on through in-depth analysis of the governmental programs, sectoral strategies, programs and action plans, and on analysis of legal documents and interviews with experts. Brief overview of the main actors and institutions related to DG policy is presented in the chapter to follow.

3.1. OBJECTIVES AND GOALS

The goals that governments aim to achieve with their DG policy are included in various policy documents such as strategies, action plans, and programmes. In this section a review of the main documents and DG targets are presented.

3.1.1. Strategic Documents

Energy strategy of 2002

The fundamentals of the energy policy in Bulgaria in the recent years are set by the *Energy Strategy* (MEER 2002). It came to replace the *National Strategy for Development of the Energy Sector until 2010* (SCEER 1998) and to guide the transition of Bulgarian energy sector to a market based one in accordance with the EU requirements. In the Strategy, the consumption of energy resources is characterized as irrational and as “energy extravagance” and introduction of energy markets and competition are seen as the solution for the wasteful consumption and generation.

The main principles to be followed by the Government in the overarching energy policy are set to be: (i) introduction of market relations in energy sector, based on cost-reflective tariffs and free contracting, (ii) active role of the state in the creation of a clear and stable legal and regulatory framework, (iii) creation of a legal, regulatory and market environment prior to the implementation of new large-scale investment and privatization projects, (iv) pro-active energy efficiency policy, (v) efficient social protection, and (vi) positioning of Bulgaria as a reliable country for the provision of future transit of oil, natural gas and electric power and as a dispatching and market centre in the region.

Although the promotion of renewable energy technologies and co-generation are not mentioned explicitly in this list they are included under different sections. For example, the need for the increase of the share of renewables in energy balance is acknowledged under *Security of Supply* Section where it is pointed that although *‘much of the RES (biomass, small hydropower plants, geothermal energy, etc.) have a significant resource, technical and economic potential’* they are *‘used irregularly and insufficiently’* which according to the authors is due to the higher cost of initial investments. As a measure overcome the barriers to renewables it is suggested that an Action Plan should be developed which was done only in 2006. Regarding co-generation – the need of its promotion is mentioned as one of the ways for improving energy efficiency.

The wider introduction of RES, CHP and natural gas in generation is also mentioned in the Section on *Environment* from the Energy Strategy. There it is seen as one of the means for Bulgaria to meet its Kyoto obligations in the area of electricity and heat generation. However, at the top of the list of relevant measures is the *'preservation of the nuclear energy share in the overall energy balance of the country through construction of new nuclear capacities'*.

Energy Strategy (forthcoming)

At the moment of writing (spring 2007), a new Energy Strategy is under preparation. It is supported by the World Bank and is prepared by an expert team led by the Black Sea Regional Energy Centre. According to well informed expert representatives of the Ministry of Economy and Energy were demanding that it is recommended that the support for renewables to be changed to one preferential tariff instead of differentiated according to the type of technology as it is at present (Expert 2007). This would have been a huge step backwards in DG promotions but has been abolished in later drafts.

Other sectoral strategies, programs, and action plans

The need for the promotion of renewables and CHP is also included in several other strategic documents:

- Second National Program on Climate Change 2005-2008 (MOEW 2005b)
- National Strategy for Environmental Protection and National Action Plan 2005 – 2014 (MOEW 2000)
- National Plan for Economic Development of Bulgaria for the period 2000-2006 (revised) (AEAF 2003)
- National Regional Development Strategy for the period 2005-2015 (MRDPW 2005).

Although renewables and/or co-generation are mentioned in various contexts and purposes in these strategic documents they do not seem to be very well coordinated in terms of proposed actions. There is no evident coherent approach on which renewable sources, apart from hydro energy, should be promoted in Bulgaria. For instance, in the Second National Program on Climate Change (MOEW 2005b) electricity generation from wind is not even mentioned as an option for the decrease of CO_2 emissions. In the National Plan for Economic Development of

Bulgaria (AEAF 2003) renewables are not mentioned at all among priorities in the energy sector or environmental protection even in the part that deals with measures regarding the diversification of fuel mix, but the promotion of natural gas is included and also the need for increased share of co-generation. In the other two documents RES and CHP are only mentioned. The other problem with these documents is that in general their implementation is poor and the funding required is only partially provided. The monitoring, evaluation and reporting of the results achieved is not always performed or is not publicly available.

Programs and Action Plans for Energy Efficiency and Renewables

There is no Program or Action Plan targeted directly at the promotion of DG, however DG is included in the various programs and action plans for energy efficiency and in the programs on renewables.

Several Programs and Action Plans on energy efficiency were prepared in the last decade but only a few of them were adopted and even those which were adopted were abolished due to the lack of financing. A summary of the main targets and financial resources needed for those which were adopted is included in Table 3. As can be seen there has not been consistent policy on EE with frequent changes and the abolishment of strategic documents possibly due to the low importance of EE attributed by the Government and the lack of financing.

In the first EE Program and Action Plan that were officially adopted but abolished recently there were measures both for EE and RES. They included concrete goals, measures, and evaluation of investment needs. The measures related to DG were for the promotion waste biomass in pellets form and of solar energy for heating in services sector, the promotion of small-scale CHP in municipal buildings, increasing the share of CHP in district heating, and introduction of renewable energy technologies in industry. However, the investment needs for the execution of these two programs were evaluated as ‘too high’ and a new Program on EE was prepared by the EEA and adopted by the Minister of Energy and Energy Resources. The new document - *National Long-term Program for Energy Efficiency until 2015* (MEER and EEA 2005), does not include any measures related to RES and the need for wider introduction of CHP is only mentioned. There are no targets or any other concrete mechanisms that will lead to the implementation of the Program but just general suggestions and suggestions on how energy intensity of the different sectors will evolve.

Table 3. Expected results and investment required for the various energy efficiency programs and action plans

Name	Expected outcomes	Investment needs	Status
National Energy Efficiency Plan (until 2010?)	**\$1.2 billion (B)** annual savings **4 Mtoe** annual energy savings	**\$2.4 B**	Not adopted
National Program for Energy Saving (until 2010)	**30-40% reduction of Bulgarian energy intensity** **€ 0.6 B** (1.1 B leva) annual savings **1.7 Mtoe** annual reduction of final consumption **6 million (M) tonnes** annual reduction of CO_2 emissions	**~€2.9 B** (5.8 B leva)	Not adopted but implementation started
National Energy Saving Action Plan (prepared 2001)	**10% reduction of Bulgarian energy intensity** **€ 0.2 B** (365M leva) annual savings **3 M tonnes** annual reduction of CO_2 emissions	**~€0.5 B** (0.9 B leva)	Not adopted but implementation started
National Program for Energy Saving until 2014	**30% reduction of Bulgarian energy intensity** **€0.6 B** (1.1 B leva) annual energy savings **1.6 Mtoe** annual reduction of final consumption **5.6 M tonnes** annual reduction of CO_2 emissions	**~€2.4 B** (4.8 B leva)	Adopted but abolished
Three-Year National Action Plan For Energy Saving (2004-2007)	**10% reduction of Bulgarian energy intensity** **€ 0.1 B** (0.2 B leva) annual savings **0.4 Mtoe** annual reduction of final consumption **1.3 M tonnes** annual reduction of CO_2 emissions	**~€0.4 B** (0.8 B leva)	Adopted but abolished
National Long-term Program for Energy Efficiency until 2015	**No quantitative targets available**	**No calculations available**	Adopted and under implementation

Sources: (EEA 2003a, b, 2006; IEA 1998b; SEEA *et al.* 2001a, b)

There were also several unsuccessful attempts to prepare Programs or Strategies for the promotion of renewables such which were not adopted. These were the *Strategy and Policy for the Development of Renewable Energy Sources in Bulgaria* and the *National Project/Programme on Renewable Energy Sources in the Republic of Bulgaria 2004 – 2014*. They did not include targets or financial evaluation. Their implementation could not lead to the fulfilment of the EU requirements for 11% RES electricity by 2010 and a new Program (EEA 2006) was adopted in October 2006.

In the *National Long-term Program for the Promotion of Renewable Energy Sources (2005-2015)* (EEA 2006) there is an extensive review of the different studies on the potential for renewables for heat and electricity generation. However, there are no clearly set targets or measures. It is concluded that the share of RES in electricity consumption in the country can only reach 8% of the gross electricity generation by 2010, and 9% by 2015. That is why measures on the reduction of consumption are suggested as the main mechanisms for reaching the 11% indicative RES - electricity target set in the EU accession negotiations. The Program concludes that the main source that can contribute significantly to the increase of RES - electricity by 2015 is the development of biomass-fuelled units. Regarding the heat demand according to the program all needs of the country can be met by renewables in combination with EE measures. The estimation is that by 2015 the share of RES can reach 40% of the heat energy generated in the country.

3.1.2. National Indicative Targets

According to the Law on Energy (LE) (National Assembly 2003, last amend. 2006), the Minister of Energy and Energy Resources should propose a national indicative target for the next ten years which should represent the share of renewables (in percent) in the total annual electricity consumption in the country (Art. 157 from the LE). Even though the Law was adopted in 2003 such targets had not been officially adopted until the Government was obliged to set such as part of the EU accession obligations, i.e. in the EU Accession Treaty. As a result the targets were set at 11% of electricity from renewables in the final consumption by 2010. Although, there is a significant potential for renewables it is rather arguable whether this target can be met.

There are no targets for electricity and heat produced in CHP mode or for heat from renewables.

3.2. PUBLIC POLICY INSTRUMENTS

Bulgarian Government has adopted a number of policy instruments in order to reach the above mentioned goals and targets. For their identification and analysis the classification of Hood (1986) is used. Hood proposes four categories for grouping of policy instruments which provide a good synthesis of the possible instruments for the realisation of the governmental policies. The four types of instruments are Nodality (or information), Authority, Treasury (or fiscal), and Organisation - or if all abbreviated NATO - according to the resources government uses for policy implementation.

Authority based instruments are those used by the governments to impose the implementation of their policy through various command and control measures. Treasury-based instruments include all *“forms of financial transfers to individuals, firms, and organisations from governments or from other individuals, firms, and organisations under governments”* (Howlett and Ramesh 2003, p. 108) and are dependent on the available public funds. When using organization based instruments governments rely on existing formal organisations for policy implementation or create conditions for the establishment of markets for these purposes. In the category of nodality based instruments all measures that governments use to disseminate information on the various policy instruments are included.

The main instruments included in the Bulgarian legislation to facilitate the integration of renewable energy technologies and CHP units are included in Table 4. More explanation on the classification of instruments and how each of the instruments identified in Bulgaria is applied are presented in the following text.

Table 4. Public policy instruments used in Bulgaria to promote distributed electricity generation, as of May 2007

Authority based instruments	1. Obligatory connection of DG units to the grid 2. Obligatory Purchasing of Electricity from DG 3. Feed-in tariffs 4. Tax incentives for large-scale projects 5. Preferential connection to the transmission than to distribution natural gas network 6. Preferential treatment for big investment projects 7. Environmental Impact Assessment
Treasury based instruments	8. Kozloduy International Decommissioning Support Fund (KIDSF) 9. EBRD credit lines (not governmental instrument) 10. Energy Efficiency Fund (public private partnership) 11. Enterprise for the Coordination of the Activities for Environmental Protection 12. National Trust Eco- Fund 13. RTD support
Organisation based instruments	Creation of markets 14. Green electricity obligation and certificates (planned) Creation of organizations 15. Energy Efficiency Agency
Nodality or information based instruments	16. Brochures on investment process in various renewable technologies 17. Conferences and workshops

3.2.1. Authority Based Instruments

In many cases governments use their authority to impose certain policy. This can be in different forms such as command and control regulation; delegated or self-regulation; and though advisory committees and quangos (Howlett and Ramesh 2003).

When using the command and control instruments governments regulate by setting certain requirements or by prescribing certain activities or behaviour on individuals, private or public entities which are imposed through some administrative process by, in general, specifically designated agencies (Reagan 1987). The incompliance in most cases is followed by a penalty. There are a number of benefits mentioned by Howlett and Ramesh (2003) for governments from these instruments: there is no need of extensive consultations with the subjects to be regulated as is with the voluntary instruments. They allow better co-ordination because they are more predictable than the other instruments, might require less financial resources from the government than the fiscal instruments, and can be plausible to the public if there is demand for quick and definite action. There are also a number of limitations such as that they inhibit innovation by creating security in the markets; are inflexible and are difficult to be suited for all possible cases, and can lead to economic inefficiencies. Other constrains from their wider employment is that the governments usually do not have the resources to regulate every undesired activity and even may not have the capacity to enforce the regulations which are already adopted.

In Bulgaria command and control regulation instruments for DG promotion are related to grid connection rules, purchasing of green electricity, and obligation for evaluation of environmental impact for some projects.

Market interventions can also be in the form of favourable prices and/or quarantined quantities for the electricity produced from decentralised units. In this way governments do not use fiscal resources and price rise in many cases is paid by the producers who pass it to consumers. Such instrument in Bulgaria are the preferential feed-in tariffs.

Requirements for the construction of DG units can also be included in the national building codes, standards and/or guidelines and in the design or architecture guidelines (IEA 1997) which are not yet developed in Bulgaria.

Obligatory grid connection of DG units

The obligatory access to transmission or distribution grid of DG units is set by Art. 160 and 162 of Bulgarian Law on Energy (National Assembly 2003, last amend. 2006) Transmission system and distribution system operators (TSO/DSO) are obliged to connect with priority all power plants generating electricity from renewable energy sources, including HPP with total installed capacity of up to 10 MW, and from highly efficient combined heat and power plants[2] which hold certificate of origin. The connection costs that are within the borders of the site of the producer are to be paid by the producer while all other, including the expansion and reconstruction of transmission and/or distribution networks involved in the connecting of a new power plant are to be paid by the TSO and respectively the DSO. However, in the implementing secondary legislation it is stated that if there are costs for expansion and reconstruction they are to be included in the connection fee and in practice this happens (Art. 25. para 1 to 3, Regulation on the regulation of electricity prices (Council of Ministers 2004a)

There is a possibility for TSO/DSO to deny access to their network if the units either: do not comply with technical requirements; might reduce the security of systems or the security and the quality of electricity supplies to consumers; might have negative impact on health and life of the population and the property of third party (Art. 3, para 1 and 2 of Regulation # 6 from 9.06.2004, (MEER 2004c)). These clauses are used to prevent or delay connection (for more details see Section 6.2.2, page 124).

Another problematic issue for TSO/DSO is that DG producers aim at fully utilizing the opportunities by maximizing their electricity output. Still, in some areas there is no need of this electricity and they have to export it to the medium voltage network which causes solvable technical problems for the network.

Obligatory Purchasing of Electricity from DG

According to Art. 159 and Art. 162 of the LE the public provider and/or public providers must purchase the entire volume of electricity generated by units using renewable energy sources, including hydroelectric plants of up to 10 MW, and from high-efficiency co-generation power plants, if they are registered with a certificate of origin. The exception is for the volumes for which the producer has entered into contracts within which the prices are freely negotiated or with which the producer participates in the balancing market. Due to the fact that the distribution company has to buy electricity at preferential price and that the State Energy and Water Regulatory Commission keeps the marginal return rate very low, so that the electricity prices for final consumers do not increase significantly, the distribution companies are trying

[2] High-efficiency co-generation of heat and electricity from thermal power plants are those, which, if constructed after the adoption of the Law on Energy, lead to at least 10% fuel savings in comparison to the same quantity of heat and electricity produced separately. In case the plants are constructed before the adoption of the Law or such that utilize renewable energy sources and/or are with less than 1 MW installed capacity the fuel savings should be at least 5% (Additional Remarks, 5 from the Law on Energy).

to prevent the new entrants (Expert 2006). This problem is analyzed in detail in Section 5.3 where the barriers related to imperfect competition are studied.

Feed-in Tariffs

The differentiated feed-in tariffs are set in Bulgaria for electricity produced from renewable sources, including hydro of up to 10 MW, and CHP with output below 50 MWh. For renewables they are determined by the Regulator on the basis of the average price of electricity for households for the previous year - they should be no less than 70%[3] of this price (Art. 33 (2) of the LE). For co-generation the preferential tariffs are determined individually for each installation on the basis of cost plus model. Before January 1, 2007 the feed-in tariffs were not guaranteed over a period of time but with the amendments in the Law on Energy from 2006 the feed-in tariffs for renewables are guaranteed for 12 years and for CHP for 7 years after the start of operation of the unit. These are valid for units that enter into operation before the end of 2010.

Until recently, there were feed-in tariffs only for electricity from HPP, and from wind power plants under 10 MW and for co-generation units (see Table 5). From January 1, 2007 feed-in tariffs for photovoltaics were set by the Regulator but still there are no such for biomass, biogas and geothermal as according to the Regulator there is no request by investor for setting of such tariffs. The electricity produced in CHP mode above the limit of 50 MWh can be sold at negotiated prices and/or at prices set at the balancing market.

Table 5. Feed-in tariffs in Bulgaria for electricity producers

DG producers	Preferential tariffs (VAT excluded)	
	October 26, 2005*	June 29, 2008*
Producers utilizing RES:		
HPP below 10 MW	35.8 €/MWh	43.6
HPP with high head that can run continuously for more than two hours a day	40.8 €/MWh	40.9 €/MWh
Wind power generators below 10 MW	61.1 €/MWh	
Wind power generators in exploitation after 01.01.2006 in operation less than 2250 hours per year	N/A	89.6
Wind power generators in operation more than 2250 hours per year	N/A	80.0
Photovoltaics below 5 kW	N/A	400.4
Photovoltaics above 5 kW	N/A	367.6
Biomass below 5 MW (depending on the source)	N/A	94.2 – 101.1

[3] Until, September 2006 this percentage was 80% (Art. 19, para 4,5 and 6, Regulation on the Prices of Electricity Council of Ministers 2004a) but was changed to 70% with the amendments in the Law on Energy

DG producers	Preferential tariffs (VAT excluded)	
	October 26, 2005*	June 29, 2008*
Landfill gas	N/A	N/A
Geothermal	N/A	N/A
Companies with co-generation units:		
DHCs	40.5 to 61.1 €/MWh	51.2 to 76.3
Brikel AD, TPP Sviloza AD, Deven AD, Zaharni zavodi AD	40.5 €/MWh	61.8 to 34.3
Vidahim AD	45.3 €/MWh	
Price for other power plants (only for electricity generation and not for balancing capacity)	7.6 to 24.7 €/MWh	6.5 to 29.9 €/MWh

*Interbank exchange rates as of the date indicated, Source: http://www.oanda.com

Source: (SEWRC no date)

Most units that benefit from the feed-in tariffs in 2006 were constructed a long time ago which means that there might be an accumulation of windfall profits because at the time of their construction the units were probably supported by the state and the investment costs have almost certainly been repaid. Another setback is that as set in this way the feed-in tariffs for hydro power plants are more beneficial for units with high heads and storage reservoirs which is the opposite of the efforts of environmental organizations and experts to exclude large-scale HPP so that distributed renewables are fostered. The reason for such tariffs for these HPP is that in this way they are compensated for operating at peak load. Another set back of the Law on Energy regarding the renewable energy generation and co-generation is the fact that the thermal energy, produced from renewables is not treated preferentially which does not lead to use mainly of the geothermal and biomass potential. For more limitations that are coming from the way the feed-in tariffs are set see Section 6.2.1.2.

Taxes incentives and disincentives

The levy on the value added tax on the equipment supplied is given to investors for projects bigger than BGL 10 million (EUR 5 million). This is helpful for large-scale DG projects but does not support small local investments (Investor 2006).

There are no other tax exemptions for DG equipment or projects although in the abrogated Law on Energy and Energy Efficiency (National Assembly 1999) there were also provisions on waving of import taxes for renewable energy technologies, which unfortunately never came into effect but might be a good approach for the promotion of DG, especially for the units produced outside EU. There are no subsidies or other incentive mechanisms apart from preferential feed-in tariffs.

There are disincentive taxes on pollution with a number of substances as is required by the relevant EU directives.

Preferential connection to transmission than distribution natural gas network

The natural gas network in Bulgaria is operated by transmission system operator – Bulgargaz EAD (now Bulgartransgaz EAD) and by distribution network operators. Connection directly to the transmission network means that the quantities supplied will be at a cheaper price. With a decision of the Chairman of the Bulgarian State Energy and Water Regulatory Commission from 2004 connection directly to transmission network is granted among others also to entities that have combined heat and power generation units, irrespectively of their capacity and output (Art. 2 (3) 1 of Rules on connection (SEWRC 2004)). In this way if an entity has a high consumption of natural gas for its processes it can significantly reduce its bill through the installation of CHP unit and changing its supplier. However, this also depends on where the network is situated and who owns it. It is not beneficial for distribution companies to lose consumers and if they own the network they might try to obstruct the switching to transmission network operator.

Preferential treatment for big investment projects

According to the Law on the Encouragement of Investments the investors are issued certificate for first, second or third class depending on the size of their investment (IBA 2006c). First class is issued to those that invests over BGN 70M (or EUR 35M) and as a benefit are entitled to: individual informational and administrative services; assistance with real estate "titling" issues; and more importantly if an infrastructure is to be build it is on state expenses. They are also treated preferential when different authorizations are issued and the administrative lead time can be reduced to about one third of the legally set one. Investors class two (with investment from BGN 40M to 70M or EUR 20M to 35M) and three (from BGN 10M to 40M or EUR 5M to 20M) are supported mainly through the provision of information (IBA 2006c).

Some investors in DG technologies, especially in large wind farms, have obtained such certificates. However, one of the investors interviewed for this research that is eligible for obtaining of a first class investor certificate mentioned that after considerations his company decided that there is no significant benefits for applying for the certificate if there is support from the Municipality where the project is situated and therefore no problems with the issue of relevant permits (Project developer 2006). Another investor who has first class told that they did not use any preferential treatment although they own such certificate and if the state has to construct the infrastructure it will take too much time and as a result the investors usually do and pay for he infrastructure themselves (Investor 2006).

Environmental Impact Assessment

According to the Law on Environmental Protection (LEP) (National Assembly 2002, last amend. 2006) the need of Environmental Impact Assessment (EIA) shall be considered for projects for the construction of hydro and wind power plants, for TPP and other combustion installations of 50 MW and more, and for NPP; and for the proposals for plans and programs that might have significant environmental impact (Art. 81 1.2., LEP). There are a number of conditions for screening according to which, if the projects fall within the above-mentioned criteria an EIA might be undertaken. Most conditions are related to project's characteristics, the area where it is to be constructed, the possibility of ecosystems to adapt, the characteristics of potential impacts, and public interest in the project (Art. 93 5.4., LEP). However, there is no quantitative or even qualitative system for the evaluation of the need for EIA and this can make the process rather subjective. Most decisions on the need for EIA for DG projects are taken by the Regional Inspectorate of Environment and Waters (RIEW). The investor is supposed to pay for the procedure might impose certain constraints on the experts preparing it (Art. 96. 2, LEP).

At present, in Bulgaria there are growing concerns about the rapidly increasing number of proposals for hydro power plants. For instance, due to the existing preferential tariffs and low installation costs now there are several hundred project proposals for HPP submitted for approval at the Regional Environmental Protection Inspectorates. Some of the projects are for construction at sites located at protected areas or with vulnerable ecosystems but they are granted authorization.

Another area of concern are the projects for wind farm development, especially at the Black Sea coast because of possible negative impact related to the fact that some of the sites are part of one of the two major bird migratory routes passing through Bulgaria, called Via Pontica. Some of the projects are heavily criticized by some environmental NGOs in Bulgaria. There was also a negative position regarding the projects by the well-known international nature protection organization BirdLife International. It can be questionable whether these are based on real danger or some other interests, but the growing negative opinion among the environmental NGOs regarding the renewables and particularly hydro and wind should indicate that there is a need of a more transparent EIA procedure and early involvement of stakeholders in the process.

Although biomass electricity generation in Bulgaria is not developed yet it should also be treated carefully so that it does not lead to deforestation in some regions. That is why the possibilities for wood waste use from industrial processes and agricultural residues should be developed first.

An analysis of the conflict of the environmental organizations and the investors in renewable energy sources is included in Section 4.3.

3.2.2. Treasury Based Instruments

The treasury based instruments are dependent on the financial resources which governments have at their disposal and on their ability to raise and disburse funds (Howlett and Ramesh 2003). These instruments can provide incentives when governments give subsidies or be disincentives when it penalises certain activity by increasing costs to those who exercise it through taxes or fees. Governments can also fund interests groups that might facilitate the policy development and implementation.

Using different types of subsidies (such as grants, tax incentives, and loans) is one of the ways to promote certain policies and can be the preferred option due to the fact that such schemes are easy to establish; encourage innovation; are flexible as the individual participants choose to what extend to benefit from them; and can be easily enforced as those who are interested search for them (Howlett and Ramesh 2003). They are also less opposed by different actors as although the subsidy is given to a limited number of beneficiaries it has an impact over much larger group of society (Wilson 1974). On the other hand, subsidies require financial resources, and there are other implications that prevent their application (Howlett and Ramesh 2003). First, the costs of establishing the exact amount of subsidy might be high. Second, they work indirectly and so their effect may not be apparent quickly enough to be appreciated by all interested parties. Third, subsidies might be redundant and it might be very difficult to remove the opposition of the beneficiaries. Forth, they might be considered as impediment to EU internal market and not granted permission.

One of the major problems for Bulgarian energy sector was that there were subsidies (direct and indirect) that were acting against the promotion of DG and environmental protection by keeping the price of electricity low so it was not cost-effective to construct DG units. Still, this instrument can be used for the stimulation of the penetration of DG technologies and nowadays there is a wide range of economic and fiscal incentives that can be applied for these reasons. They can be in forms of grants or subsidies involving direct transfers; credit instruments; tax exemptions; output credit for renewable electricity (IEA 1998a).

Until recently there was no properly functioning support scheme for the investments in DG projects which was one of the main reasons for the poor use of the existing potential. In the last years several important initiatives started that created some opportunities for financing CHP and RES projects. The first was the establishment of a credit line for financing energy efficiency projects and renewable energy generation by the European Bank for Reconstruction and Development (EBRD) in 2004, and of the Energy Efficiency Fund (EEF) in 2006, which provides financing to energy efficiency projects, including CHP. Other opportunities for financing DG projects are through sale of carbon credits in Joint Implementation (JI) projects. In addition, before the EU accession there was support from the EU pre-accession funds for technical assistance and demonstration projects, and in the coming years there will be support from the EU structural and cohesion funds, depending on country's administrative readiness to use the funds. Renewable energy generation projects can also be financed by the two environmental funds, but at present this support is very limited. Unlike many European countries there is no scheme in Bulgaria to support households to install DG technologies.

There is still limited experience of Bulgarian banks and funds and enough knowledge in the investors of these possibilities. In many cases it is difficult to obtain commercial credits from other financial institutions that those that work with the above-mentioned donors because of the anticipated risk for DG projects and consequently the interest rates remain high.

EBRD credit lines

Although EBRD credit lines are not a government instrument, they are one of the main sources of preferential credits for such projects and thus are included in the analysis.

In 2004 the EBRD opened a credit line of €50 million for energy efficiency projects from €20 thousand to €1.5 million each in industry and renewable energy sources in cooperation with six Bulgarian banks. The facility is established with support of the *Kozloduy International Decommissioning Support Fund* (KIDSF) which provided €10 million (EBRD 2004). Part of this €10 million are used to provide financial incentives which in the case of energy efficiency projects are in the form of 7.5% grant and 20% grant in the case of renewable energy generation projects. The conditions vary by bank and by projects' specifications but in general the interest rates are between 9% and 12.5% (ME 2005). EBRD also finds through the lines a training of personal at the banks responsible for the evaluation of the investment risk.

For three years until June 2007 about 40 DG projects were funded from the credit lines (DAI Europe & EnCon Services 2007). The scheme has been evaluated as a very successful one and an extension of EUR 50 million was provided (EC internal document – to find other source).

Energy Efficiency Fund

The Law on Energy and Energy Efficiency (National Assembly 1999) sets the rules for the establishment and the functions of Energy Efficiency Fund which provides preferential loans for energy efficiency projects. The Fund is not part of the consolidated state budget and its resources shall be spent for lending and guaranteeing activities for energy efficiency projects. The Fund started operation at the beginning of 2006. It has received USD 10 million grant from GEF, USD 1.8 million from the Bulgarian government, USD 31.96 million are expected to come from co-financing leveraged from the private sector and about USD 6 million from other international donors. Additionally, in 2003 the World Bank granted USD 300 000 as support for the preparation of the Fund (WB 2005).

The financial resources voted for the Fund are structured in three components. The first component *Partial Credit Guarantees* will provide sharing of credit risk for energy efficiency finance transactions up to about 50% of the outstanding loan principal (WB 2005). The second component *Investment Financing* will serve as an revolving fund providing loans on a commercial basis for projects between USD 100 000 and USD 2 000 000 each. The interest and the principal payments into the Fund will be used for additional loans. The third component includes *technical assistance* for capacity building measures and for the Fund administration.

Due to the fact that the Fund is operational for a very short time it is difficult to measure its performance. However, most projects by now were mainly for support to energy efficiency improvements in buildings or other infrastructure and services provided by different municipalities in Bulgaria because of the preferential loans provided to municipalities (with interest rate 2.5% to 5% compared with 5 to 9% for SMEs) (Expert 2006). With its establishment the Fund was envisaged to provide funding for projects only for energy efficiency improvements and for the installation of CHP units. By September 2006 there were no CHP projects funded and the total applications were below expected. This led to the reconsideration of the eligibility criteria and possibly the Fund will start providing financing for renewables projects (Expert 2005).

Kozloduy International Decommissioning Support Fund (KIDSF)

KIDSF is a Fund established by the EU to assist the decommissioning and the safety improvement of the Kozloduy NPP and to support projects aimed at energy efficiency improvement. It is managed by the EBRD and provides grants for the two credit lines described above and for large-scale projects (over EUR 4-5 million each) for the improvement of energy efficiency which might include construction of CHP units. However, there are no DG projects approved directly under the Fund.

Environmental protection funds

Renewable energy generation projects can also be financed from the two environmental protection funds. The Enterprise for the Coordination of the Activities for Environmental Protection (old name National Environmental Protection Fund) funds small-scale hydro projects. The provided funding is in the form of interest free loans for up to 70% of the total project costs and should not exceed €750,000 for each project and €1,750 per installed kW (MOEW 2005a). The loan shall be returned after 5 years. The financing of projects that lead to greenhouse gas emission reductions are also among the priorities of the other environmental protection fund, called the National Trust Eco- Fund (established by swap agreement under the scheme “Debt for environmental protection” signed between the government of Switzerland and Bulgaria) but no projects for renewable energy generation have been financed by the Fund.

Research and Development (R&D) support

At present, there is very limited R&D support to DG in Bulgaria which limits the opportunities for the creation of cheap DG technologies in the country. Possible national sources of funding are the National Science Fund, which provides support to basic research, and the National Innovative Fund, which supports mainly projects of private sector (especially SMEs) for the development of technologies that are close to market uptake, own sources of the research institutes and private donors. Unfortunately, DG research is not a priority and these sources provide very limited support for R&D activities. For example, only 9 out of 218 funded by the National Innovation Fund projects are related to DG, or this is only 3.7% or EUR 0.6M of the total funding of EUR 15.6M for the three rounds (2 rounds in 2005 and 1 in 2006) for which there are data. The majority of the funded projects are for biogas (4 projects) followed by photovoltaics (2 projects) hydro, wind and biomass (each 1 project) (BSMEPA 2007a).

The main source of funding in this area that significantly outnumbers the amounts provided by local sources are the EU sustainable energy programmes (such as the RTD and Energy Framework Programmes, Intelligent Energy - Europe). Still, the main problem for those of which that are not 100% financed by the EU, is finding co-financing.

3.2.3. Organization Based Instruments

Governments can implement their policies also through organizational reforms leading to the creation of agencies or units dealing with the implementation of policies, through the creation of markets.

Creation of Organizations

The creation of agencies is considered as an instrument of direct provisions of goods and services (i.e. when governments use their own resources to implement their policy) (Howlett and Ramesh 2003). The positive effects of such undertakings is that the information required for their establishment is minimal and there are opportunities for the accumulation of knowledge and experience on specific issues within the organisations created. In this way it is also possible to avoid the negotiations with actors outside of the government for their functioning and to reduce various transaction costs. The problems related to this instrument are: the usual lack of flexibility of the bureaucracy; the political control over the functions of this agencies or officials which might be used for gaining of election advantage by promoting issues not relevant to the whole society; the lack of competition which might drive the adoption of not cost-inefficient solutions.

Energy Efficiency Agency

See Section 4.1, page 56 onwards.

InvestBulgaria Agency

See Section 4.1, page 56 onwards.

Creation of markets

Creating markets can be another way for using governments' capacity to implement policy. In this case governments intervene in markets by creating scarcity of some good by setting fixed amount of property rights to be sold on auctions and by supporting the exchanges. This approach allows them to control the amount of goods to be consumed at relatively low cost, because the markets are the one which determine its price. The instrument is flexible in terms that it allows changes of the amount to be auctioned. One of the shortcomings of this mechanism is that if there is very limited amount of tradable credits of participating actors some of the actors might be able to manipulate the system for their own benefit and in this case the enforcement might become too expensive.

Markets can be created also through public procurement schemes when governments include provisions on inclusion of distributed electricity technologies when its building stock is constructed or undergoes renovation. Such practices do not exist in Bulgaria.

Renewable/green electricity certificates and certificates of origin

Renewable obligation and certificates might be introduced in Bulgaria after 2011. In the changes of the Energy Law from September 2006 it is envisaged that after the initial support through feed-in tariffs the Minister of Energy and Energy Resources should propose market based mechanism for their further promotion. It will be in the form of renewable (or green to include CHP) electricity certificates and certificates of origin and should be enacted from 2011. There were attempts for introduction of green certificates since the beginning of 2005 when a Regulation was prepared but never adopted. Based on this experience and personal communication with representatives from the Ministry of Economy and Energy Resources it is not clear whether the preferential tariffs system will be abolished and changed to renewable obligation. Although it can be argued which system is better, the lack of clear vision and long-term prospects creates additional investment risk which does not stimulate the investments in distributed generation technologies.

3.2.4. Nodality Based Instruments

Government can rely on significant amount of information which they obtain through system of data collection or is submitted to them due to the central role they play (Howlett and Ramesh 2003). Information can de disseminated by the governments passively by making the information available to the interested parties or more actively (called suasion or exhortation) by trying to change certain behaviours. The information-based instruments are weak instruments that do not provide immediate outcomes and sometimes might only disguise the unwillingness of governments to act on certain problems. Apart from these limitations they have proven to be relatively easy to develop and not requiring significant resources.

The Bulgarian Energy Efficiency Agency has published several brochures on the opportunities for investment in various renewable energy technologies. Two editions of these brochures, which include information on small hydro (EEA 2005d), wind (EEA 2005e), geothermal (EEA 2005c), biomass and biogas (EEA 2005b), and solar (EEA 2005a) were prepared in 2003 and 2005. They include information on the legal requirements and administrative procedures at the different stages of investment and brief information on the potential for each source. However, these brochures do not include all the procedures and also contain a number of mistakes. They are not updated regularly and do not include many of the recent legislative changes.

The EEA also organizes annual conferences on energy efficiency and renewable energy sources which are an important networking event for experts.

At this stage of research other information dissemination materials that were developed by governmental organization were not identified but are very much needed.

3.3. SUMMARY

There has been significant progress in the policy related to the promotion of DG in the last several years but much more needs to be done in order to have noticeable increase of its share. The main legal prerequisites, such as indicative targets, obligatory connection of DG with certain capacity to the grid, purchasing of whole volume of electricity, and preferential tariffs exist. However, there is a big difference between targets and objectives and political will and real actions to implement these instruments. There are also a number of problems associated with the functioning of these instruments and some of them need to be further developed. There is also lack of clarity and continuity of the approach used regarding these instruments (i.e. the plans for change of feed-in tariffs to green certificates) that creates unfavourable conditions increasing the investment risk perception. Detailed discussion on the problems with the instruments used is provided in Chapters 6 and 7.

DG is mentioned in a number of strategic documents but until now there is no constant strategy for its promotion. The proposed *National Long-term Program for the Promotion of Renewable Energy Sources (2005-2015)* (EEA 2006) departs from the EU related indicative target to reach 11% share of renewables in the total domestic electricity consumption mentioning that this is not possible. There is no strategic document or targets that aim at the promotion of CHP and microgeneration and of the heat from renewables.

Until 2004 there were no dedicated sources of funding for DG projects. The situation changed with the establishment of the EBRD credit lines for energy efficiency in industry and renewables, the Energy Efficiency Fund, the Kozloduy Decommissioning Fund supported projects. However, the support within these sources is very limited, exhaustible and cannot make the huge change that is needed for the Government targets and objectives to be met. In addition, there is not enough experience with the banks on the risks associated with DG projects and information provided to the investors on the financing possibilities. It is still difficult to obtain commercial credits from other financial institutions that those that work with the above-mentioned donors because the anticipated risk for DG projects and consequently the interest rates remains high. Although a fund on Energy Efficiency was established it does not deal with renewable energy projects at the moment and its support for CHP is also very limited. The two environmental protection funds provide financing mainly for small HPP.

There is no sufficient information to guide the investors in their choice of technology and region and on the various procedures to be undertaken during the investment process.

4. ACTORS, INSTITUTIONS AND STRUCTURES RELATED TO DISTRIBUTED GENERATION IN BULGARIA

An essential element of DG public policy development are the various actors and institutions who are engaged in policy formulation, adoption, and improvement and in the realization of its goals and objectives. The aim of this research is not to make a comprehensive institutional analysis as such deserves a separate doctorate on its own. However, in order to position the research within the actual settings and to provide background conditions it is important that a brief overview of the main institutions and actors identified as important to DG policy in Bulgaria in the research is provided. This is carried out in the following text. The chapter concludes with observations on the interactions between the main groups of stakeholders.

Although there are different approaches on the importance of the role individual and collective actors play in the process of policy development and the importance of the institutional context in which they operate, Howlett and Ramesh (2003) adopt the position that both the institutions and actors have a significant influence and that they are an integrated system called ‘policy universe’. Institutions are looked at by their narrow definition as “actual structures or organisation of the state, society, and the international system” (Howlett and Ramesh 2003, p. 53). To ease the analysis the actors and institutions are classified in three main groups: state, social, and international.

4.1. STATE ACTORS AND INSTITUTIONS

According to Howlett and Ramesh (2003), state actors are divided into two categories: elected and appointed officials. Here only the role of appointed officials is studied as their work is more relevant to the objectives of the research, i.e. making of a snapshot of the current policy and their implementation, and due to time limitations. The list of state actors and institutions identified in the research is presented in Table 6 below.

Table 6. State actors and institutions relevant to DG promotion in Bulgaria

Ministries
Ministry of Economy and Energy
Ministry of Environment and Waters (and subordinate institutions: Regional Inspectorate of Environment and Waters (RIEW), Basin Directorates (BD))
Ministry of Agriculture and Forestry
Ministry of Regional Development and Public Works

State Agencies
Energy Efficiency Agency Executive Environment Agency InvestBulgaria Agency Bulgarian Small and Medium Enterprises Promotion Agency
Regulatory bodies
State Energy and Water Regulatory Commission
Local Authorities
Municipalities, City and Regional Councils

Source: own research

Ministry of Economy and Energy (MEE)

The main institution responsible for the development of energy policy is the Ministry of Economy and Energy (MEE). In the last decade there were constant changes in the name and status of this body. For a long time it was a separate Committee on Energy and a State Agency of Energy and Energy Resources. Then in 2001 it became a Ministry of Energy and Energy Resources (MEER). At the end of 2005 it was merged with the Ministry of Economy and within this a separate Directorate was designated to deal with the issues of energy efficiency and environmental protection.

The Minister of Economy and Energy is responsible for the development of the energy and other sector related strategies, for the issuing of statutory instruments of secondary legislation, and for preparing reports to the European Commission as required in the *acquis communautaire*. Among the main functions of the Minister related to DG as listed in Art. 4 of the Law on Energy from 2002 is to prepare national long- and short-term programmes for the promotion of renewable energy. However, these were not officially adopted until recently (for energy efficiency in 2003 but abolished and new adopted in 2006, and for renewables in 2006 as discussed in Section 3.1.1, page 36). The Minister is also supposed to set national indicative targets for the promotion of renewable electricity generation and to prepare annual reports on their attainment. These were adopted with significant delay in 2006 and became effective only from 2007 and only because EU accession requirements. Another function of the Minister is to prepare an analysis of the national potential for high-efficiency CHP and to evaluate the progress made. This report is not available to the European Commission by December 2007.

The Ministry of Economy and Energy does not have the capacity to develop strategic documents and often the Minister outsourcers them to other institutions or organizations. For example, the strategies and action plans on renewables and energy efficiency are usually prepared by the Energy Efficiency Agency. The new Energy Strategy is under development by a team lead by the Black Sea Regional Energy Centre (intergovernmental organization) and is funded by the World Bank. The development of legislation is also strongly supported by experts from outside of the Ministry. For example, two branch organizations were asked to provide a draft of the new law on the promotion of renewables which was then discussed and amended at a number of stakeholders meetings.

The delay in the implementation of the legislation or the adoption of regulations (such as the regulation on green certificates, and of the certificates of origin) show the low importance of DG in Bulgarian energy agenda.

Other Ministries

Other relevant ministries are: the Ministry of Environment and Waters (MOEW), the Ministry of Agriculture and Forestry (MAF), and the Ministry of Regional Development and Public Works. The Ministry of Environment and Waters has very important functions to ensure that DG units are installed and operate in an environmentally friendly way. This is done through the procedure for screening of the need for Environmental Impact Assessment (EIA) or Complex Permit (see Chapter 5), and if needed for guiding and monitoring of the process and final approval of the results. The Executive Environment Agency (EEnA) to MOEW is responsible for determining emission standards, including for CHP and the monitoring of the implementation of state policy. Regional Inspectorates of Environment and Waters (RIEWs) are the regional representatives of MOEW and are responsible for the EIA procedures and issuing of Complex Permit. Basin Directorates are responsible for the management of river basins and for the issuing of water permits. The environmental protection and resource use administrative procedures and the role of state authorities are discussed in Section 5.2.1.3, page 94 and Section 5.2.1.4, page 96.

The Ministry of Agriculture and Forestry and Ministry of Regional Development and Public Works are responsible land and forestry designation and spatial development issues (see Section 0, page 89).

State Energy and Water Regulatory Commission (SEWRC)

The functions of an independent regulator of energy and water markets are carried out by the SEWRC (also commonly referred as the Regulator), that was established in 1999. It has very important functions related to DG, i.e.: (i) issuing of licences for energy generation and transmission, (ii) setting up of the prices of electricity, heat and natural gas based on 'cost plus' model, (iii) developing the rules for connection to electricity and gas distribution and transmission networks, and (iv) issuing green and certificates of origin (Council of Ministers 2004, last amend. 2005).

As most regulators in Central and Eastern Europe, SWERC has a problem with capacity and funding. The experts have to answer a number of requests and claims that take a large amount of SWERC resources. There is a significant number of law suits against SWERC which challenge its decisions of electricity prices and feed-in tariffs setting which are often lost by the Regulator. There are also problems associated with the setting of feed-in tariffs by the Regulator. There are commonly accusations that the Regulator keeps energy prices too low or delays their increase to answer political needs of the governing parties. These and other problems are discussed on several places in the text and in Section 6.2.1.2, page 122 in particular.

Energy Efficiency Agency (EEA)

The EEA is a separate legal entity on budgetary financing and serves the functions of an Executive Agency to the Minister of Economy and Energy. It is the successor of a unit within MEER which was created back in 1992 and has been a separate body since 1999. Its main responsibilities are in the field of energy efficiency. However, if the Minister delegates his/her responsibilities to the Executive Director of the EEA, he/she can perform functions related to renewable energy generation too. The Agency has participated in several EU funded projects and in the preparation of several energy efficiency programs and action plans and is currently preparing such for the promotion of RES. Another responsibility is the collection of information on energy efficiency and renewable energy generation in the country.

The EEA capacity has been gradually improved, employing about 50 people (including the administration) (Council of Ministers 2005, last amend. 2006) but there is a need of its further strengthening and improved coordination with stakeholders. The lack of financial resources is a very serious limitation to the work of the Agency. Apart from the state funding it mainly depends on funding coming under various EU programmes. The wages are very low (for young experts the starting wage in 2006 was about EUR 150 gross per month and for senior - about EUR 250 per month) and many of the experts do not remain with the Agency for more than several years which creates a significant problem with work continuity (Expert 2006).

InvestBulgaria Agency and Bulgarian Small and Medium Enterprises Promotion Agency (BSMEPA)

The two Agencies have mainly indirect functions to the promotion of DG in Bulgaria. Both were established with decisions from 2004 but were successors of bodies with similar to them functions in the past. The Investment Agency issues certificates to big investors to facilitate the administrative and infrastructure aspects of their projects but the usefulness of these certificates is questioned by some investors (see Section 3.2.1). It also prepares overviews on the legislation and opportunities to invest in Bulgaria. BSMEPA supports SME by providing information, consultancy advice and training (BSMEPA 2007b). It also manages the National Innovation Fund which provides limited support for DG projects (as discussed in Section 3.2.2).

Energy Efficiency Center in Industry

The centre was established in 1995 after agreement of the Bulgarian Government and the Japanese International Cooperation Agency. It works in the area of energy efficiency in industry by executing energy audits, providing consultations, and organizing events. There is no indication of active support to DG by this Centre.

Local Authorities

Local authorities have responsibilities for most authorizations required in the due course of DG investment process. For example, they are one of the institutions responsible for changes of land designation, of detailed spatial plans, for approval of investment proposal and construction works (for more details see Section 5.2). Therefore their role in DG investment process is very important. Municipalities also own a number of buildings (such as administrative ones, hospitals, and schools) that can serve as a best practice examples of sustainable energy technologies. However, as the local authorities are usually budget-constrained or there is not enough knowledge and experience in these technologies or the funding opportunities, their role as initiators and investors in DG projects is very limited or non-existent at all.

The main actors are the Major, the Regional Governor, Chief Municipal or Regional Architect. They act based on the conclusions from the work of various permanent or temporary committees or after a decision of the Municipal Councils. They are independent from the state authorities in their decisions regarding DG. They also determine and collect fees for the processing of applications for the various permits.

4.2. SOCIAL STRUCTURES AND ACTORS

The state actors are very important in policy development and implementation but for its successful implementation the input and support of the other interested parties is crucial. Howlett and Ramesh (2003) describe two categories social structures and actors: (i) political economic structures and actors, and (ii) political and research structures and actors[4]. The actors and structures comprising the former group are businesses, such as project developers, investors, consultants, equipment suppliers, and labour organisations. Due to the low engagement of the labour organisations in Bulgarian DG sector they are omitted from the research. Within the latter group main actors and structures according to Howlett and Ramesh (2003) are think-tanks, research organisations and interest groups, while other such as the general public, political parties, and the mass media are involved mainly indirectly and are not be studied. In the discussion national and international social structures and actors are included.

4.2.1. Economic Structures and actors

The main social actors and institutions identified are presented in Table 7.

Table 7. Social actors and institutions relevant to DG in Bulgaria

SOCIAL ACTORS AND INSTITUTIONS (1) ECONOMIC ACTORS AND INSTITUTIONS
Project Developers and Investors in DG technologies
A number of companies that can be classified in several groups: Investors that have other main business Joint companies between Bulgarian developers/investors and well-established foreign companies with DG among their main business activities District heating companies (DHC) Project development organizations and associations
Distribution and Transmission System Operators
Electricity and natural gas distribution company National Electric Company (NEK) Bulgargaz
Consulting Firms

[4] Howlett and Ramesh (2003) name this category as 'Political structures and actors'. However, in Bulgaria the research units are not always actively involved in policy formulation but are essential for market transformation. That is why the word 'research' was added.

Energoproekt ESD Bulgaria Ltd Ecofys – Bulgarian Branch
Equipment suppliers
Bulgarian: Energoremont, Nicola Vaptzarov, Vipon - Vidin Foreign: GE, ABB, Tedom, etc.

Source: own research

Project developers and investors

There are various DG project developers and investors in Bulgaria. Based on personal observations the project developers and investors in Bulgaria can be categorized in three groups. The first group comprises of firms led by experts that in many cases have either been occupying high levels in the hierarchy positions in the government or related institutions (i.e. NEK). The second group consists of firms that either have foreign partners, are representatives of foreign companies or were purchased by foreign companies. There is also a third group of Bulgarian investors who have other main business and sufficient financial resources to invest in DG. The close ties that the first group has with state actors in many cases is a precondition for a smooth obtaining of permits or good knowledge funding options from local sources. For the second group having international partners facilitates obtaining of bank credits, and in some cases, easies the purchasing of equipment. For instance, turbines for one of the wind parks in Kaliakra region will be produced by the Mitsubishi Heavy Industries factories in Japan. Foreign investors are also more aware about the opportunities for additional financing under international schemes, such as joint implementation. For example few years ago JI was not well known in Bulgaria and some projects, such as introduction of CHP in District Heating Varna and some HPP did not use it as a source of supplemental funding. The third group does not have problems with obtaining bank credits as they have enough assets to provide credit securities but are not experts in DG technologies and might be mislead by consultants who want to maximize their profits.

With the prospects of EU accession and good economic growth a number of international firms became interested in doing projects in Bulgaria. This is mainly the case for wind farm projects which require significant financing. Examples of such projects which are still under development are 120 MW Kavarna wind farm (initiated by Geo Power Ltd. - a Bulgarian-German renewable development firm and is to be implemented with the US AES Corporation) (AES 2006), 33 MW Kaliakra wind farm (developed by the Bulgarian INOS-1 in cooperation with Mitsubishi Heavy Industries), and 64 MW wind farm in Suvorovo (project of Bulgarian-Spanish venture Eolica).

Investors in individual second-hand wind turbines are usually firms or individuals that have other main business and see this as a new business opportunity.

For hydro power plants main initiators and investors are Bulgarian firms. Initially large number of HPP were owned by NEK but most of them were privatized mainly by the end of 1990s. Many questions were raised on the legality and transparency of some deals and the sources of funding. Even the former Minister of Energy and Energy Resources – Milko Kovatchev warned that investing in HPP and small energy projects is a way of money laundering for the criminal structures in Bulgaria (Novinar 2005). Still, it should be mentioned that the pay-back time is very short (in some cases about 3 years), investments relatively small and therefore HPP are very attractive option. This also explains why there are already plans for most suitable locations and there is real danger of 'overbuilding' of some rivers.

The investments in CHP units were done mainly after the privatization of the district heating companies (DHC). It is easier for DHC to obtain bank loans as they have other property that can be used as credit securities, except in the cases in which they have huge depths (which is rather often the case for DHC in Bulgaria). The installation of CHP has been speeded up by the privatization of four large DHC by the firms of Hristo Kovachki – a businessman who owns large portion of privatized energy generation plants and some coal mines (Netinfo 2005).

Several CHP units have been installed at industries that have high energy demand and steam demand for processes (such as Biovet JSC - manufacturer of antibiotic feed additives and pharmaceuticals). There are plans for the installation of units at the Sofia water supply company – Sofia Water AD and even at the Kozloduy Nuclear Power Plant. There are also projects' ideas for biogas power generation at several animal farms but their owners do not have sufficient financial resources.

The interest in developing and investing in photovoltaics projects is rather limited mainly due to the lack of preferential tariffs for electricity. There was an interest from German firm (also with Bulgarian expert working for it in Germany) which even wanted to build a factory for the production of PV modules in Bulgaria but due to the lack of possibility for their realization on the Bulgarian market the factories are now placed in the former East Germany, the Czech Republic, and Poland (Investor 2006).

There is a similar situation with biomass electricity generation - there are ideas for its development but nothing has been realized due to the lack of state support, i.e. feed-in tariffs that for several years were set up only for hydro and wind and not biomass and photovoltaics (as discussed in Section 3.2, page 40 and Section 6.2.1.2, page 122). Still, several local heating projects on biomass, such as district heating projects in the cities of Ardino and Bansko, have been established by local developers and investors which points to the fact that if there is an adequate fiscal policy there will be more such projects.

There are also many associations and experts with bold and innovative ideas for various DG projects but without the support of investors.

For various reasons, mainly financial and lack of experts, there is limited participation of municipalities in the development of DG projects.

Distribution and Transmission System Operators (DSO and TSO)

The National Electric Company EAD (NEK EAD) was established in 1992 and was a monopoly organization that was responsible for electricity transmission, generation, trading, and was central dispatching unit. With the EU accession it had to be unbundled and now electricity generation is separate from the transmission system operator (TSO). NEK EAD owns a significant part of large-scale hydro power developments, including 34 hydro power plants and pumped-storage hydro power plants of total capacity 2.6 GW. It also owns Kozloduy NPP and is responsible for the preparation of the tenders for the second NPP. NEK is responsible for the preparation of forecasts for the development of energy supply and demand in Bulgaria, usually called Least Cost Energy Plan. The transmission system operator is responsible for the preparation of a study on the conditions for connection of DG units (above 5 MW) to electricity grid, for update of the grid, if needed, for proposing and signing connection and electricity purchasing contract, and purchasing of DG generated electricity at preferential prices.

Distribution system operators (DSO) are eight electricity distribution companies (EDC) that operate in different regions of Bulgaria. They used to be state-owned but in 2004 were grouped in three packages and 67% of their shares were sold to CEZ a.s. (covers Western Bulgaria and consists of EDC Stolichno, EDC Sofia Oblast, EDC Pleven), to E.ON Energie AG (South-Eastern Bulgaria: EDC Gorna Oriahovitza and EDC Varna), and to EVN AG (EDC Plovdiv and EDC Stara Zagora) (MEER 2004a).

DSO and TSO play an important role to DG deployment as they are to allow the connection of new capacities to the grid, which at present is rather prohibitive than supportive as discussed in Section 6.2.2, page 124.

Consulting firms

There are a number of consulting firms are engaged in the project development process. Until recently, most of these firms were either the remainder of well-established communist state-owned companies whose assets were gradually privatized[5], such as Energoproekt Ltd, Energoproekt – Hydropower Ltd, or established and run by Bulgarian experts consultancies, such as Energy Institute, and Company for Energy Savings JSCo (CES AD), Hydroekoenergo – TAC Ltd, Delectra Ltd, Hydro Ltd. In recent years foreign companies are trying to establish themselves in Bulgarian market, such as Energy for Sustainable Development (ESD) – Bulgaria, Ecofys – Bulgaria.

Equipment suppliers

Unlike, the significant number of different organizations and consulting firms, there are only few manufacturing firms that produce DG units in Bulgaria. There has been significant experience in the production of turbines for HPP and some in the production of boilers for CHP units. At present, HPP units are produced by three companies in Bulgaria: Energoremont (which is situated in the town of Plovidv), Nicola Vaptzarov factory (in the town of Pleven), and Vipon - Vidin (in the town of Vidin). However, most of their products are produced under licence agreement with foreign companies. Some foreign companies are starting to enter Bulgarian HPP market. For example, the Czech Marvel has provided the equipment for 7 HPP in Bulgaria (Mavel a.s. 2007).

Apart from the above-mentioned, most DG equipment is imported and is either second-hand or new (for more discussion see Section 5.1.2, page 79). New CHP units are supplied mainly by GE Energy, Wartsila (Swedish), Tedom Holding (Czech), Lek/Habo Groep B.V. (the Netherlands), and several others. For the supply of new wind turbines negotiations with well established producers, such as Vestas, Enercon, Gamesa, Ecotechnia, Dewind, Mitsubishi

[5] The process of privatization of the large well-established during the Communism energy consultancy companies in Bulgaria took many years and in many cases they were bankrupted so that can be purchased at very low price by firms close to those in power or simply because of bad management.

Heavy Industries are carried out. Second hand units are imported by small, mainly Bulgarian, consulting or project developing firms, such as Dr. Energy Systems Ltd (for CHP) and ATM Bulgaria Ltd (for wind).

4.2.2. Political and research structures and actors

The main political and research structures and actors are presented in Table 8.

Table 8. Political and research structures and actors relevant to DG in Bulgaria

SOCIAL ACTORS AND INSTITUTIONS (2) – SOCIAL/RESEARCH ACTORS AND INSTITUTIONS
Research institutions and Universities
Research centres and institutes to the Bulgarian Academy of Sciences: - Central Laboratory of Solar and New Energy Sources (mainly photovoltaics) - National Institute of Meteorology and Hydrology (mainly wind energy and some hydro) - Institute of Water Problems (hydro) - Forest Research Institute (biomass) Research Institute on Land Reclamation and Agricultural Mechanisation of the Ministry of Agriculture and Forestry Universities: - Technical University, Sofia - Agrarian University, Plovdiv - Technical University, Varna - South-West University, Blagoevgrad - Technical University, Gabrovo
Branch Organizations
Association for Alternative Sources of Energy Cogen Bulgaria Association of the Bulgarian Energy Agencies National Association of the Independent Energy Producers ‘Ecoenergy’ Bulgarian Energy Sector Chamber Bulgarian Wind Energy Association Bulgarian Section of the International Solar Energy Society
Other organizations
Black Sea Regional Energy Centre Sofia Energy Agency – SOFENA Sofia Energy Agency – Sofena EnEffect Sofia Energy Centre
NGOs
Bulgarian Society for the Protection of Birds (BirdLife partner in Bulgaria) Balkani WildLife Society Green Balkans For the Earth Centre for Environmental Information and Education

Source: own research

Research institutes and universities

The main actors and structures that conduct DG research in Bulgaria are several institutes and centres to the Bulgarian Academy of Sciences (BAS) and various units within different universities (as listed in Table 8). In addition, limited research is carried out by private firms or associations mainly funded under EU research framework programmes or since recently under the National Innovation Fund.

BAS is an institution with long tradition in research formally established in 1911 based on predecessor organization from 1869. It is autonomous and on a state budget. The funding is usually limited and if no international (mainly EU) sources are ensured it is often difficult for BAS to offer proper staff remuneration and to purchase the needed equipment.

Many of the universities are well-established and provide good training for engineers in the traditional large-scale technologies. However it is difficult for most universities to provide up-to-date courses on DG technologies as this is still a new area for Bulgaria and therefore most courses are mainly theoretical as there are no financial means to purchase equipment. There are also no sufficient courses on policy and economics of DG. Universities are funded by the state budget, student fees (which are very low), and international donors and there are the same limitations of resources as for the BAS.

Branch Organizations

Several organizations represent DG projects' investors and DG projects developers. The most active ones are the Association for Alternative Sources of Energy, the National Association of the Independent Energy Producers 'Ecoenergy', and Cogen Bulgaria. The interests of investors in energy sector in general are represented by the Bulgarian Energy Sector Chamber. Some of the associations have significant impact on policy formulation, i.e. some of them were invited to draft the Law on Renewables which is still under discussion, while other have much more limited role.

There are also a number of energy agencies, established under SAVE II programme of the EU. Representative of the energy agencies and of municipalities is the Association of the Bulgarian Energy Agencies

Other organizations

In the last decade a number of organizations have been created that are carrying out policy research, consultancy and advice for the Government, investors and other stakeholders. Most of them were established with international support coming mainly under the EU programs, such as Synergy, Thermie, SAVE, and from the USAID. Some of the most active from this group are the Black Sea Regional Energy Centre (which an intergovernmental organization of the countries of the Black Sea Region), EnEffect, Sofia Energy Agency – Sofena and Sofia

Energy Centre. They have continued to operate after their initial funding was exhausted and are very successful in being awarded EU support as part or coordinators of EU-wide consortia. Still finding of co-financing, if needed, can be very problematic. With increasing EU support for DG several projects were initiated. Some of the reports were very useful and were used in the research, especially for the part of potentials but other are too general[6]. As part of the projects a number of meetings are organized and brochures printed but as there is usually no continuation after the projects are finished their impact, in some cases, is very limited. Also not all of the reports are published online or are easily available which make their impact limited.

Environmental Non-governmental Organizations (NGOs)

Civil society organizations did not exist during the communist era and therefore there was no established practice of public consultation or inclusion of NGOs in decision making. In the last decade with the support of foreign donors a number of organizations that represent civil society were created, especially in the area of nature conservation and minority rights. NGOs are actively trying to engage in policy formation and the monitoring of its implementation. However, most of their impact on DG policy is limited.

Several NGOs have interest in DG in Bulgaria. The Bulgarian Society for the Protection of Birds (BSPB) - BirdLife International partner in Bulgaria, Balkani WildLife Society, and Green Balkans are commonly opposing projects for wind and hydro projects that they consider damaging for the environment but some of them cooperate with investors by proposing suitable locations and the preparation of EIA.

While most NGOs are interested in nature conservation and become involved in DG issues only when possible conflicts with environmental protection objectives occur, there are a limited number of NGOs that have energy as one of their main areas of interest. For example, For the Earth and Centre for Environmental Information and Education have been working consistently from their creation on the promotion of energy efficiency and renewables. Both of them have been part of CEE Bankwatch network – a network of NGOs who monitor the sustainability of the investments of the International Financing Institutions.

[6] As was mentioned earlier the present research (esp. Chapters 1.8, 3 and parts of 5) has been partially carried out under DIGENAS project which is funded under the EU's Sixth Framework programme.

Most NGOs employ young people without experience who the support in their professional development. Mainly the experts working for them are with nature conservation or related background. It is rare to meet people with education or experience in energy matters and even rarer to meet highly qualified experts in DG matters as consultancy or public sector jobs are better paid or more secure. This is significant limitation to NGOs' ability to engage in DG policy formulation and its monitoring.

4.3. INTERNATIONAL ACTORS AND INSTITUTIONS

International actors and institutions play important role in policy development and influence the promotion of DG through provision of technical and financial assistance, lobbying for or imposing the adoption of specific legislation. One group comprises of international institutions (such as the institutions and bodies of the European Union, International Energy Agency), donor organizations (such as the European Bank for Reconstruction and Development, the European Investment Bank, the World Bank Group), and national governments (see Table 9 below). Another group of international actors are project developers, investors, consulting firms, equipment suppliers, NGOs but their role was discussed under the category *Social Structures and Actors* as they are integral part of the system that is active on local level.

Table 9. International actors and institutions relevant to DG in Bulgaria

INTERNATIONAL ACTORS AND INSTITUTIONS
International institutions and European Union institutions
European Union Institutions: European Commission (in particular Directorate General (DG) Energy and Transport, DG Internal Market, DG Environment, DG Enlargement) Council of Ministers, European Parliament International Energy Agency
International Financing Institutions and Development Agencies
European Bank for Reconstruction and Development European Investment Bank The World Bank Group International Monetary Fund USAID and other development agencies
National governments
International Social Structures and Actors (discussed in Section 4.2 above)
Developers, investors, consulting firms, equipment suppliers, NGOs

Source: own research

The European Union accession was the main driving factor behind the developments in DG field. Bulgaria had to align its legislation with the EU's ones. With the insistence of the European Commission (EC) Bulgaria adopted indicative target of 11% renewables of final domestic electricity consumption by 2010 under the RES - electricity Directive (2001/77/EC) and strengthened the capacity of the EEA. Measures on the promotion of CHP should also be undertaken in line with CHP Directive (2004/8/EC).

Apart from direct insistence on legal and policy changes EU supported various activities to popularize sustainable energy and to enhance the capacity of Bulgarian institutions and organizations. A number of studies were carried out, and seminars funded under EU programmes were organized to support exchange of experience and knowledge, for showing best practices and helping the networking of experts. However, in many cases there was no follow-up of these initiatives. Many of the projects that were carried out were archived and well forgotten.

Several organizations were established with EU funding as mentioned in the text above. For example, the Black Sea Regional Energy Centre (est. 1995) and Sofia Energy Centre (est. 1998), were founded under OPET initiative; six local agencies, i.e. Sofia Energy Agency - SOFENA (est. 2001) and seven regional ones, such as Plovdiv Energy Agency (est. 2000) and Bourgas Regional Agency for Energy Management (est. 2005) were created under SAVE II and other EU funded programmes. Most agencies are operational and carry out local sustainable energy projects.

International donors also provide financial support to DG projects. As a compensation for the closure of units 1 to 4 of Kozloduy NPP a special fund, called *Kozloduy International Decommissioning Support Fund* (KIDSF), was established in 2001 to support the decommissioning of the NPP units and demand and supply side energy projects (EBRD n.d.). The total commitments to the KIDSF are EUR 170 million coming from the European Communities and ten countries. The Energy Efficiency Fund was supported by the Global Environment Facility and other international donors. Another international donor that supports sustainable energy projects and capacity building is the USAID. It assisted in the establishment of EnEffect and funded energy efficiency projects in municipalities but are now diminishing its funding for Bulgaria.

National governments have also supported the development of DG in Bulgaria. For example, the Austrian Government through the Austrian Energy Agency (E.V.A.) has financed policy development studies, i.e. *National energy saving program of Bulgaria* (SEEA *et al.* 2001b); has participated in the organization of conferences, i.e. the *Austrian Energy Days in Bulgaria* in 2004. Additional investment support from national governments is provided under joint implementation scheme for selling of emission reduction units which are supported with memorandums of understanding between the Bulgarian Government and the governments of Austria, Denmark, Netherlands, and Switzerland and the World Bank.

4.4. COOPERATION AND DIALOGUE BETWEEN THE ACTORS, INSTITUTIONS AND STRUCTURES

Revealing the organization of decision making system and the interactions between the various participants is not an objective of this research. However, some observations on their interactions between stakeholders are included in this section.

Governmental institutions – stakeholders

There are no well developed procedures regarding the participation of the various stakeholders in policy cycle. However, there is a dialogue between the state institutions and actors and public structures and actors. Public authorities draw extensively on the experience and information that can be provided by the investors in DG technologies or organizations that represent them. This was the case when the draft Law on Renewables was prepared as discussed in the text above. The Regulator also uses information from investors or lobby organizations when setting up preferential tariffs. There are also conflicts between these two groups. For example, many investors argue against the setting up of feed-in tariffs and even initiate legal procedures against the Regulator.

The impact of NGOs and research institutions on DG policy cycle is very limited. There are many cases of confrontation between the Bulgarian Government and NGOs that oppose certain DG projects that they consider as detrimental for the environment.

European Commission – Bulgarian Government

The Bulgarian Government submitted application for EU membership in December 1995, in January 2000 formal negotiations were opened, and on January 1, 2007 Bulgaria joined the Union. During the years to accession the country had to meet a number of challenging criteria including the transposition of the EU *acquis communautaire*. In general, when a country is acceding to the EU there are no possibilities for changes in any of the existing EU legislation which was already adopted and catered to the needs of the Member States that participated in its development, but there is a possibility to negotiate derogations, i.e. to postpone the meeting of requirements. In this way the policy transfer is rather one-way and the applicant countries have to ensure transposition and compliance if they want to join the Union. This was also the case for Bulgaria. Member States can usually choose what mechanisms to adopt in order policy to be implemented, for example Bulgaria choose feed-in tariffs to promote DG than green certificates. Also the targets are to be negotiated, as those for the share of renewables. However, the Commission adopted rather hard stand on the accession countries, including Bulgaria, and had high requirements. For example, regarding the target for renewable electricity initially the MEER proposed 9% target but the Commission insisted that it should be higher, i.e. 11%, and Bulgarian Government agreed. After the accession the Commission continues to monitor the adoption and implementation of EU policy and if there is non-compliance infringement procedures are to be initiated and fines imposed.

As was explained in the text above the Commission supported the policy transfer and institutional capacity thought funding a number of projects and organizations.

NGOs - investors

Regarding the dialogue between the NGOs and projects' developers there are two distinct patterns of communication: no dialogue at all, or the opposite - dialogue from early stage of investment process. Most investors, esp. the big ones, do not consider NGOs as partners and do not consult them when developing their ideas. These results, in some cases, to a very severe opposition from environmental NGOs at rather late stages of project development which they consider can cause significant environmental impact but due to shortcoming in the EIA procedures receive a permission to continue. There was a heated debate on the impact of wind farm developments on birds' migrations on the Black Sea coast and several other places (like city of Dragoman) and of construction of HPP on river ecosystems. Some NGOs, such as the Bulgarian Society for the Protection of Birds (BSPB) and Balkani Wildlife Society, bought to court some of the EIA decisions but the former lost many of them. This inevitably had negative impacts on the accounting balances of the Society as it had to cover all legal costs. Some investors accuse NGOs for blackmailing and serving the purposes of other investors. There is mistrust of investors towards NGOs and vice versa.

Other, though limited number of, investors work in close cooperation with NGOs when developing and executing their projects. They acknowledge that there is a need of such dialogue as the likelihood of their projects having negative impacts is decreasing and moreover they are not facing problems at later project stages when changes are more difficult and even impossible (esp. once land is bought and some permits obtained). Some of the leading environmental NGOs, such as BSPB, are also consulting and preparing EIA for projects at the Black Sea coast. There are also very close cooperation between BSPB and the Association for Alternative Sources of Energy. Outcome of such collaboration is a project for construction of 64 MW wind farm near the city of Suvorovo.

4.5. SUMMARY

The main driver behind the DG policy formation was the EU accession and the need to adopt the EU legislation, with the European Commission being the main institution responsible for the negotiations with the Bulgarian Government. Ambitious but achievable targets and objectives on the promotion of renewables and CHP were set out as part of Accession Agreement. The process was rather one-side transfer of EU requirements with only limited possibility for ‘real’ negotiations. The transposition from EU side was supported though funding of studies, the creation of organizations and training courses. It is difficult to evaluate the impact of these efforts but, in some cases, after the completion of the projects, there was no follow up and their results were left unused.

On the other hand for the Bulgarian institutions DG was not an issue of main concern as there was a long tradition of coal and nuclear large-scale energy generation, existing overcapacity of the system, and the plans for construction of new conventional power plants. DG was considered as a new and expensive technology and was against the interest of lobby groups that wanted large generation projects. As a result the institutions were slow in adopting and implementing the policy documents and instruments and taking full advantage of the capacity development opportunities. In addition, there was and still is lack of experts that understand the specifics of DG. In the past the level of knowledge of foreign languages (apart from Russian) was very low and the experts were trained in traditional energy generation. At present, the salaries in the public sector are low and it is difficult for the public institutions to keep their experts.

Nevertheless, many local and international project developers, consultants, and investors gradually realized the potential of DG and started to take advantage of this new market niche. They are building their capacity and knowledge and the number of DG projects is constantly increasing. Some of them formed associations to represent their interests which actively lobby and cooperate with the state organizations in shaping Bulgarian DG policy. Still a large missing group are the installers and maintenance technicians. The problem is especially acute with the new for the country technologies such as wind and photovoltaics. Equipment manufacturers are also important group that, apart from some hydro and CHP components producers, is virtually missing. This can be important business opportunity which will soon be lost as foreign supplier companies are quickly entering Bulgarian market and once they become well established it will be very difficult for Bulgarian manufacturers to compete with them.

Finding well trained experts is significant problem for all actors and institutions in Bulgaria. Until recently there were no graduate courses on sustainable energy policy, economics, or technologies or the level of knowledge of foreign languages is not high. This is particularly a problem for state institutions, especially in local and regional level, and for the research institutes and universities. As these organizations are not able to provide proper remuneration for their staff it is difficult to attract highly qualified experts or to train young experts and even if they do it is very difficult to keep them with the organization.

There is a lack of tradition for inclusion of stakeholders in the policy formation. This is especially true for the environmental NGOs but there is also lack of capacity within the NGOs to engage in the process. The dialogue between the Government and NGO sector is very limited and mainly related to conflict situations when NGOs oppose certain projects. Still the Government and the Regulator draw on the experience of investors' associations for the preparation of legislation and the setting of the feed-in tariffs. However, the final decision is based on the political priorities and international pressure.

5. INVESTMENT PROCESS, ADMINISTRATIVE PROCEDURES AND INVESTMENT COSTS IN BULGARIA

In the previous chapters analysis of the potential, preferential policies, and actors and institutions engaged in the promotion of DG was presented. While DG offers a specific investment niche with possible good returns and growing importance due to geopolitical and environmental concerns, many investors fail to realize their projects. The development and implementation of DG projects in most of its phases is similar to those for many other economic areas, but in addition, has distinctive features, for example, related to the collection of information for resources availability and in obtaining various authorizations (such as for land and resources use, environmental protection, construction, and technical matters).

Therefore, an important element of understanding the needs and barriers that prevent higher DG capacity is an analysis of the steps that investors or project developers have to follow from the initial project ideas to the project completion and to identify the possible difficulties that might delay or even stop projects' realization. Such an analysis is carried out in the following text, where first the investment process, divided in several phases as suggested by Uyterlinde *et al.* (2003), is described and the main limitations outlined. Second, due to the fact that the administrative procedures are an important reason for delays and additional transactions, those relevant to DG developments in Bulgaria are studied in detail, especially from the point of view of procedures, time required and authorities involved. Finally, a brief overview of the investment costs and pay-back times of some DG projects in Bulgaria is presented. Based on this analysis and the previous chapters on support policy a summary of the barriers to DG in Bulgaria is presented in the following Section 6.

The analysis is based on a literature review, mainly of legal texts, and on interviews with investors in DG projects and other stakeholders. Due to confidentiality reasons the information collected is summarized and no data on individual projects is presented. Also no names of experts are quoted as this might be harmful to their projects' development. However, a list of interviewed expert and the organization they represent is included in Annex IV. Due to the limited number of DG projects implemented or in the planning phase the interview sample covers most wind power developments (three investors in large scale projects and the Director of the Association of Producers of Ecological Energy – the association of wind energy developers), most CHP installations (all but one investors in CHP installations in DHC, and a project developer for small scale CHP units) and some in HPP (three investors and project developers each of them owns several HPPs and has worked for the development of other HPP). There are no projects for other DG sources in Bulgaria yet but there is an interest and projects in the pipeline. For photovoltaics, landfill gas, and biomass one developer per resource was interviewed.

5.1. INVESTMENT PROCESS

In order to analyse possible barriers that might occur during the investment process, first different phases and related requirements were studied. This was carried out using (Uyterlinde *et al.* 2003) division of investment process into three main project phases with several subphases: (i) planning (with three subphases: search/pre-feasibility, negotiation/ development, administrative procedures), (ii) implementation, and (iii) production (See Figure 8 below). Although in some cases, phases overlap or are executed simultaneously, this division provides good background for systematic analysis. Due to the high importance of administrative obligations are studied in a separate subsection.

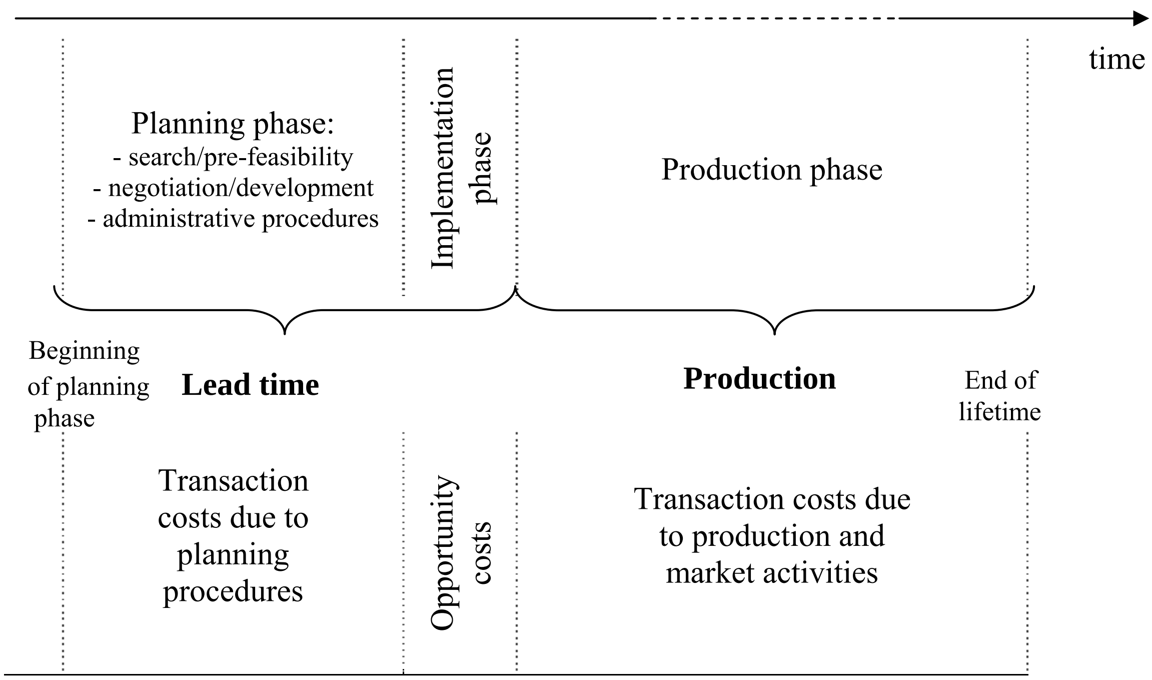


Figure 8. Project phases

Source: Uyterlinde *et al.* 2003

5.1.1. Planning Phase – Search / Pre-feasibility Subphase

This subphase includes finding interested partners to the transaction; identifying one's own position and optimal strategy; search for a suitable site and enquiries about its availability; choice of desired technology, measurement of resource; rough determination of available budget (Uyterlinde *et al.* 2003). It usually concludes with accomplishment of one or more pre-feasibility studies.

In Bulgaria important issues to be considered are: evaluation of the availability of energy resource; ensuring of project funding; and acquiring of land.

Evaluation of Energy Resources Availability

DG technologies utilize very different energy sources and therefore the approach for their evaluation differs.

Wind power evaluations are the most time and capital intensive. At present, there is no sufficiently reliable information on wind potential in Bulgaria as data are based on observations made for meteorology purposes by the National Institute on Meteorology and Hydrology. Therefore, resources are measured at 10m height and then extrapolated to needed hub height which is usually over 50m. Another source of data are airports, if there are such in the vicinity. Although not sufficient, these data sources provide information on where possibly there are locations with reasonably good wind speeds.

When sites are chosen, a detailed evaluation of potential is required which includes measurements for at least one year and about half a year of data processing. For large-scale wind developments these evaluations have to be carried out by a licensed company so that their results are accepted by the banks when developers apply for bank credits. There are no such licensed companies in Bulgaria and international companies are hired which have higher fees than the Bulgarian firms. By now for several of the big wind farms the services of Garrad Hassan and Partners Ltd – an international consultancy with headquarters in Bristol, UK. There are some Bulgarian firms which offer cheaper but not licensed measurements that can be used by investors in individual units with their own capital and they do not need bank credits.

When choosing a site and evaluating resource availability it is also important for developers to consider possible conflicts with nature conservation objectives, such as the European nature conservation network Natura 2000 or possible negative impact on birds' migration. Natura

2000 sites are not clearly determined yet and some investors (especially with projects on the Black Sea coast) face strong opposition to their projects from nature conservation NGOs. Those who have adopted position of first enquiring about possible problems by now did not have problems with environmental NGOs, like Suvorovo wind farm project and some others of the Association of Producers of Ecological Energy. The others, particularly INOS-1 and GEOpower were bought to court by NGOs (i.e. the Bulgarian Society for the Protection of Birds) but won and proceed with huge delays. The EIA procedure and some of its shortcomings are discussed in Section 6.4, page 130.

Hydro engineering is a historically well developed sector in Bulgaria. The potential for HPP on various rivers is well-known and thus it is not difficult for investors to decide on which location to place their HPP. Once this is decided more detailed evaluation of water quantities (which depend, among others, on the whole water catchment basin, and on the terrain and its changes) are required. Some investors use data for at least 40 years in order to choose proper site and technology. That is why the availability of reliable data is essential. In Bulgaria such data are collected by the National Institute on Meteorology and Hydrology and they are available against a fee to those interested.

The determination of solar resources can also easily be done based on the available data again from the National Institute on Meteorology and Hydrology, studies of research and organizations institutes, and on-site measurements. In order to get higher energy yields the orientation of photovoltaic panels is important but it depends on the site where they will be mounted.

The evaluation of potential for introduction of CHP in DHC or industries depends on heat demand. Usually, data on heat demand for about 5-7 previous years are needed as well as scenarios on the future demand, on the prices of energy resources and on inflation rates. In the cases of DHC the units are usually planned to cover the minimum summer demand for hot water.

Studies on the feasibility of installation of CHP at district heating companies in Bulgaria were prepared under various projects (such as World Bank 1992-93; under ECOLINKS –USA - 1999-2001; from Danska Energy Management and EKF 2002-2003). However, due to many reasons, there was not significant advancement with these projects until recently. These include the lack of funding, lack of willingness and commitment of the owner – the state, or due to intrusion into the process of some political parties (Investor 2006). For example, for DH Vratza a prefeasability study and funding application for the Danish Export Credit Fund

(EKF) were prepared by Danska Energy Management (Danish Energy Agency) and Bulgarian consultants. The 25% grant and 25% investment by the Danish CHP equipment provider were ensured and a bank guarantee from the Bulgarian government was needed for a loan from the European Investment Bank. However, due to political reasons the project was not supported by the Kostov Government (1997-2001). Koburgotski Government (2001-2005) expressed strong interest in providing the needed support but after the changes of Danish Government in 2001 the financing under this scheme for Bulgaria was stopped. Finally, the project was realized when the DHC was bought by a private investor without foreign participation. A similar situation happened with several other DHC. The prefeasability and other economic and technical studies were used by the new owners and thus the costs for them were minimal as their original authors were not renumerated.

5.1.2. Planning Phase - Negotiation and Development Subphase

This subphase includes negotiating the terms of the contract between partners, visits to the project site; hiring lawyers to draft contracts; evaluation of different financing schemes; negotiations regarding loans and ensuring of financing; acquiring land; finalizing the economic and technical feasibility studies (Uyterlinde *et al.* 2003). Issues that were identified to have impeding impact over project development in Bulgaria are mainly: ensuring of project financing; acquiring land; and purchasing of equipment.

Project Finance

Many projects are not realized because of the lack of financing. Majority of the investors in DG technologies in Bulgaria need bank credits to proceed with their ideas. Usually, problems with obtaining credits have small investors that do not have enough assets to provide credit securities. Still, the Bulgarian banking sector is very active and according to the investors in large-scale developments banks are ready to provide credits for DG projects if the investor has good creditworthiness. Important factor in the improving of DG projects risks appreciation are the credit lines for energy efficiency and renewables established by EBRD in cooperation with six Bulgarian banks (see Section 3.2.2, page 48 for more information). The usual credit conditions depend on many factors, such as type and size of project, credit rating of the applicant, opportunities for providing credit securities.

Credit conditions

The conditions of the individual credits are commercially confidential, but in general, typical interest rates vary a lot and based on the investors interviewed are between 8% and 12%. Credits are usually provided for no more than 5 years though there are exceptions and there is 1 to 1.5 years grace period. There are limited opportunities for preferential credits under EBRD supported credit lines, Bulgarian Energy Efficiency fund and the two environmental protection funds. For more details on these sources refer to Section 3.2.2.

Credit securities

For the less-established technologies and small-scale projects it can be very difficult to find sufficient security interest. For example, most investors in small wind installations have other businesses as main source of profits. This is because it is still difficult for small investors wishing to install wind turbines to obtain bank credits only by providing equipment bought for the project as a security interest. For large-scale wind projects the equipment is put as a credit security. In some instances investors in small-scale HPPs were asked to put on mortgage property that was four time higher than the credit requested. This inevitably increases the risk perception among the prospective investors. Once the first HPP was built and operating without problems the investor could obtain credits for the next ones by using first HPP as a guarantee.

Exhaust tower - District Heating Company Varna, photo: G. Miladinova

For CHP units, banks accept equipment for credit securing. When this is done one still needs to find funding for all the other activities required during project development and implementation. Another significant problem for the purchasing of DG equipment for DHC is that some of them have huge debts to the natural gas system operator and supply company - Bulgargas (for example DHC-Varna had about EUR 0.5 million depth at the time of project development) and because of this it is difficult for them to obtain bank credits. Still, these companies could find solution and in the case of the above-mentioned DHC the solution was to purchase the equipment on a lease contract. In this case a credit, secured through the sale of thermal energy, was still needed to cover the initial lease payment but it was much smaller than if it was for the whole project.

As for large-scale wind farm projects there are banks interested to provide credits. Still, according to some investors: '*Bulgarian banks do not have sufficient experience for large developments, i.e. of more than EUR 50 million, and are very suspicious to give credits, especially when there is no mortgage of equipment or property but only data on the wind potential'* (Investor 2006). Therefore they usually work with foreign banks which form lending syndicates with other banks to share the risk. Audit firms to the banks consult them on project's profitability based on business plans and information on resource availability. Certified and independent wind characteristics data for 1 – 1.5 years and data for about 10 years from the closest monitoring point is required. In these cases the banks can provide credits for more than 15 years.

For successful application for such credits the creditworthiness of the companies in the project development consortium is very important. When partners are well established international firms the credit is provided more easily.

In some cases, such as for CHP project, when credits are obtained from foreign banks a guarantee from a local bank is also required because the credit image of Bulgarian firms is not very good. This increases the interest rates. For one project US bank provided credit with 5% interest rate but after it was confirmed by the bank registered in Bulgaria the interest rate increased to 8.5%.

Preparation of application

Usually no external consultants are used in the preparation of documentation required for credit application but experts from the banks, and lawyers and economists employed by the investors are responsible for the preparation of relevant documents. The time for preparing the application is different and depends on technology. Based on the interviews the time for application and obtaining of bank credits are as follows: for CHP at DH – from 2 to 5 months; for small-scale HPP – about 4-5 months; for small-scale wind projects – about 6-7 months, for large-scale – minimum 2 years.

External consultants are usually used when an application for additional financing under the JI scheme or other international source is developed.

Preferential credits

When asked about the preferential credits (i.e. EBRD credit lines, EEF, two environmental funds) investors responded in two opposite ways. Some of them who did not use preferential credits often said that they are not easily obtainable and do not provide very good conditions (i.e. the grant is as much as the taxes for the credit and interest rates higher than normal ones). Another more serious concern regarding the EBRD credit lines is that as they are designed for the development of banking sector in Bulgaria there is no possibility for obtaining of the grant if no credit is taken. Some investors hinted that it is still possible to take credit even if they have enough funding only to obtain the grant but this means that they have to spend additional time and money in the preparation of documents and various transactions and some of it will be taken as service taxes.

The investors who have been granted funding are very satisfied with the procedures and the terms of conditions. According to the latter, the process is very transparent with elaborated and strict procedures, with many audits and no possibility for corruption. The consulting firm that works with the EBRD has also been praised for its cooperation and support.

Acquiring Land

The acquiring of land is another limiting factor for most DG projects, with the exception of CHP units that are often constructed within the site of DHC or factory and thus there is no need for land purchasing. For many years during the communist era the land was state-owned. Now it has been returned to the heirs of those who owned it before its 'nationalization' in the early 50s. In many cases this means that there are many people who own very small parcels and many of them are not living in the area. This makes negotiations for purchasing of land very complicated and slow. Another significant limitation is that there is not enough land owned by local authorities. It is perceived by the investors that if this was the case it would have been much easier for them to obtain rights to use it.

The price of land is very high at some places as there are conflicting uses. At present, there is massive development of tourist resorts and the land at the Black Sea coast can be very expensive. The prices are also driven up in some areas with high wind speeds by the increased investment interest for construction of wind turbines.

Another limitation to foreign investors in general in Bulgaria was that until recently according to the Bulgarian Constitution no foreign nationals or foreign legal entities could own land in Bulgaria. However, due to country's accession to EU changes in the basic law were introduced in 2005 and land can be purchased in the future by EU citizens and firms (7-year derogation period applies). However, legal entities registered in Bulgaria can own property and thus this was not a significant problem to foreign investors (IBA 2006a).

For some installations, when the purchasing of land is not possible, project developers can sign long-term renting contracts. This often happens for wind farms developments. The area to be rented depends on project parameters but can be as much as 2 decares (2,000 m^2) per turbine. This is a very good way for the owners to earn profir for their land. In this case they are much higher than if they were producing grain or other corns.

Once the land is acquired its status might need to be changed if it is not designated as a land for industrial uses, or change of the regional development plans might be required which according to some investors is as a very challenging and bureaucratic process. More details on the related administrative procedures are provided in Section 0 page 89.

Purchasing and Supply of Equipment

Choosing and purchasing DG equipment is important, and in some cases, impeding to investments in DG step. The production of DG equipment in Bulgaria is very limited, except for water turbines and some CHP components. Because of this most units are imported. Depending on financial constraints, investors either purchase second-hand or new units.

Wind turbines

Purchasing of new wind turbines can be a significant problem as globally the demand outstrips supply and there can be about 1.5 to 3 years delay between the purchasing and the production of turbines and usually about 25% of the total cost deposit is required (Investors 2006). This makes purchasing of wind turbines problematic especially by small firms that do not have enough experience and capital. The large wind farm developments in Bulgaria are carried out by project consortiums that include well-established, large foreign companies. For example, in the three largest developments at the Black Sea coast the partners to Bulgarian firms are the Japanese Mitsubishi Heavy Industries (MHI), the Spanish Eolika and the American AES. These firms facilitate the supply of equipment.

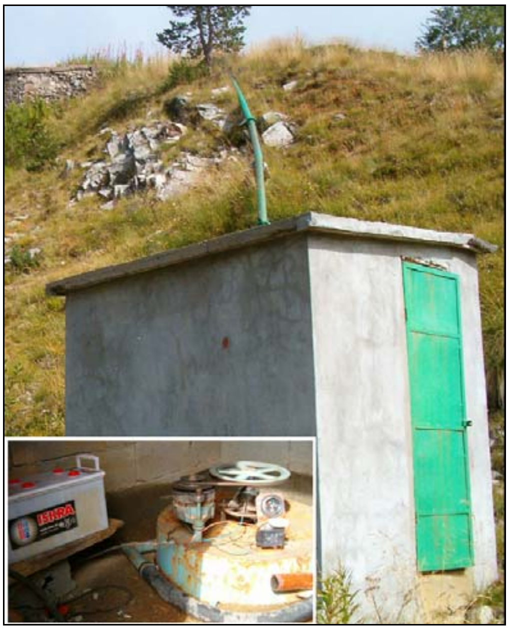
The wind turbines supplied for small developments are usually second-hand and at much lower price than the new ones. The cost to buy such unit varies a lot. There are even cases when the investors have to pay only the transportation costs for units at the end of their exploitation life. The problem with second-hand units is that in many cases they are not provided with warranty, factory service, technical specifications, or software. Some of these turbines are functioning without significant problems but it is also common that the investors are having technical problems and thus financial losses that, in some cases, can be significant.

HPP

In Bulgaria there is a tradition in hydro power generation and therefore there is local production of turbines and pumps but now most of them are produced under licence agreements. Other equipment is imported. Bulgarian production is in general cheaper but some investors prefer to import them as they consider that the imported ones are more reliable. The purchasing decision also depends a lot on the operational conditions.

Bulgarian investors are also very ‘innovative’. For one HPP project the investors installed a pump, bought from Bulgarian firm, which was modified to generate electricity. In this way the turbine cost was three times lower than if it was purchased from a foreign company. The HPP is in operation and there are no problems but the investors considered this very risky and the other turbines they are installing are purchased from a foreign producer.

There are also very basic solutions as the one on the photo which consists of derivation pipe, small construction to host the turbine and accumulator (shown in the insert at the low left corner).



Micro HPP in Rila mountain,
Photo: G. Miladinova

CHP units

There is no production of complete CHP systems in Bulgaria but only of water boilers. Initially, most CHP units installed in Bulgaria were second-hand. With the liberalization of energy markets in the EU the conditions for CHP worsened and there was large amount of second-hand CHP units offered at very reasonable prices (Project developer 2006). At present, the markets have stabilized and there are fewer machines that come from the replacement with newer once but the growing demand from the Asian markets might cause future shortages. It is also difficult to find on the second-hand market units with very small (below 100kW) and large (above 1.5 MW) capacity.

At present, both second-hand and new units are purchased. Swedish Wartsila holds the significant share in supplied CHP units to DHC in Bulgaria. Most of its units are purchased by one company which negotiated with the producer to establish a warehouse for spare parts and provide better technical support in Bulgaria (Project developer 2006).

Due to the high demand the lag between purchasing and supply of units is also increasing but is still shorter than for wind turbines. For instance, for small-scale units this period is now about 5-6 months while several years ago it was only 3 months (Project developer 2006).

For CHP projects it is crucial to choose units that will have the maximum possible annual working load at the given heat demand. Some small investors with no sufficient knowledge of CHP issues were misguided by firms that supply the equipment and purchased units with larger capacity than their needs which turned the projects into big financial loss (Producers' association, expert 2006). This is possible because the firms that offer equipment also do the evaluation of the needs and as they are interested in selling larger units they might be tempted in providing bad advice.

Other DG units

There is no significant trading of other than wind, CHP and hydro units in Bulgaria and also there is no production of such units in Bulgaria. Therefore, all other types of DG units have to be imported.

5.1.3. Planning Phase - Administrative Procedures Subphase

Due to the importance of this subphase it will be discussed in a greater detail in a separate subsection 5.2, page 88.

5.1.4. Project Implementation Phase

This phase covers the time from the obtaining of construction permits until the actual start of selling of electricity. Apart from the costs of construction works, other costs that incur during it are opportunity costs and thus any delays can be translated into financial losses. Delays in this phase might be caused among others by: supply, technical or construction problems with equipment; difficulties of meeting various standards; delays in connection to distribution/transmission network due to administrative procedures; bad meteorological conditions; and protests of stakeholders. The majority of these are unpredictable and therefore difficult or impossible to plan.

Poor quality of construction works or unprofessional decisions can be a serious problem. For example, after the completion of HPP construction works it turned out that the firm responsible for construction works decided to reduce its costs and instead of laying suitable pipes installed some that did not answer technical requirements. As a result they had to be changed at a high cost borne by the investor who had to take legal actions against the construction firm.

Similar problems occurred during the start of operation tests for the first district heating plant in the city of Bansko[7]. Project developers were planning to utilize existing but not recently used district heating pipelines. However, it turned out that the water does not reach the final consumers and the reason was that the pipelines were discontinued at some places in the city after renovations. As there were no records, the project developers had serious problems and delays in identifying and replacing the discontinued sections.

Slow administrative procedures can cause significant delays of project implementation. Project developers report various problems with almost all of the involved authorities or distribution/transmission companies. Investors try to overcome these problems in many ways. Some communicate actively with the authorities from early stages of project development. In other cases investors start or continue construction works even if not all procedures for this are satisfied taking the risk of fines, but also, decreasing the losses that they might bear due to delays. This is possible as there is no stringent control or it is not excersized even if the authorities know that there are some problems. When it is not possible to disregard some requirements or to arrange the speeding up of the process by persistent contacts (and even bribes) with the authorities, investors wait and this increases the project costs and decreases their willingness to do business in Bulgaria. Details on the possible delays are discussed in detail along with the description of the administrative procedures - Section 5.2, page 88.

Problems with the lack of trained technicians and experts that can ensure proper instillation of the units can also be a limitation in this phase. Some technologies are better understood in Bulgaria and thus this problem is with different significance depending on the project, with wind power generation projects being the most problematic once. An additional serious limitation for wind projects is that, in some cases, when second-hand units are imported, there are no detailed design documentation. Some investors in large-scale CHP units have sent their engineers to help the dismantling and repairing of the second-hand units they were buying. Once these engineers were trained they could help the installation and the maintenance of units and even to mend some other second-hand units of the same producer (which was not

[7] The project of DH Bansko is not for generation of electricity but of heat from biomass. However, it is mentioned on several occasions as there are many similarities with biomass-fuelled CHP projects.

very well appreciated by the producer but was much cheaper for the investors). However, this can be very expensive for small DG investors. Due to lack of technical support for some technologies delays are possible if some parts of equipment need to be replaced.

Legal proceedings can also delay project development, implementation and operation. For example, in order to change the ownership of water permit an investor spent three years of negotiation with public authorities and legal appeals that he won. Court appeals brought by environmental organizations against the EIA are also very common especially for wind farm projects to be situated at the Black Sea coast or for HPP in a vulnerable or unique ecosystems.

5.1.5. Production Phase

Once the units are installed and normal operation starts various expected (such as maintenance and operation costs, costs for monitoring and verifying of different transaction, costs for complying with various requirements), and unexpected costs (such as losses due to natural disasters, technical failures) occur. Additional factors as quickly changing regulatory regimes might also be a significant problem and financial burden during this phase.

During the operation of most DG units, with the exception of photovoltaics, regular maintenance and occasional repairs are required. The arrangements on by whom and how these are carried out depend, among other, on the technology, the size of the development, supply company, and capacity of project development firms. The lack of trained local experts can be a significant problem for the maintenance of the units.

Some of the DG projects development companies ensure their own maintenance. This is usually possible for technologies well-known in Bulgaria, such as hydro and CHP, and when investors or project developers have the needed technical experience. Other firms hire local experts for ongoing maintenance and foreign experts when serious problems occur. Some DG owners are ‘subscribed’ and against certain constant fee, that usually depends on the operational hours, all the costs that might occur for maintenance and repairs are born by the service company. The later provides additional security for the investments especially in the second-hand units (Project developer 2006). Such services are usually used for small-scale CHP units.

Maintenance from the producers of equipment is provided by some supply companies, esp. of CHP units and water turbines which also have established their offices in Bulgaria. For example, the Czech Tedom is sending its experts from the Czech Republic when technical problems occur (Producers’ association, expert 2006). For wind turbines there are still no producers that have established their branches in Bulgaria as for now most turbines supplied are either second-hand or only several are purchased for one producer and it is not economically viable for the producers to invest in representation in Bulgaria.

Technical problems happen also due to failure of onsite equipment, and also, because of sudden big voltage changes coming from the grid which are possible due to the poor condition and the lack of proper maintenance of electricity grid.

Another reason for technical problems or stopping of operation, especially of HPP, are natural disasters. In the recent years there were very serious damages caused by flooding on a number of settlements and infrastructure. Some of the HPP were also affected very badly. However, the units are usually insured and when there were damages, including such that some turbines needed replacement, the costs are born by the insuring company.

5.2. ADMINISTRATIVE PROCEDURES

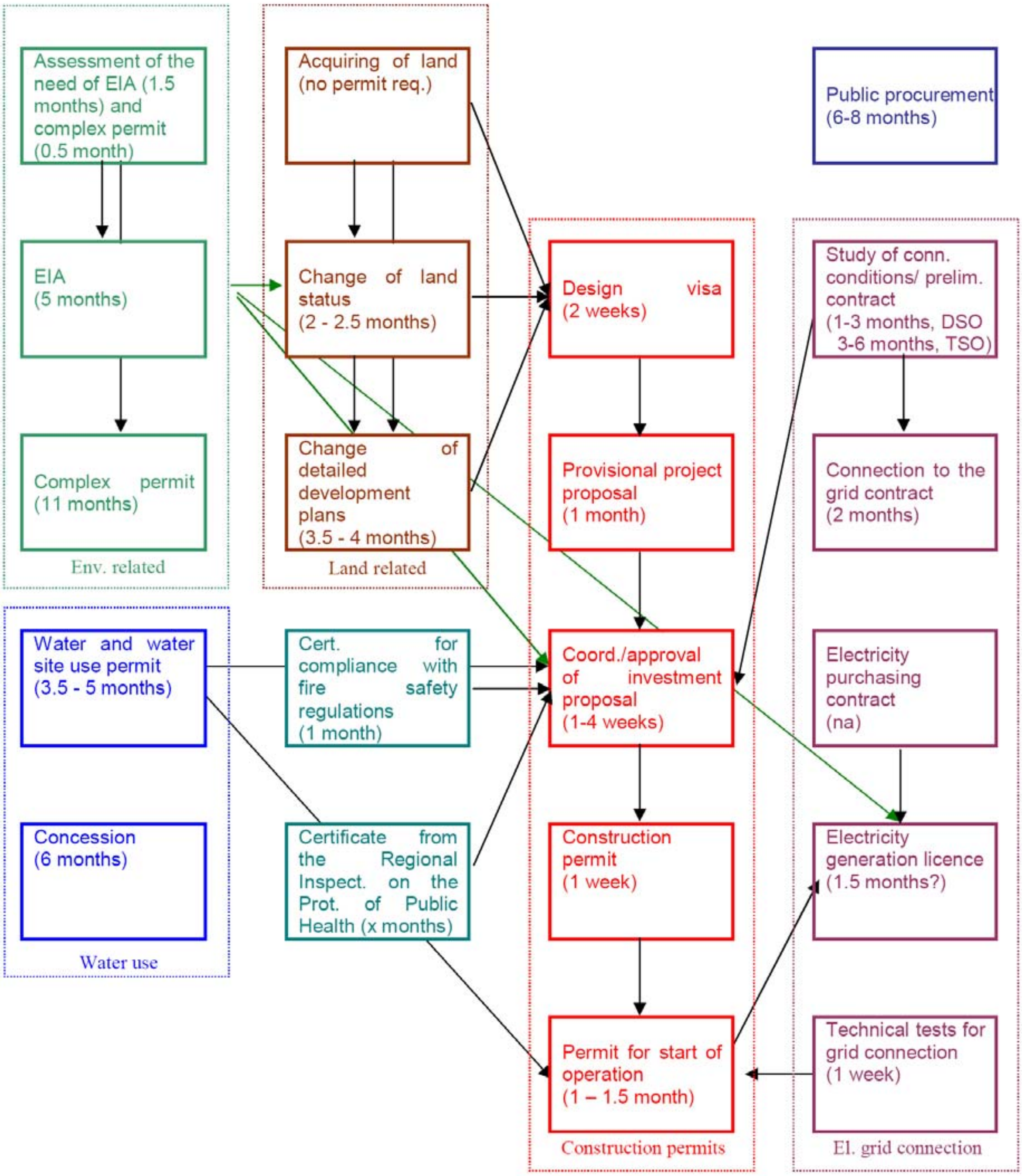
Long administrative procedures constitute a significant limitation to DG projects worldwide (EC 2003a; ENIRDGnet 2003; IEA 2002; Uyterlinde *et al.* 2002). That is why it is very important to know what permits are required, to understand the procedures for their obtaining, and what problems can be anticipated by the investors. That is why, in the following text, detailed account and analysis of the various authorizations required before the start of operation of DG units in Bulgaria is presented. These authorizations or procedures relate to different issues and for the needs of the present study are divided in five groups: (i) land use and planning related procedures, (ii) procedures related to construction, (iii) environmental protection related procedures, (iv) resource use related procedures, (v) electricity/heat generation related procedures, and (vi) other procedures.

The analysis is based on extensive review of existing legislation (as of May 2007) and on interviews with investors and experts. While the list of administrative procedure is comprehensive still as there might be specific procedures for some projects some might have been missed out.

This subsection includes an overview of all authorizations identified which is followed by a summary of the estimated administrative lead time, information on the number of authorities engaged in the process, and analysis of the identified problematic points (or ‘bottlenecks’) in the process.

The complex nature of the authorization process which investors in DG have to overcome is demonstrated in Figure 9 below. The total number of possible authorizations is 20. However, not all authorizations are required for all DG technologies (as presented in Table 10, below). The maximum number of authorizations per technology is 15 – for hydro power plants above 5 MW, and the minimum is 3 for photovoltaics installed on buildings (but there is no experience with this and as the legislation is not clear more might be required in practice). On average for most DG technologies the number of authorizations varies between 11 and 13 and each of this requires a number of steps for its obtaining. This points to the conclusion that the administrative procedures are a serious constraint to DG projects and that is why they are subject of more detailed examination in this research.

Figure 9. Summary of the main authorizations required for DG projects in Bulgaria



Source: own research

The arrows in Figure 9 represent that in order for one authorization to be obtained proof that the previous one has been granted is needed. This interrelation additionally prolongs the time for obtaining the permits and is not strictly followed by investors which try to apply for as many permits at early stage as possible.

Table 10 Administrative procedures and their relevance for various DG technologies

<table>
<tr><th>TYPE OF AUTHORIZATION</th><th>Administrative time</th><th>Hydro (≤5MW)</th><th>Hydro (>5MW)</th><th>Wind (individual)</th><th>Wind (parks)</th><th>Biomass (≤5MW)</th><th>Biomass (>5MW)</th><th>Landfill gas</th><th>Solar (individual)</th><th>Solar (>5MW)</th><th>CHP (natural gas, ≤5MW)</th><th>CHP (biomass, ≤5MW)</th><th>CHP (all, >5MW)</th></tr>
<tr><td colspan="14">LAND USE AND PLANNING</td></tr>
<tr><td>Change of land status</td><td>2-2.5 months</td><td>Likely</td><td>Likely</td><td>Very likely</td><td>Very likely</td><td>Possibly No</td><td>Possibly No</td><td>No</td><td>No</td><td>Possibly No</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td>Change of detailed development plan</td><td>3.5 -4 months</td><td>Very likely</td><td>Very likely</td><td>Very likely</td><td>Very likely</td><td>Very likely</td><td>Very likely</td><td>Likely</td><td>No</td><td>Possibly No</td><td colspan="3">Possible in some cases</td></tr>
<tr><td colspan="14">CONSTRUCTION</td></tr>
<tr><td>Design visa</td><td>2 weeks</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td><td rowspan="5">Possibly No but no practice yet?</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td><td rowspan="5">Yes</td></tr>
<tr><td>Provisional consultation</td><td>1 month</td></tr>
<tr><td>Coord. and approval of investment project</td><td>1-4 weeks</td></tr>
<tr><td>Construction permit</td><td>1 week</td></tr>
<tr><td>Permit for start of operation</td><td>1-1.5 months</td></tr>
<tr><td colspan="14">RESOURCE USE</td></tr>
<tr><td>Permit for resource use</td><td>3.5-5 months</td><td>Yes</td><td>Yes</td><td rowspan="2">No</td><td rowspan="2">No</td><td rowspan="2">No</td><td>No</td><td>No</td><td rowspan="2">No</td><td rowspan="2">No</td><td rowspan="2">No</td><td>No</td><td>No</td></tr>
<tr><td>Concessions</td><td>6 months</td><td colspan="2">In limited cases</td><td>In lim. cases</td><td>No</td><td colspan="2">In limited cases</td></tr>
<tr><td colspan="14">ELECTRICITY/HEAT</td></tr>
<tr><td>El grid study/ preliminary contract (DSO)</td><td>1-3 months</td><td>Yes</td><td>No</td><td>Yes</td><td>No</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes if grid connected</td><td>No</td><td>Yes</td><td>Yes</td><td>No</td></tr>
<tr><td>El grid study/ preliminary contract (TSO)</td><td>3-6 months</td><td>No</td><td rowspan="4">Yes</td><td>No</td><td rowspan="4">Yes</td><td>No</td><td>Yes</td><td>No</td><td>No</td><td>Yes</td><td>No</td><td>No</td><td>Yes</td></tr>
<tr><td>Electricity grid contract</td><td>2 months</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes?</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Licence for energy generation</td><td>1.5 months?</td><td>No</td><td>No</td><td>No</td><td>Yes</td><td>No</td><td>No</td><td>Yes</td><td>No</td><td>No</td><td>Yes</td></tr>
<tr><td>Test for grid connection</td><td>1 week</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes?</td><td>Yes</td><td rowspan="2">Yes</td><td rowspan="2">Yes</td><td rowspan="2">Yes</td></tr>
<tr><td>Setting of feed-in tariffs</td><td>?</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No tariffs</td><td>No</td><td>No</td></tr>
<tr><td colspan="14">ENVIRONMENTAL PROTECTION</td></tr>
<tr><td>Assessment of the need for EIA/complex permit</td><td>0.5-1.5 months</td><td>Yes</td><td>Yes</td><td>Yes</td><td rowspan="2">Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td rowspan="3">No</td><td>Yes?</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>EIA</td><td>5 months</td><td>Not likely</td><td>Very likely</td><td>Only in limited cases</td><td>No</td><td>Not likely</td><td>No</td><td>No</td><td>Not likely</td><td>Not likely</td><td>Not likely</td></tr>
<tr><td>Complex permit</td><td>11 months</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td colspan="3">Only if total load≥50MW_{th}</td></tr>
<tr><td colspan="14">OTHER</td></tr>
<tr><td>Public procurement</td><td>6-8 months</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No?</td><td rowspan="2">No</td><td>No</td><td colspan="2">If state-owned</td><td>No</td></tr>
<tr><td>Coord. - fire safety auth.</td><td>1 month</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
</table>

Source: own research

The Bulgarian legislation provides with maximum time for the consideration of application or request by the relevant authorities. Therefore in the values in the boxes on Figure 9 and in Table 10 show administrative time set out the maximum permissible in the Bulgarian legislation. They represent only the time that is required for decision, completion of documents, and consultations and do not include any of the time for preparation of application or other supporting documentation. The lower of two values is for the cases when no additional documents are required and all the procedures are carried out without any additional prolonging but does not mean that the procedures may not be carried out for a shorter time. Still, it is also possible, and it happens often, that there are delays with the various steps of the authorization process, so in this case the administrative lead time can be much longer.

5.2.1. Authorizations Required

In this subsection overview of the various authorizations required is presented. Detailed account of the steps, actors, administrative time, and the legal base is included in the tables in Annex II.

5.2.1.1.Land Use and Planning Procedures

The construction of DG units can be done on land that has a designation for being for industrial purposes. With the exception of CHP units, which are in most cases constructed within existing industrial sites, and of photovoltaics, which in most cases are installed on buildings, most of land that is acquired for wind, hydro and biomass on new sites is not designated as industrial but as agricultural and forests and its designation should be changed.

In addition, the land on which the unit is to be constructed should be included in a detailed development plan for which a lengthy procedure should be followed. At present, there is no obligation for setting up of areas designated for the development of renewable energy projects in the local planning documents.

Change in designation of agricultural lands and of forestry lands

Altering the designation of agricultural lands to industrial requires 3 steps (see Table 23, Annex II) and of forestry to industrial requires 4 steps (see Table 24, Annex II). Prior to the initiation of the process an EIA scoping is required and if needed a complete Environmental

Impact Assessment (EIA) (Law for the Preservation of Agricultural Lands (LPAL), National Assembly 1996, last amend. 2003). Once the investor has positive decision regarding EIA the legally prescribed time for the procedure for a change of the status of agricultural lands should take about 2.5 months and for the exclusion from the State Forestry Fund - about 2 months.

Change of detailed regional development plans

The spatial organization of territory in Bulgaria is established in Regional, General and Detailed Territory Development Plans. With direct relevance to DG are the Detailed Territory Development Plans (know as PUP in Bulgaria) which in most cases should be modified prior to projects' realization. Several procedures for the change of PUP might be required for one DG project, i.e. for the site on which the installations are to be constructed, for the place where the electricity substation will be built (for large capacity projects), for the track through which electricity cables are passing through.

The modification of PUP is rated by investors interviewed as one of the most elaborated and time consuming steps. The process is the same as if entire new PUP is developed which makes the process complex – includes about 8 steps - and is time-consuming (see Table 25, Annex II). The minimum administrative time, if the legally set timeframe is observed, is 3.5 to 4 months, excluding the development of the draft PUP. When the project covers more than one municipality changes of the General Development Plan might be required. The procedure for this is more complex and will not be discussed as it is only relevant for large-scale developments.

5.2.1.2. Procedures Related to the Construction

According to Bulgarian legislation, in particular the Law on Spatial Development (LSpD) (National Assembly 2001, last amend. 2006), the investment projects consist of several phases: provisional project proposal, technical project, and working project.

Several types of authorizations are needed while planning, developing and bringing into operation DG units. These are: (i) design visa, (ii) provisional project proposal consultation, (iii) coordination and approval of investment project, (iv) construction permit, and (v) permit for the start of operation. To obtain these five authorizations nine steps in total, excluding if there are requests for additional documentation, should be undertaken as presented in Table 26, Annex II. The maximum administrative time for all of them is about 4.5 months.

Some investors interviewed report for delays with the issuing of construction permits. There was even a case when the permit for the start of construction works was issued after the works were completed which was possible because of the lack of control and enforcement capacity of the public authorities or a ‘flexible approach’ of not ‘noticing’ the incompliance.

5.2.1.3. Environmental Protection Procedures

Three types of environmental authorizations are related to DG, i.e.: (i) preliminary assessment (or scoping) for the need of Environmental Impact Assessment or Complex Permit, (ii) Environmental Impact Assessment (EIA), and (iii) Complex Permit.

The majority of DG proposals do not fall into the category that requires compulsory EIA according to the Environmental Protection Law (LEP), (National Assembly 2002, last amend. 2006). However, most of them need to undergo screening for EIA. The list includes: (i) industrial installations for the generation of electricity, steam and hot water below 50 MW, (ii) hydro power plants, (iii) wind turbines, and (iv) primary forestation or deforestation with aim change of the status of land use. If after this assessment it is considered that they will have adverse environmental impact then a complete EIA is required.

The complex (or Integrated Pollution Prevention and Control (IPPC)) permit is issued for certain type of installations that are causing pollution. For DG such a permit is needed only for CHP units part of bigger district heating companies or industries and have total thermal installed capacity of more than 50 MW (LEP).

Assessment of the need of Environmental Impact Assessment (EIA) and/or of a complex permit

The investor is obliged to inform of its project the relevant public authorities and stakeholders at stage pre-investment studies (Regulation on EIA, Council of Ministers 2003, last amend. 2006). The procedure consists of five steps (see Table 27, Annex II) and the administrative time for obtaining decision on the need of EIA is about 1.5 months and for the complex permit about 0.5 month. The documents required for the EIA screening are very elaborate and according to some investors are a ‘small EIA’.

Environmental Impact Assessment (EIA)

Once there is a decision that the investment proposal should undergo detailed assessment of its environmental impacts, an EIA report should be developed. The EIA report is prepared by a team of certified experts who are hired and paid by the investor. The length for the elaboration of the assessment depends on the type of distributed generation source, local conditions and thus the time for its preparation is case dependent. Once the final report is prepared the administrative time for carrying out all procedures for its approval is about 5 months. More information on the all eight steps of the process is provided in Table 28, Annex II .

The fact that EIA report is paid by the investors makes some environmental protection NGOs question the credibility of its conclusions. Also it is probable that investors would not like to hire experts that might come to a negative EIA conclusion and stop the project. The practice confirms this and no EIA report had a negative conclusion. There is also big discrepancy between the depth of different EIA reports with some teams of experts carrying out detailed field studies while others conducting mainly review of existing research.

Some NGOs also argue that the public consultations are not announced properly accusing that when investors are concerned that there might be an opposition, they are trying to prevent them from participating or for not integrating their concerns in the minutes. On the other hand some investors accuse environmental NGOs for blackmailing and unreasonably stopping their projects. In the recent years some of the positive EIA reports were contested at courts by NGOs. At the end most of them were won by the investors. This caused financial problems with the NGOs that had initiated the appeals, but also, financial losses for the investors due to the delays.

A serious criticism from investors' point of view is that a lot of 'irrelevant' information is collected and included in the EIA on the characteristics of environment. This is indeed an essential part of the EIA, but in some cases, the expert teams prepare a very detailed scientific research of the area and investors argue that they will be glad to learn more on possible impacts and the ways they are mitigated than to read long scientific reports.

Complex permit (Integrated Pollution Prevention and Control (IPPC) permit)

The process of obtaining the permit is very complicated - includes 13 steps - and time-consuming (see Table 29, Annex II). The maximum time for passing through all the administrative procedures, without the preparation of the assessments needed, should be approximately 11 months, if no additional documents are requested and all the deadlines are met. Serious delays with this permit were reported by investors.

5.2.1.4. Resource Use Procedures

Of all DG technologies, only hydro resources require the issuing of permit for resource use. Depending on the case, permits for water use and for water body use or concession are required.

Permits for water and water body use

According to the Law on Waters (National Assembly 1999, last amend. 2006) the permits for water use and for water body use are required in all cases when more than 10 m^3/day are diverted from the river, except if water is not diverted from the water course and a turbine of maximum capacity of up to 20 kW is installed. In the cases both permits are required then a single one is issued.

For the application a standard set of documents is required, including EIA or decision that it is not necessary. If all the deadlines are observed the minimum time for issuing of the permit is about 3.5 months and the maximum about 5 months. Details on the seven steps of the process that have to be followed are presented in Table 30, Annex II. Once issued specific requirements for water and water body usage are specified in the permits. These include, among others, provisions on distribution of permitted volumes, on the minimum permissible stream flow into rivers, and on monitoring requirements. However, representatives of NGOs report of the lack of enforcement of these obligations.

From the Law on Waters it is not clear what happens if there are several applications for one place and there are a number of cases when such problems occur. Sometimes there are also concurrent requests for the extraction of gravel and for the placement of HPP.

Concessions

It is not very common for DG projects to require concessions and therefore the process will not be discussed in detail. The cases relevant to DG projects for which concession is to required are: (i) the use of water sites and connected to them water systems and equipment that are public property, (ii) construction of new hydrotechnical, hydroenergy systems and equipment, and (iii) the use of state or municipally owned forests (Law on Waters (LW), (National Assembly 1999, last amend. 2006) and Law on Forestry (LF), (National Assembly 1997, last amend. 2003)).

The issue of concession contract is a long process with compulsory tender procedure and involves many public authorities. It is difficult to provide exact figures on the timeframe as in many cases some of the decisions are contested at courts which prolongs the procedure. However, the maximum administrative time set in the Law on Concessions (National Assembly 2006) for a decision once tender documents are submitted is 3 or 2 months (depending on the type of tender) and if there are no appeal procedures initiated the contract should be signed within 3 months.

5.2.1.5. Electricity/Heat Generation Procedures

The electricity generation procedures that should be followed before the commercial feeding of electricity to the electricity grid are: (i) study for connection to electricity grid and preliminary contract with the distribution/transmission system operator (DSO/TSO), (ii) licence for electricity generation for units with capacity of more than 5 MW, and (iii) technical tests for the start of operation. The heat generation related procedures are not analysed as they are carried out simultaneously to those for electricity generation.

Request for a study of conditions and the way of connecting to electricity grid and preliminary contract

A study must be prepared by the nearest to the site DSO if the installed capacity is less or equal to 5 MW or by the regional sub-unit of the TSO for installed capacity of more than 5 MW (Regulation 6 from 9.06.2004, (MEER 2004c)). The applicant should request the study to be prepared by the DSO or TSO and the fee for the study should be standard and predetermined by the operator.

The DSO/TSO are obliged to connect distributed generation units to the grid as stipulated in the Law on Energy (LE) (National Assembly 2003, last amend. 2006). However, temporary rejection of the request is possible based on technical inability to meet the proposed connection date but an alternative timeline should be proposed (MEER 2004c). Nevertheless, DSO/TSO often use their monopoly to try and prevent the new entrants and one of the ways to do this is to refer to technical problems that prevent connection. In addition, although it is clearly formulated in the Energy Law when the units should be connected to the distribution and when to transmission network it is very common that the DSO are trying to direct applications to the TSO. This additionally slows and complicates the process.

The preliminary contract for connection includes, among others, agreement on the sharing of the connection costs (MEER 2004c). They should be born by the DSO/TSO but the applicant can also take the responsibility for this. In the latter case the ownership of the infrastructure constructed by the project proponent should be transferred to the DSO/TSO while the construction costs are to be deducted from the connection fee as agreed in the contract for connection.

The minimum time for the whole procedure is 30 or 90 days depending whether the connection is to distribution or transmission grid. It is difficult to determine the maximum time as the application might be redirected to distribution company (delay of 1 month), or there might be requests for completion of the dossier (maximum delay 1.5 months) and for the submission of additional information (14 days for each request). Based on the existing practice numerous additional documents or clarifications are required which prolongs the whole procedures. The detailed account of the relevant – nine – steps for obtaining of a connection to the grid contract is provided in Table 31, Annex II.

Shortcomings of the way the connection costs are determined and issues related to unfair competition practices of the DSO/TSO is included in Section 6.2.1.2, page 122.

<u>Licences for electricity generation and for electricity and heat generation</u>

Licences for electricity generation and for heat and electricity generation, in the case of CHP, are required for plants with total installed capacity of up to 5WM which is issued by the State Regulator (LE). A decision whether a licence is to be given shall be made by the Regulator and once the unit is constructed a second review of the documents and construction is carried out and a permit for the commencement of exercising of licensed activity is issued. The whole procedure includes five steps and the administrative time is about 2.5 months (see Table 32, Annex II).

Procedure for connection to electricity grid

The connection of new power plant to electricity grid is carried out in three phases: (i) testing of the connection equipment for 72 hours, (ii) testing of electrical equipment of the power plant for 72 hours, and (iii) parallel connection to the grid (MEER 2004c). The tests are performed by the experts of the DSO/TSO.

5.2.1.6. Other Procedures

Procedures that do not fall within the above mentioned categories are public procurement rules for the state owned enterprises and certificates for coordination or approval from other relevant institutions, such as the fire safety and public health authorities. Additional certificates might also be required. For instance, for the import of some equipment an investor had to apply for additional authorization as some of its elements were categorized as such with possible ‘double use’, i.e. for military or other uses.

Public procurement procedures

For state-owned companies public procurement procedures are to be followed according to the procedures laid down in the Law on Public Procurement (National Assembly 2004, last amend. 2006). For example, DHC-Varna was still state-owned when a project for the installation of CHP was realized. They had to announce two procedures: for the obtaining of the bank credit, and for purchasing of equipment. The procedure is slow and is not very well fitted to the specific needs of DG projects but is essential tool for corruption prevention. As privatization is well advanced now and thus it is not very common for DG projects to undergo this procedure it will not be discussed in detail. Still, it should be mentioned that public procurement procedures might cause additional hindrances and delays, especially for projects initiated by municipalities or for the remaining state-owned DHC. Based on investors accounts the procedure last about 6-8 months.

Certificate for compliance with fire safety rules

Upon written request and submission of construction, technical and technological and other relevant documentation the site should be examined by the National Directorate Fire and

Accident Safety (IBA 2006d). Within 1 month a certificate of the application certificate, which is valid for 3 years is issued by the Director of the National Directorate Fire and Accident Safety.

Investors report that there are significant problems with the obtaining of the certificate. According to them not only that the administrative times are not respected but the fire safety experts are not well acquainted with the specifics of CHP installations and impose requirements that are not necessary for the safety, and in some cases, even prevent the normal functioning of the units. Some investors also mention corruption as a probable reason behind and an easy solution of the complications.

Coordination with the Regional Inspectorates on the Protection of Public Health

A certificate that there are no threats to public health associated with the project development is required for the approval of investment proposal. An investor reported that it took him about 2 months for its issuing which according to him is too long for a certificate that it not relevant to renewable electricity generation project – wind turbines in the case mentioned.

5.2.2. Administrative Lead Time

Lead time is the time that is required to complete all transactions from the initial project idea to its realization (i.e. when electricity is sold to electricity grid) (Skytte *et al.* 2003). There are two types of lead time: techno-economic and administrative, described in the literature (Skytte *et al.* 2003). In the present research only the administrative lead time is studied because it depends mainly on the country's legislation, the type of DG technology and the installed capacity. In general this time is also less dependent on the project developers and it might be more difficult for them to predict its duration and hindrances if they do not have significant previous experience. By contrast, the techno-economic lead time involves mainly technical issues, such as site selection, availability of the resource, selection of equipment and economic evaluations and is usually well-known by the investors.

Table 11 below shows the administrative time required by the relevant authorities to respond and decide on application, the time for which stakeholders have to provide their comments on the procedures and for the investors to complete their applications if information is missing. The minimum case includes the shortest administrative deadlines included in Bulgarian legislation. It is based on Table 10, page 91. The procedures marked as possibly 'no', 'not likely' and 'likely', that were used in Table 10 are excluded in the minimum case. The maximum case includes almost all possible procedures and the maximum administrative time as included in the legislation. For both cases concessions, complex permits and public procurement procedures are not included in the cited figures as they are not very likely to be required for the majority of DG projects. Also, the time for decisions on feed-in tariffs for CHP units is not included. The different times are calculated as if the procedures are executed one after another and there is no overlap.

Table 11. Minimum and maximum administrative time-lags (in years) for consideration of various applications for DG developments

	Hydro ≤5MW	Hydro >5MW	Wind (ind.)	Wind (parks)	Biomass ≤5MW	Biomass >5MW	Landfill gas	Solar (ind)	Solar >5MW	CHP all ≤5MW	CHP all >5MW
MIN	1.4	2.1	1.3	2.0	1.1	1.4	0.8	0.3	1.1	0.7	1.0
MAX	2.0	2.8	1.6	2.4	1.4	1.8	1.4	0.4	1.5	1.3	1.7

Source: own research

The shortest administrative lead time of 4 to 5 months is for photovoltaic installations at individual building when no permits related to construction are required. Surprisingly, large-scale wind developments require less time (2 to 2.4 years) than the large-scale hydro (2.1 to 2.8 years) mainly because of the water and water site use permits to be obtained. However, if the time for the evaluation of resource and for the preparation of EIA is included the wind farms developments will undoubtedly require more time than hydro unit. When the complex permit is not required for CHP units the administrative lead time is shorter than the other technologies. Projects for landfill gas use are also among those with shortest administrative lead times (0.8 to 1.4 years), but also, only small units can be installed on them and in this case the transaction costs might be too high. In addition, there is no feed-in tariff for electricity generated from landfill gas and no willingness from the local authorities to permit this use of landfills which stalls the development of such projects.

Another conclusion that can be drawn up from Table 11 is that there is a difference but not significant in the administrative lead times between small- and large- scale projects. This means that for very small-scale projects the administrative lead time and associated costs can be prohibitory high. The only facilitation is that when the units are less or equal to 5 MW[8] they have to be connected to distribution network and no license for energy generation is required and that for hydro projects below 20kW no water permit is required.

[8] That is why Table 10 and Table 11 the units are differentiated in two groups – with capacity ≤5 MW and <5 MW.

In practice based on the interviews the administrative lead time for application's preparation and for obtaining all permits varies a lot. For example, for small-scale HPP it can be 2 or 3 years. For large-scale wind developments it is about 2 years but only if the procedures are carried out simultaneously. Some investors suggested that it can take as much as 5 to 6 years if they follow the legally set sequence and do not pursue actively the issuing of various permit. In the meantime the validity of some of the permits might expire. For CHP the time is usually between 1 and 2 years but often there are delays with the complex permit and it not uncommon that it is issued after the unit starts its operation.

5.2.3. Administrative Fees

Different administrative fees are collected by the public administration during the process of obtaining various administrative authorizations. There are one-off fees that are to be paid when an application for authorization is filled but there are annual costs, such as resource use fees, and licences. Some of the fees are determined at national level and same for the whole country but some of the one-off fees are set up at local level and thus there are regional variations of the costs.

The administrative fees vary but in general are relatively low and not seen as a barrier by the investors. One of the 'cheapest' procedures is the issuing of design visa which is determined locally by the respective Municipal Council and is about EUR 10 (IBA 2006b). The highest fees are collected in the case of application for the issuing of a complex permit - depending on activity the fee is between EUR 250 – 5,000 (Council of Ministers 2004b), and for the issuing of licences for electricity and heat generation. For the later, there are three types of fees: (i) fee for review of application or fee for the modification of already issued licence (each is about EUR 500), (ii) initial fee for licence issued (about EUR 7500), and (iii) annual fee (about EUR 1 100 plus 0.055% of the annual income of the company) (Council of Ministers 2004d));.

Although the level of administrative charges is acceptable, apart from them, there are a number of additional costs for the preparation of the various application supporting documents and for the following of the procedures. However, these are very specific for each project and are not quantified in the research.

5.2.4. Authorities Involved

The large number of authorities involved in the administrative procedures related to authorization of DG projects is another serious burden. A summary of the main authorities and actors that participate in some way in decisions regarding different authorizations of DG projects is provided in Table 12. The number of institutions, actors listed in the table is about 35, including the various committees, but not all of them are engaged in the authorizations required by individual DG technology. The maximum number of authorities and actors per one technology is about 22 which is the case for large hydro power plants (above 5 MW). On average there about 19 authorities are involved in the process which makes it rather complex. The highest number of authorities, committees, and individual state actors are required for the construction permits. The minimum number is 1 for individual photovoltaic installations at buildings at residential and tertiary sector but this figure includes only authorizations related to connection to the grid. As there are no many practical examples it might be the case that in some regions construction permits are also required which might increase the number to 13.

The numbers provided above do not include mainly public authorities (and the DSO/TSO) other stakeholders, such as general public, NGOs, various experts and consultants, other businesses, have not been counted as the aim of the research is to investigate the role of the public sector. However, one has to bear in mind that there is a large number of stakeholders which additionally complicates and prolongs the process.

Table 12. Main institutions and actors involved in administrative procedures related to DG projects

LAND USE AND PLANNING RELATED PROCEDURES	
Change in designation of agricultural lands	
Main institutions	Commissions to the regional directorates Agriculture and Forests (1) or Commission for the Farm Lands (2), Mayor of the Municipality (3)
Additional	Cadastre Agency (4)
Change in designation of forestry lands	
Main institutions	Commission to the National Forestry Directorate (NDF) (5)
Decision	Council of Ministers (proposal of the Minister of Agriculture and Forestry) (6, 7) or the Minister of Agriculture and Forests (proposal of the Director of the NDF) (8, 9)
Change of detailed regional development plan	
Main institutions	Municipal Mayor (10), Chief Municipal Architect (11), Municipal (or National) Expert Committee (12, 13)
Consultation	Other interested institutions, general public
Decision	Municipal Mayor, or Regional Governor (14), or Minister of Regional Development and Public Works (15)
PROCEDURES RELATED TO THE CONSTRUCTION	
Design visa	
Decision	Chief Municipal Architect
Provisional project proposal consultation	
Main institutions	Chief Municipal Architect

Consultation	Municipal or National Expert Committee (16, 17)
Decision	Chief Municipal Architect, or Regional Governor, or the Minister of Regional Development and Public Works
Coordination and approval of investment project	
Main institutions	Chief Municipal Architect, Expert committee of the approving administration (18) or independent licensed firm
Consultation	Fire Safety Authority (19), Regional Inspectorate on the Protection and Control of Public Health (20), other relevant institutions
Decision	Chief Municipal Architect, or Regional governor, or the Minister of Regional Development and Public Works
Construction permit	
Decision	Chief Municipal Architect, or Municipal Council (21) and Chief Architect of the Region (22)
Permit for start of operation	
Main institutions	Directorate for National Construction Supervision (DNCS) (23), Special committee (24)
Additional	Cadastre Agency, DSO/TSO (25, 26)
Decision	Director of DNCS
ENVIRONMENTAL PROTECTION RELATED PROCEDURES	
Assessment of the need of Environmental Impact Assessment (EIA) and/or of a complex permit	
Decision	Director of the Regional Inspectorate of Environment and Waters (RIEW) (27) or the Minister of Environmental Protection and Waters (28)
Environmental Impact Assessment (EIA)	
Main institutions	RIEW, MOEW, regional authorities
Consultation	Interested stakeholders
Decision	Director of the RIEW or the Minister of Environmental Protection and Waters
Complex permit (Integrated Pollution Prevention and Control (IPPC) permit)	
Main institutions	EEnA (29), RIEW, MOEW, Municipality
Consultation	Interested stakeholders
Decision	Minister of Environmental Protection and Waters
RESOURCE USE RELATED PROCEDURES	
Permits for water and water body use	
Main institutions	Basin Directorates (30), MOEW, Municipal Mayor, Specially appointed Commission (31)
Consultation	Interested parties
Decision	Basin Directorate Director or the Minister of Environment Protection and Waters
Concessions	
Main institutions	Council of Ministers, Ministry of Environment and Waters, Ministry of Economy and Energy (32), Minister of Agriculture and Forestry, Regional Water Basins Directorates, Regional Governor, Municipal Mayor and Municipal Council, National Forestry Directorate (33)
ELECTRICITY/HEAT GENERATION RELATED PROCEDURES	
Request for a study of conditions and way of connecting to electricity grid and preliminary contract	
Main actors	Distribution or transmission system operators
Contract for connection to electricity grid	
Main actors	Distribution or transmission system operators
Licences for electricity generation and for electricity and heat generation	
Main institutions	State Energy and Water Regulatory Commission (34)
Procedure for connection to electricity grid	
Main actors	Distribution or transmission system operators
OTHER PROCEDURES	
Public procurement	
Main institutions	Ministry of Economy and Energy, Public Procurement Agency (35)
Certificate for compliance with fire safety rules	
Main institutions	National Directorate Fire and Accident Safety
Certificate for compliance with health safety rules	
Main institutions	Regional Inspectorate on the Protection and Control of Public Health

Source: own research

Note: the figures in brackets are used for counting of the authorities engaged in the process. They indicate that it is the first time authority is mentioned (commissions and special actors are counted separately).

5.2.5. Administrative 'Bottlenecks'

It is difficult to evaluate whether there are such and if so which of the administrative procedures and thus actors or institutions represent a 'bottleneck' to DG projects. The interviews with investors revealed that they have encountered problems virtually with all institutions but while some mentioned one institution as the most obstructive others praised it for its support. According to investors interviewed some institutions were helpful and ready to provide guidance regarding the various procedures. However, in many cases investors stated that the ease of obtaining some authorization depended on investors' networks or devotion of time for regular 'reminding' of the requests.

Most 'complaints' from investors interviewed were related to environmental protection authorizations, i.e. obtaining of EIA or complex permit from the MOEW and RIEW. Regarding the EIA the slow consideration of relevant documents was said to be most common problems. Two investors even claimed that they were asked for bribes by a very high ranked civil servant so that no problems with the EIA are encountered. In some cases, final decision on the EIA is delayed until the maximum time set in the legislation, even if there are no problems which according to investors, are because they do not want to pay bribes in order for the process to be speeded up.

Problem with the complex permit for CHP units is that cannot meet existing emissions targets. Several investors in cogeneration using gas piston engines mentioned that as the permissible pollution norms are determined for natural gas-fuelled turbines and not for piston engines and it is very difficult for the norms to be met but the relevant authorities lack trained people to understand the problem and willingness to provide support. Apart form this problem there are many delays in the issuing of complex permit and accusations of bribes as well.

Another set of procedures that were pointed out by the investors as causing 'horrible problems' are those related to land use and change of the detailed development plans. Some investors claim that the relevant local authorities do not observe any legally set deadlines and are corrupt. Also that as there is no direct state control it is difficult to make them accountable for their actions. Nevertheless this is not true for all projects. Attracting investments, especially of large ones, is highly desired by many local authorities. Some investors acknowledged that that the regional and local authorities were very helpful and without their assistance their projects would not have been realized.

Another permits that involve environmental protection and local authorities for which issuing some investors had significant problems are the water and water site use permits.

Investors also pointed to the fact that the distribution and transmission companies are, in many cases, trying to prevent their entry and hence create them a lot of bureaucratic problems which are discussed in detail in Section 6.2.1.2, page 122. The Energy and Water Regulator is also commonly pointed as a serious constrain to DG penetration in Bulgaria. This is especially true for CHP projects for which the feed-in tariffs are determined on the cost plus model and the investors consider that their returns are kept very low (about 4 to 8%) and for renewable technologies for which there were no feed-in tariffs for a long period of time. This was also the case for photovoltaics and biomass for which preferential tariffs were adopted as of January 2007 (pv) and July 2007 (biomass). This delay stalled any developments for these two sources. More analysis on the role of the Regulator is included also in Section 6.2.1.2, page 122.

5.3. INVESTMENT COSTS AND PAY-BACK TIMES

Due to the fact that almost all DG equipment is either imported or produced in Bulgaria under licenses of international firms the investment costs for DG projects might be considered close to the international ones. Still, there are several major differences. First, the costs for project development and implementation are lower as in many cases they are carried out by local experts. Second, financial limitations made many investors purchase second-hand equipment, which in some cases, is significantly cheaper than new one. Third, the unstable DG support framework increases the investment risk perceived and therefore the conditions of bank credits are less favourable increasing pay-back times. In addition, significant impacts on the pay-back time have feed-in tariffs. Another factor is the possible changes in natural gas prices.

In the following text summary of the information collected from field research in Bulgaria during August and September 2006 is provided (the list of investors interviewed per technology is included in Annex IV). At the time of the research there are no projects for biomass or solar electricity generation and therefore no information on the actual investment costs for Bulgarian can be provided.

Investment Costs

Information from interviews shows that the average investment needs for new CHP units at DHC in Bulgaria are about EUR 580-600 per installed kWe (all development and equipment costs are included). It should be noted that it is cheaper to install units at existing DHC sites as in most case there is land, infrastructure, and processes (water pre-processing) available. When steam or hot water is used for some industrial processes this might require additional adjustments and costs. For some second-hand units at DHC the investments per kWe installed can be as low as EUR 230-240 or if the connection costs are included - up to EUR 340 EUR/kWe.

For large-scale wind developments when new equipment is purchased the costs are about EUR 1100 - 1400 EUR/kWe. It is difficult to provide reliable figures on the cost of second-hand units as it varies a lot but for some projects in Bulgaria the costs were about 400 EUR/kWe. According to some investors for some second-hand units investors have to pay only the transportation costs which depend on distance but can be about EUR 70-80 000 to transport a unit at 500km.

The overall costs for the construction of new HPP are between 500 to 750 EUR/kWe. Part of equipment can be purchased in Bulgaria as it is produced under international licence. In these cases the costs are closer to the lower limit but some investors prefer to import equipment as they consider it more reliable. No information on second-hand units was collected but purchasing old units is much more limited than for wind or CHP.

According to the investors interviewed one of the ways for the reduction of investment costs is to hire local experts. Apart from the large investments in wind farms all of the investors interviewed mentioned that they used Bulgarian experts in the preparation of prefeasability, economic and technical studies because it is cheaper and local experts are more aware of typical issues for Bulgaria. For example, for the technical study for the installation of CHP unit at one of the DHC a foreign consulting firm asked as much as EUR 400 000 and at the end it was prepared for EUR 4 000 by experts from the DHC. These experts were better acquainted with the specific conditions and therefore there were almost no problems during project's implementation and operation of the units or if there were problems they were fixed very easily as the experts were onsite and new the project from its start (Project developer

2006). For dismantling and shipping from the UK of second-hand CHP units the investors in another DHC were asked to pay EUR 120 000 but by sending five of their experts it cost them only EUR 50 000 and was done in a very short period of time – about 20 days.

Not all parts of project preparation are performed by local experts. In some cases as the preparation of Joint Implementation (JI) financing application and the purchasing of second-hand equipment investors usually use foreign consultancies with representations in Bulgaria as there is not enough experience with Bulgarian owned firms.

Pay-back Times

According to the investors interviewed the average pay-back time for CHP projects in DHC in Bulgaria is about 5-7 years but this is very much dependent on heat demand for which the unit is designed, preferential feed-in tariffs and natural gas price. For example, for one DHC initially the calculations were that the pay-back time will be about 4 years but after the Regulator gave them very low tariff for electricity purchasing they think that it might take them as much as 20 years. In this case some of the investors delay their payments for natural gas to Bulgargaz and replay their credit for the CHP unit. Still, investment in CHP is considered as one of the very few ways to make some profits from DHC as the prices of heat and hot water are low.

The pay-back time for small-scale CHP installations varies a lot, depending on their use. In some exceptional cases this can be as short as a couple of months. This is the case when CHP is used as back-up power for industrial processes for which each power shortages, that are still very common for Bulgarian electricity system, can cause huge losses. For instance, in a factory for diary products, cuts in the electricity supply were causing breaks off in the processes about 2 to 3 times a week. For each the losses were from BGL 1000 to 30 000 (EUR 500 to 15 000), depending on the production phase. With the installation of a second-hand CHP unit that runs as a back-up power generator there were no interruption and the investment was repaid for 2 months.

Very short pay-back times are also common for industries that have high heat demand, such as the production of vegetables in greenhouses where second-hand unit can be repaid for about 1 year. According to some suppliers, depending on the operational hours second-hand small-scale cogeneration units can be repaid for 2 heating seasons (if they do not work during the hot seasons) or 1 year (if they operate on a constant annual load). For new units the pay-back time is usually twice these of second-hand ones.

The pay-back time for HPP also varies a lot. Most investors interviewed mentioned that on average it is about 4 to 6 years for new projects but there are also examples for projects for which the return of investment can be as short as 3 years.

The longest pay-back times are for large-scale wind developments. That is why it is important to obtain long-term bank credits. In these cases investors are interested for how long their contribution to the project will be returned. For example, for a project with 20% own capital and 80% credits from banks the pay-back can be about 3.5-4 years for the own capital and about 15 years for the banks. Such short own capital pay-back times are possible after the adoption of very favourable feed-in tariffs for wind generation which came in force from January 1, 2007. No data were obtained on the rate of return for small-scale wind developments.

5.4. SUMMARY

The investment process in DG technologies in Bulgaria has many similarities with investments in any other sector, such as development of pre- and feasibility studies, finding and negotiating with partners, purchasing land and equipment, and has distinctive features and problems. First, an important difference is related to finding proper site, determining resource potential and choosing the best technology for the circumstances as these depend on data to be collected over long period. If the site or technology is not chosen properly the whole project might turn into significant financial loss. In Bulgaria there are general data on potential (for wind, hydro and biomass as discussed in Section 2.7, page 24) and detailed evaluations are prepared by local experts, except for the wind developments for which internationally certified firm should carry out the measurements.

The second specific characteristic of DG project is that they are still perceived as high risk projects and therefore it is more difficult to obtain bank credits. Securities that are required are high and because of this projects are mainly carried out by investors who have other business as a main source of income that can be put on mortgage which posses a huge limitation to investments. In most of the cases for now CHP units are constructed at existing DHC or industries which assets can be used as credit securities. For large-scale wind developments long-term credits are possible to be obtained as the developing firms are well-known foreign ones wit good credit rating.

A third significant problem and limitation is the lack of qualified experts especially in new technologies, such as wind, some CHP and photovoltaics or the lack of enough information on the technical characterises of second-hand units. This can be a significant hindrance during the maintenance and operation of units. Although there are very well trained engineers in Bulgaria but as the technologies are rather new there are still not enough people who can carry out maintenance and retrofitting of units. Due to the small size of DG market in Bulgaria there are also not enough international firms that have their representations and offer technical support which means that if there are problems with equipment it might take quite some time for them to be fixed. Another problem is the lack of trained experts in the public authorities.

The last difference and constraint is the obtaining of various permits. On average 11 to 13 different authorizations are required and the administrative lead time is on average 2 years. The minimum number of authorizations is 3 with the administrative lead time of 0.3 years (for individual photovoltaics) and the maximum is 15 which means administrative lead time of about 2.8 years (for HPP of more than 5 MW). There is almost no preferential treatment for DG projects apart that for projects below 5 MW – no licence required and the grid connection is to be to distribution network and for HPP below 20kW – no water use permit required. On the contrary there is preferential treatment for large-scale projects under the Law on the Encouragement of Investments (National Assembly. 1997, last amend. 2007) for which administrative procedures can be one third shorter in time (see Section 3.2.1, page 41). This and the fact that the investment costs are high and there have not been feed-in tariffs for photovoltaics and biomass until recently makes the realization of projects utilizing them very difficult and virtually impossible.

As for how easy is to obtain the various authorization very indicative is the following quote from an interview with investor:

> *'To obtain the various permits depends on how much one pushes for it. There is no one unified system or way through which the various permits are obtained. There are many different ways to get them and it is up to the investor to pursue its interest and to press for the fastest way and to convince the officer. That is why one Law that regulated this is needed.' (Investor)*

One project developer who had realized a number of DG projects went further and described bureaucratic requirements as a 'state terrorism'.

There is a large number of authorities (as many as 35 related in some aspect to DG and with about 19 on average per DG technology) involved in the process which is another hindrance to the investments. Moreover, while some of the institutions are very supportive others are slow in their responses, not complying with the legally set deadlines, and lack capacity to deal with DG projects. In some cases corruption is also a problem.

The investment costs are also different, depending on the type of DG technology, but are close to international once as there is no local production apart from some hydro, which are produced under licence, and some parts of CHP units. Due to the high investment costs for new units second –hand wind and CHP turbines are quite common in Bulgaria. The return of investment can be as short as a couple of months for CHP units used in some industries or as long as 20 years for large-scale wind developments. The lack of investment support scheme specially targeted at very small-scale units and all other limitations that were already discussed makes highly distributed electricity generation systems very limited in Bulgaria.

6. BARRIERS TO DISTRIBUTED GENERATION IN BULGARIA

The main legal and policy prerequisites for the promotion of DG in Bulgaria already exist. For example, there is an indicative target of 11% contribution of renewables in domestic electricity consumption by 2010, obligation for the connection of DG with certain capacity to the grid, mandatory purchasing of whole volume of decentralized generated electricity, and preferential tariffs as described in Section 3, page 35. However, the share of DG in electricity generation is minimal because of a number of barriers that still exist. In this chapter analysis of the main barriers, i.e. (i) policy, regulatory and administrative, and (ii) economic, that prevent the wider penetration of DG in Bulgaria is presented. Both are considered equally important and limiting to DG in Bulgaria as it is essential to have both enabling regulatory framework and sufficient financial stimuli for investing in DG.

In addition, a brief overview of environmental and technical constraints is also included. As the renaissance of nuclear power might have negative impact over the need for more capacity and thus might impede the installation of new DG units a summary of the main developments towards construction of a second NPP is also provided.

The analysis is based on review of documents, interviews with experts, but also, on review on the international experience and identification whether similar problems exist in Bulgaria.

6.1. POLICY, REGULATORY AND ADMINISTRATIVE BARRIERS

Stable, long-term and clear policy framework is essential when decisions on investment in DG technologies are made and therefore problems with it can be one of the major barriers to DG (ESD *et al.* 2001b; Strabac *et al.* 2002). A general problem for DG in many countries is that energy systems and policy were developed with the view of large-scale generation and not suited for small-scale solutions. There is a lack of tradition and willingness for DG support which leads to various gaps and inconsistencies in the legal documents. There are also powerful lobbies supporting the fossil fuel and nuclear industries (Cole *et al.* 1995; EC 2003a). In addition, a number of concrete regulatory barriers hamper the development of DG, such as long and expensive permitting procedures, and requirements and standards that are difficult to be met by intermittent sources (EC 2003a; ENIRDGnet 2003; IEA 2002; Uyterlinde *et al.* 2002). The main policy, regulatory and administrative barriers to DG in Bulgaria are summarized in the text below.

6.1.1. Long Tradition of Conventional Centralized Energy System and Low Priority for the Alternatives

The Bulgarian energy system was planned in a highly centralized manner. Its development started at the beginning of twentieth century but had significant advancements towards centralization after the World War II when Bulgaria had to join the economic organization of communist states, called Council for Mutual Economic Assistance (COMECON). In COMECON the participating countries had to specialize in different sectors. For Bulgaria it was heavy industry and the country had to make a leap from an agriculture dominated economy to a heavy industrial one. Large plants for steel and ore processing were established and to feed them with electricity large-scale coal and nuclear power plants were constructed at several locations. The energy sector was the backbone of the Bulgarian economy and the mining of coal became the main source of income for part of the rural population. Several generations of engineers were trained in Bulgaria or Russia to manage this system.

After the changes in 1989 there were no major changes in the energy sector. The processes of liberalization and privatization were advancing slowly. With the aspirations for EU accession measures to increase the share of renewables and co-generation were introduced. However, there is still an emphasis and tendency towards the realization of large-scale solutions. An example of this are the plans for a second nuclear power plant (of 2 GW) and for new coal units (of about 700-800 MW). If these capacities are installed there will be an overcapacity in the country and new DG units will be redundant, except, if they compete on the retail market, i.e. reduce the price of electricity for the final consumers directly and are not sold on the wholesale market as the case of most large-scale wind developments at present.

For many years the DG option, apart form hydro, was not considered seriously with statements such as *‘wind energy is too windy’* (Expert 2004) being illustrative of the general opinion. At present, they are still not treated with priority but because of the EU pressure are included, though inconsistently, in the strategic papers.

6.1.2. Lack of Strategic Approach and Policy Implementation

Until recently, there were no targets for the promotion of renewables although one of the functions of the Minister of Energy and Energy Resources as laid in the Law on Energy from 2003 (Art. 157) was to propose targets for renewables that should be adopted by the Council of Ministers. Indicative target for electricity from renewables was adopted only after the insistence of the European Commission and entered into force in January 2007. There are no targets for co-generation and there is no discussion for such to be set.

The strategic documents related to DG in Bulgaria were discussed in Section 3.1.1, page 36. Another function of the Minister of MEER from the Law on Energy from 2003 (Art. 4 (9)) was to develop short- and long-term plans for the promotion of renewables. However, as it was mentioned before, it was only in September 2006 when *National Long-term Program for the Promotion of Renewable Energy Sources (2005-2015)* was adopted and a short-term Action Plan for its implementation is under development. Still, the programme departs from 11% target of renewables in the total domestic electricity consumption by 2010 and even acknowledges that meeting the target is not feasible. There is no programme for the promotion of CHP. Measures to promote were included in some of the programmes on energy efficiency that have been abolished but there are no such in the last one.

An example of a slow implementation of legislation is the introduction of feed-in tariffs. The first provisions on feed-in tariffs were included in the abrogated Law on Energy and Energy Efficiency from 1999 (Art. 22 (2)), but a secondary legislation for its implementation was adopted only in 2002 and the first tariffs for hydro and CHP were introduced only in 2002. As was mentioned on several occasions in the text for some sources, i.e. biomass and photovoltaics, such were enforced only in 2007 or almost eight years after the legal requirements entered into force.

6.1.3. Inconsistency in Policy and Lack of Security in the Support Mechanisms

The lack of a strategic approach is also connected with the lack of consistency in policy related to DG. For example, several programmes on energy efficiency were adopted in recent years but usually soon after their adoption were abolished as was shown in Section 3.1.1, page 36. This is indicative of the low priority in the policy agenda of energy efficiency and renewables.

Another very serious inconsistency is related to the support system. According to the Law on Energy from 2004 the existing differentiated feed-in tariffs should be replaced by tradable green certificates but there was no indication of when this should happen. In the amendments of the Law on Energy from September 2006 a provision was added that the system should be changed to a market based one at the end of 2010 but preferential purchasing of DG electricity is ensured for 12 years for the installations constructed before December 31, 2010.

Still, as the feed-in tariffs are set by the Regulator on an annual basis, they are not included in a legal act as is the case for example in Germany and the Czech Republic. Therefore, there is no guarantee that they will be sufficiently high for the investment to be repaid. There is a text in the Law on Energy that the price of feed-in tariffs, disaggregated by December 31, 2022, shall be determined by a separate ordinance (§ 127. (3)) but there is no deadline as to when it will be introduced so it is not clear when this problem will be solved. All these uncertainties increase the investment risk.

Another limitation with the feed-in tariffs is that although there is a lower limit for them (i.e. they should be higher than 80% of the electricity price for final consumers for the previous year) there is no obligation that they should be higher than the one from the previous period. Therefore, there is no guarantee that the tariffs will not decrease. Further, there is no differentiation on the lower limit for various technologies although the tariffs are differentiated according to the resource. Moreover, in the proposed draft Law on Renewables[9] a decrease of the lower limit - from 80% to 70% - was proposed but later rejected. This creates additional uncertainties and increases the investment risk. Furthermore, there are discussions in the MEE for the introduction of one tariff for all renewable energy sources.

There are also other problems related to the setting up of the feed-in tariffs which are discussed under the Section on Economic Limitations 6.2.

Some legal texts on the support to DG were never implemented. For example, in the abrogated Law on Energy and Energy Efficiency from 1999 there were provisions on the waiving of the import taxes for renewable energy technologies. Unfortunately, the provisions were abrogated just before the date (January 2001) they were supposed to come into effect. There are no tax reductions for small-scale DG and on the contrary a VAT levy is offered to large-scale projects as described in Section 3.2, page 41.

6.1.4. Legal Provisions Not Suited for Small-Scale Generation or Creating Additional Complications

The secondary legislation is better suited to the needs of large scale generation and its implications on DG are not fully considered. This is due to the low integration of these technologies into the system at the time of writing of the legislation and the lack of

[9]The complete name of the law is Law on the Promotion of the Utilization of Renewable Energy Sources, Alternative Energy Sources and Biofuels. In the following text only Law on Law on Renewables will be used.

knowledge on the possible implications that some texts might cause. In addition, the administrative procedures are very complicated to be fulfilled by small-scale DG producers. However, instead of them enjoying preferential treatment such is available for large-scale investments as discussed in Section 5.4, page 109.

Some requirements are redundant and impossible to be met. For example, in the provisional project proposal for wind power plants the investors are obliged to provide data on the wind speed as a function of time and direction for the particular location for no less than 10 years (Art. 136. 1a of Regulation 14, (MRDPW and MEER 2006)). It is impossible to present such data for most wind projects if they are not located very close to a monitoring point of the National Institute for Meteorology and Hydrology.

Another article says that for the provisional investment proposal for photovoltaic systems investors shall prove that they have software to operate the system and that this software is validated for the specific location (Art. 136 3d). There is no clarification how one can prove that the software will run on this location. This requirement shows the low knowledge of renewable systems of the experts who are developing the relevant legislation. Usually software is not essential to run system but only to monitor electricity generation. It typically comes with the inverter or is downloadable and is not site specific (Installer 2007).

According to the definition in Regulation 14 (MRDPW and MEER 2006) a photovoltaic system consists of photovoltaic generator, inverter, and also, of accumulator (Art. 145 (1)). To ensure that the supply is not interrupted and that the photovoltaic system is in line with the one of the grid an inverter and diesel generator are also required (Art. 145 (2)). There are no mentioning of the requirements for individual photovoltaic installations and it is very possible that the investors in such might also be required a back-up generator and batteries which unnecessary increases the investment costs.

6.1.5. Secondary Legislation that Contradicts Primary Legislation

In some cases the secondary legislation includes provisions that contradict the main law. For example, the Law on Energy stipulates that the costs for connection of renewable and co-generation units up to 10 MW up to the property border are to be paid by the producer while the costs for expansion and reconstruction of transmission and/or distribution networks are to be paid by the transmission and distribution company respectively. Based on this one can conclude that the 'shallow' model is used in Bulgaria. However, in the implementing regulation it is stated that if there are costs for expansion and reconstruction they are to be included in the connection fee (Art. 25. para 1 to 3, Council of Ministers 2004a). This article is used by the TSO/DSO to require that all the expenses related to the connection of DG units are paid by investors, which in some cases, can be significant amount of money, especially if the substation is to be rehabilitated or a connection cable of several kilometres is to be constructed.

For example, the investors in wind farm project had to pay EUR 1.5M for the connection to the grid (12km distance from the grid) and EUR 3.5M for constructing a new substation (110/20 kV) at their site and for upgrading of an old substation (110/20 kV) of NEK. These costs were about 10% of total project costs and increased the price per installed kW by EUR 250. For other projects the investors had to construct 7 km connection to the grid (for a wind farm development) and 5 km (for a HPP). After the investors construct the connection they have to transfer the ownership of the connection to TSO/DSO in order for TSO/DSO to maintain it. The investors will have to pay transmission fee in which the investment costs are included for use of this part of the grid. This is a serious financial burden for the project and should be done according to the legislation by the TSO/DSO. However, due to conflicting legislation and that TSO/DSO have other priorities and postpone the construction of the connection – the investors finally do it themselves.

Apart from the high costs, another shortcoming of this model is that when new entrants want to connect there is no methodology for the sharing of the connection costs. In this way the initial investor might indirectly support the project of the next ones. Also, in some cases, TSO/DSO require unnecessary upgrades to the system that should be part of their investment programme.

6.1.6. Inexistent Policies for Microgeneration

There is no policy targeted at the installation of DG units at private homes or municipal or other public buildings. Without strong investment support it is very unlikely that microgeneration technologies will be purchased as the incomes of the general public are too low and the municipalities are budget-constrained. Therefore, if increase of the share of DG, development of DG industries, and public awareness is sough it is desirable that this niche is developed.

However, even if there was a support for microgeneration it will not be possible to install wind power generators on private homes or in urban areas. This is because of another problem with the legal base, i.e. Art. 141 (1) of Regulation 14 (MRDPW and MEER 2006) mentioned above stipulates that wind generators shall be situated at least 500 m away from the territory of the closest populated area.

6.1.7. Lack of Inclusion of DG into Regional and Local Planning Process

Another serious limitation for the use of DG potential is the fact that when spatial planning at regional and municipal level is performed areas designated for DG developments are not decided. This creates problems when land use permits are to be issued for DG projects as in many cases there is a need for a change of the land use designation and of the detailed development plans. Also there is no zoning of the country showing regions where DG potential is high and there are no potential negative environmental consequences.

6.1.8. Long and Complicated Administrative Procedures

A detailed analysis of the administrative procedures and the administrative lead time was carried out in Sections 5.2, page 88 and 5.2.2, page 100 where it has been demonstrated that these constitute a serious burden to investments in DG projects in several ways. First, on average 11 to 13 authorizations related to land designation, regional planning, resource use, environmental protection, and energy generation are to be obtained. This requires a very detailed knowledge of Bulgarian primary and secondary legislation and time for preparing of documentation and fulfilling the various obligations. Second, the number of authorities that might be involved in the process can be as many as 22 for DG technology (out of 35 relevant authorities to DG in total) which translates in time and thus expenses. Third, delays are possible with almost all institutions and other actors and it is difficult to point to a single one that plays as a bottleneck. Fourth, there is lack of administrative capacity and knowledge within the authorities.

According to investors, if the sequence for the issuing of all permits is followed the process can be very long. Therefore they start with several procedures simultaneously and even continuing with project execution if some authorizations are not acquired. The later is possible as the monitoring of compliance is not stringent or hardly exists. Therefore, there is no single well-known and pre-determined sequence but many different ways to obtain the documents required. Personal contacts, insistence, and regular reminders of those responsible are prerequisites for the successful completion of procedures. Moreover, for some permits, long delays for their issuing are possible, and in some cases, bribes are required. As DG are new technologies for some projects investors even provided technical assistance and information about the international experience so that decisions by the relevant authorities are taken. All these make the process difficult to predict, requiring a lot of time, work with the authorities and patience. Several investors and project developers mentioned that they would not have started if they knew that there will be so many problems.

6.1.9. Insufficient State Capacity to Monitor Compliance

The lack of capacity of the state institutions also makes it difficult for them to monitor policy implementation effectively. This is particularly true and problematic when the compliance with the prescriptions of the EIA or water use and water site use permits is important for ensuring minimal negative environmental impacts. NGOs report that some small rivers are entirely diverted through HPPs which completely destruct the local ecosystems.

Some investors reported that they started construction works without having the needed permit but this was possible as the construction was within their site and the possibility for relevant authority to notice the works was limited. In some cases the authorities are aware that there is incompliance but after discussions they verbally agree not to check for compliance. Such cases were discussed in the case for complex permits when the procedure is so complicated that it is rare that such is issued in time (see Section 5.2.2, page 100).

6.2. ECONOMIC LIMITATIONS

The economic limitations come from the fact that the costs for installing and operating some DG units are higher than those of the conventional ones, and from the existence of market failures. While with the advancement of technologies and proper policy mix to encourage innovation and its market uptake it is possible to overcome the former limitation, market failures are more fundamental and difficult to solve. According to the theory of the welfare economics, market allocation is efficient, however this is not the case in practice and a number of ‘market failures’ are observed (Fisher and Rothkopf 1989). The market failures in general are caused by the fact that in the real life there are sub-optimal market structures and that all the benefits or costs of certain products or services are not included in their price. Three market failures relevant to DG sector are studied quantitatively in detail in this section, namely: failure to internalize the externalities; imperfect competition; and imperfect information (Golove and Eto 1996). In addition, based on the field work in Bulgaria another limitation – corruption is added to the list of economic ones.

6.2.1. Failure to Internalize the Externalities

Externalities are defined as *"costs or benefits of production or consumption experienced by society but not by the producers or consumers themselves. Sometimes referred to as 'spillover' or 'third-party' costs or benefits"* (Sloman 2004, p. 291). In the energy sector externalities represent the failure of the markets and in many cases of the regulators, to include all costs of energy generation into the energy price. This leads to underpricing of electricity produced from technologies that have negative environmental and social impacts and to over- and inefficient consumption. In this way DG technologies that offer additional environmental, social, and economic benefits are not valued appropriately and are not competitive.

In Bulgaria the lack of internalization of externalities is manifested in two ways. First, electricity generation costs from conventional sources are low due to state support at their construction and also because environmental considerations are not included in the costs. Second, the mechanisms, such as initial investment support, preferential tariffs and support for R&D, used to compensate for this market failure and to promote sustainable electricity generation, are insufficient or not working properly.

6.2.1.1.Cost of Electricity Generation and Fuel Costs in Bulgaria

There is no detailed information available on the generation costs as this is commercial information. There are no studies on the externalities and the expenses of power plants to comply with the environmental regulations. However, experts from the MEE interviewed report that the generation costs at which Bulgarian power plants generate their electricity vary between 2.5 and 4 Eurocents/kWh (with only very few exceptions). For comparison, Resch (2005) calculate that the electricity generation costs from renewables in the EU-15 in 2004 were on average between minimum 2.5 Eurocents/kWh (for biogas and biowaste) to up to maximum 22 Eurocents/kWh for solid biomass and 160 Eurocents/kWh (for photovoltaics)[10]. The other technologies vary within this range.

The generation costs from conventional sources in Bulgaria are low due to several reasons. First, the majority of the installations were constructed during the communist era and the initial investments were supported by the state or are now repaid. Second, the environmental consequencies of generation are not sufficiently included in the price. There are regulations

[10] These costs represent long-run marginal costs for 2004, pay-back time 15 years

restricting the SO_2 emissions from point sources, and compliance with the Large Combustion Plants Directive (2000/80/EC) is mandatory after 2014. Although, this will lead to an increase of electricity generation costs from coal it will most probably still remain a cheaper option than most renewables. Bulgaria is also participating in the EU emission trading scheme but this would not lead to internalization of all externalities related to fossil fuels. Fourth, not enough investments in refurbishment are carried out which limits the costs but can be a huge potential problem. This is done due to the lack of financing opportunities, but also, because the Regulator is trying to keep energy prices low due to social and political reasons and keeps the costs for modernizations allowed to be passed on to the final consumers low as reported by some energy generation companies.

Another reason for the low electricity generation costs are the low fuel costs. Table 15, Annex I shows that the specific price of coal is less than the one for biomass, natural gas, and oil. This is due to the fact that there is no proper internalization of all associated costs of coal mining and carbon emissions into the coal price, and due to the low labour costs.

For the most renewables the fuel price is zero, i.e. wind and solar, or very low, i.e. hydro and biomass. For hydro resources a water use fee, is to be paid a significant burden according to investors, or in rare cases a concession fee. Biomass is relatively cheap and there is significant potential, as was demonstrated in Section 2.7.1.1, page 25. There is no commercial production of biomass for the needs of energy generation, i.e. there are no energy crops plantations, and there are significant problems with illegal logging or deforestation which might limit its possible use. The effect on the resource of the construction of several biomass-fuelled power plants is not studied. For instance, there are possibilities for a quick exhaustion of biomass material especially from close locations which might lead to high fuel costs and to the creation of scarcity in the market and significant and sudden increase of the price of biomass (as happened in Hungary upon the construction of two biomass-fuelled units). That is why an evaluation of the opportunities should be prepared.

The biggest challenge for the increase of the natural-gas fuelled co-generation is the high and increasing price of natural gas. Because of the low price of domestically mined coal it is much cheaper to produce only heat from coal than to utilize the heat waste for electricity generation in natural gas-fuelled CHP units. That is why without governmental support the future development of natural gas-fuelled CHP will be significantly restricted. To this adds up the fears that the price of natural gas will increase and the costs for the construction of heat delivery network. In Bulgaria the natural gas prices were lower than the international ones because of a long-term agreement with Gazprom. The agreement was due to expire in 2010 but after a pressure Bulgarian Government signed another long-term natural gas supply and transit contract with Gazprom at the end of 2006 - weeks before the EU accession. The conditions of the agreement were not made available to the interested stakeholders and therefore it is not clear how much will be the increased.

6.2.1.2. Failure to Reward DG

To compensate for the market failures and to support the development of DG Government worldwide has developed different policy instruments. Their aim is to create an increased demand which is to stimulate higher production volumes and lower the costs per unit and the improvement of production technologies. This on its own can stimulate further developments in the sector, creating a 'virtuous cycle' (IEA 2003). The main mechanisms aims to drive this cycle in Bulgaria are the feed-in tariffs and to some extent the investment support. However, due to problems in their design and functioning they do not offer the needed compensation to market failures and support for market uptake. These are studied in the following text.

Limited Investment Support

As the upfront costs for some DG projects can be prohibitively high, support for the initial investment needs is essential. However, in Bulgaria such support is rather limited.

Information on the sources for financing of DG projects was provided in Section 3.2.2, page 48. The major stake comes from the European Bank for Reconstruction and Development (EBRD) supported credits line (namely Bulgarian Energy Efficiency and Renewable Energy Credit Line or BEERECL). From 2004 until June 2007 loans and grants (for up to 20% of project costs) were provided for 17 wind power generation projects (total installed capacity - 16.6 MW, total project costs - EUR 13M, BEERECL loans – EUR 11M, grants EUR 2M), 16 hydro power projects (total installed capacity – 36.7 MW, total project costs - EUR 22M, BEERECL loans – EUR 15M, grants EUR 3M), and 4 CHP projects (total installed capacity – 21.6 MW, total project costs - EUR 15M, BEERECL loans – EUR 5M, grants EUR 0.4M) (DAI Europe & EnCon Services 2007). Under the Bulgarian Energy Efficiency Fund there were no CHP projects funded until September 2006 and renewables were not included in the list of eligible projects. Some HPP were funded with the assistance of the two environmental protection funds but there is no information on their number and installed capacity.

The data above shows that although there is some support for initial investment it is rather limited and provided from international sources and not by the Bulgarian Government.

Problems with the Rewarding Scheme

The lack of preferential tariffs set for the various technologies or the fact that they were not high enough was one of the main hindrances to investments in DG projects (see Section 3.2.3, page 52). In 2006 and 2007 there were very positive developments regarding the feed-in tariffs for wind and photovoltaics. Since June 2006 tariffs for electricity for wind have been differentiated according to the annual hours of operation of the installations. This facilitates the development of projects for locations where wind conditions are not so favourable but, for example, the possibilities for conflicts with nature conservation are lower. Due to the sharp increase of the feed-in tariffs for wind power (from 120 BGL/MWh to 156 and 175 BGL/MWh, depending on the annual operational hours) some investors in other technologies argue that this has been done under lobbying pressure and does not imply fair treatment for the other technologies for which there was no increase. Nonetheless, these tariffs are creating very favourable conditions for wind developments in Bulgaria. The same is true for photovoltaics. After long waiting feed-in tariffs introduced in January 2007 are close to those in some well-advanced European countries (see Section 3.2.3, page 52). Also at the beginning of 2007 preferential tariffs were finally adopted also for biomass.

Nevertheless, there are still a number of problems with the rewarding scheme. There are shortcoming due to inconsistency in policy which were explained in Section 6.1.3, page 114. The feed-in tariffs do not provide the needed security in investments in DG technologies. This is mainly because they are determined on irregular periods on the basis of unclear methodology and, apart that they should be 80% of final consumer electricity prices, there is no guarantee that they will increase enough to meet the costs.

Feed-in tariffs for CHP are formed at the cost-plus model and vary for the different DHC. The rate of return of own capital costs on which the tariffs were set by the Regulator was about 4% in 2006 while for comparison the rate of return for DSO was 16% (Investors 2006). The feed-in tariffs are determined once the business plan is ready, i.e. the project is well advanced, and therefore the tariff comes too late. As there is no well established methodology the figures can be lower than what was expected by the investors. All these, according to the investors in CHP, make the installation of CHP units at DHC unprofitable.

Limited State Funding for Research and Development (R&D) and Demonstration Projects

The limited funding for R&D activities related to DG in Bulgaria also limits the development and uptake of DG technologies. Possible national sources are the National Science Fund, the recently established Innovative Fund, own sources of the research institutes and private donors (for more details see Section 3.2.2, page 48). Unfortunately, DG research is not a priority and these sources provide very limited support for R&D activities in the area of distributed technologies. Another source that significantly outnumbers the amounts provided by national ones is the EU sustainable energy programmes (such as the RTD and Energy Framework Programmes, Intelligent Energy - Europe). Still, the main problem for those of which that are not 100% financed by the EU is finding of co-financing. Demonstration programmes to show the benefits of DG and to explore the possible limitations are also insufficiently funded.

6.2.2. Imperfect Competition

One of most common market failures is imperfect competition, which in the case of DG can be associated with the problems of discrimination of DG producers from the existing power monopolies (Golove and Eto 1996). DG producers can be seen as competitors by the DSO or the TSO, which in many countries are continuing to be natural monopolies, and they might create a number of problems for the grid connection and the purchasing of DG energy (Jorss *et al.* 2002).

Many ways can be used to by the network operators to prevent the connection of DG producers, including by charging them very high and nontransparent connection fees (Jorss *et al.* 2002). In Bulgaria the decision on the conditions and the fees for connection is taken by the DSO or TSO. However, the connection of DG units is not beneficial to TSO and DSO from economic perspective, even on the contrary it causes additional expenses and losses as they might have to bear part of the connection costs and have to purchase the electricity from the units at preferential tariffs. In addition, there are transaction costs related to negotiations and construction works. It should be mentioned that most of associated costs are paid at the end by the final consumer but the Regulator is trying to squeeze the profits as much as possible so that the prices of electricity do not increase significantly and full recovery of these costs may not be possible. As a result the DSO and TSO are trying to refuse or postpone the connection in many ways using some gaps or unclear texts in Bulgarian legislation.

First, some DSO claim that it is not technically feasible for the connection to be realized. For instance, according to experts from DHC - Burgas, Stara Zagora Distribution Company refused connection of a new CHP unit installed at the DHC – Burgas on the grounds that there is no grid in the area but at the same time they were selling electricity to the DHC obviously using the ‘nonexistent’ network. Possibility for a refusal on technical grounds is included in Art. 3, para 1 and 2, Regulation 6 from 9.06.2004 (MEER 2004c).

Second, the DSO might refuse to connect DG units of more than 5 MW because according to the secondary legislation if a unit is of this capacity then it should be connected to the transmission network (Art. 50, Regulation 6 from 9.06.2004, MEER 2004c). This happens even if there is distribution network much closer to the unit than the transmission grid. In this way the connection costs can become prohibitory high. There will also be losses due to the fact that the voltage will have to be transformed to higher, i.e. 400 kV or 220 kV, and back to lower if it is to be supplied to the close-by distribution network. For example, if a generator works at 11 kV it can easily feed electricity into 10 kV or after transformation 20 kV distribution network. If the unit is to be connected to transmission network the voltage has to be transformed to 110 kV and if it is to be supplied back to the distribution network at the substation or close to it the voltage will have to be transformed back to 20 kV and to 11 kV.

Third, it is more of a practice than exception to have delays with the development of a study on the conditions, and the signing of preliminary and final contracts. There are fixed periods in the legislation within which decisions should be made and announced, which were described in Section 5.2, page 88. However, there are no penalties and according to the investors nobody respects the deadlines. According to some of the investors interviewed upon the privatization of the DSO there is no control on them and it is very difficult to advance with a project when there are some issues that are not welcomed by the DSO. In this case the Regulator intervenes. There is more control of the TSO (NEK), which is still state-owned and in some cases if the DSO refuses to connect the TSO might propose a contract as a solution. Still, there are delays with both TSO and DSO. For example, DHC – Burgas waited for 9 months before obtaining the preliminary contract for connection to the electricity grid instead of 3 months as included in the legislation.

Even more problematic are the cases when construction, reconstruction or rehabilitation of the network or substations is required as in the legislation there is no timeframe on when these should be built. They are not a priority for the DSO/TSO and the investors might wait for indefinite long periods before they can start selling their electricity. Moreover, in the case of the TSO (NEK) as a state-owned company, even if they decide to build it they have to follow public procurement procedure which will cause additional delays to the project (according to some investors about 8 months). Therefore, usually the investors do the connection themselves and, as the costs for it are included in the connection fee, they are also supposed to pay for it.

Forth, the TSO and DSO may require unjustified demands for reconstructions or rehabilitation of the network and substations, installation of expensive optical cables and other that are not needed for the particular connection or should be done within the normal maintenance programme of the TSO/DSO. However, the TSO/DSO are the one that commission the study on the conditions for the connection and as there is no independent control they might include whatever they want. Because of the existing model when all costs are included in the connection fee these ones will also be born by the investor.

It is not only the DSO/TSO that abuse their dominant positions. For example, one DHC had to build automatic natural gas dispatching station and high pressure natural gas pipeline in order to connect to natural gas network although Bulgargaz (the natural gas transmission network operator) is supposed to do it but they refused. The total investment was about EUR 200 000.

Finally, as discussed in Section 3.2.1, page 42, in Bulgaria the connection to the electricity grid of renewables (including hydro of up to 10 MW) and cogeneration is compulsory. The connection costs are according to the shallow model but as discussed in the same section the secondary legislation is dubious and provides that all the costs are to be born by investors, i.e. deep charges model is *de facto* applied which is a serious barrier ot DG.

Another very important area in respect of imperfect competition is the lack of sufficient number of DG suppliers and installers so that there is a real competition. This is a precondition for driving of the prices down but as at present the markets are not well developed there is almost no competition which is essential for their proper functioning.

6.2.3. Imperfect Information

The problem of imperfect information is typical not only for the DG projects but for the whole economy and is related to the theory of bounded rationality. This problem emerges in different forms such as: (i) lack of information, (ii) high cost of information, and (iii) low accuracy of the information; and limited ability of the actors to use or act upon this information (Golove and Eto 1996). In Bulgaria there is insufficient data on the potential, investment process, and the availability of financing as discussed on several occasions earlier in the text.

While information on the availability of wind, hydro and solar resources can be purchased at a reasonable price from organization responsible for its collection, it is not always easy to obtain the reports on the potential prepared under various studies. This was true for most reports that were used for the writing of Section 2.7. They were obtained based on personal contacts and because they are to be used for research purposes. In many cases the organizations are keeping the reports as commercial products or trying to use them for other similar studies. Most of these studies were carried out with the EU or Bulgarian Government funding, i.e. are paid by the EU or Bulgarian tax payers, and therefore should be available for free. Another problem with the data on resource availability is that they are collected for other purposes, for example wind speed is measured at 10m height as part of regular meteorological observations, and may not always be adequate enough for DG needs.

There is also limited information on the investment process. Insufficient or outdated information is provided in the investments guides prepared by the Energy Efficiency Agency and the InvestBulgaria Agency (for more details see Section 3.2.3, page 52). Information on some of the procedures to be carried out at local level is sometimes provided on the municipal websites. For example, detailed explanation on the procedures and fees for obtaining various construction or regional planning permits is included on the websites of several municipalities, such as the Municipalities of Blagoevgrad[11], Pernik[12], and Dobrich[13]. Information on the EIA is also provided on some of the websites of RIEW (such as RIEW Veliko Tarnovo[14], Pleven[15], and Russe[16]). However, this is not true for all municipal or RIEW websites and some of them even do not have internet presence.

Another aspect of the problem with the imperfect information is the lack of knowledge with the institutions on how to deal with specific for DG technologies issues as most of these technologies are relatively new and there is no proper training of those responsible at the relevant authorities on how to deal with them. This can be a serious hurdle to DG investment process as it causes delays and requires additional resources either for the project developers or the responsible institutions or both to solve the problems.

[11] http://www.blgmun.com/?lang=bg&t=2&id=94
[12] http://www.pernik.bg/services_3.html
[13] http://www.dobrich.org/index.php?s=sc&id=73
[14] http://www.riosv-vt.hit.bg/p1.html

There is also insufficient knowledge and interest in general public regarding DG issues and the impacts of conventional electricity generation on environment. This leads to low demand for low or zero carbon generation and lack of signals to the decision makers that these issues are important and should be supported.

6.2.4. Corruption Practices

Initially, corruption was not intended to be included in the research but as it was mentioned on many occasions in the interviews with investors and project developers as an important impeding factor. The purpose is not to produce evidences or to blame some institutions but briefly to summarize the information on such practices collected during the field work.

Investors and project developers report that, in some cases, they were hinted or directly asked for bribes. For example, for a positive EIA two investors claim that were asked EUR 250,000 and 400,000. Other investors mentioned that as they did not want to give bribes the administrative procedures were delayed, and a lot of additional and not relevant information or project modifications were requested. In one case the delay was three years as the investor contested the decision of the authority in court. The decision was positive for the investor but the delay caused significant financial losses. Usually the institutions mentioned by the investors are those responsible for issuing environmental protection or resource use permits, those that have to give their opinion on investment proposal or start of operation (such as environmental protection, fire safety, and local authorities and even NGOs).

Still, investors declared that it is possible to proceed without providing bribes but often they have to wait more.

[15] http://riewpleven.hit.bg/proceduri/usl/index.html
[16] http://www.riosv.ruse.bg/

6.3. TECHNICAL LIMITATIONS

A detailed study of the technical limitations is not a primary objective of the present research. However, with the growing number of DG installations, the issues related to grid connection and management will become of primary importance. Therefore, a brief overview of the existing problems is provided in the text below.

Medium voltage transmission line in a mountainous area, Photo: G. Miladinova

With the centrally planned electricity system and the intermittence of some DG sources a number of technical problems might be expected. For example, the limited predictability of wind power and the geographical concentration in remote areas is potential source of frequency control problems. The electricity injections to the medium and low voltage grid create reverse to the normal direction (which is from high to middle to low voltage) power flows that impose significant change of the standards regulating the design, construction and operation of medium and low voltage electricity networks. In order to maintain a high level of security of supply, more planning security for future grid extensions/enforcements is needed. It will concern particularly the automation, relay protection, and control. In addition, a number of actions and investigations need to be taken by legislators, regulators, grid operators, and grid users, aiming at establishing of harmonised rules for the smooth integration of DG.

Detailed analysis of the technical problems and the means for reliable and economically effective integration of DG in Bulgaria is not available. The only study that has been identified and deals to some extend with the problem is entitled Distribution Networks Modernization Incentives in Pre-accession Countries (DINEMO)[17]. The project is financed under the Sixth Framework Programme of the EU and coordinated by the Black Sea Regional Energy Centre but at the time of writing has not been completed.

One of the most commonly acknowledged problems revealed during the field work is the lack of grid capacity to uptake the electricity produced by distributed generation. This is mainly true for wind and hydro power sources (Ignatovski 2006). For instance, most projects for

[17] EU Sixth Framework Programme project, Ref: FP6-2002-INCO-WBC/SSA-3, start date: February 1, 2007

wind farms are for sites situated at the Northern Black Sea coast. There the network is 110 kV and is not with good spatial coverage and with insufficient transfer capacity. One of the problems associated with this situation is that there are high costs for the expansion and rehabilitation of the network when new units are connected. In addition, if all projects are realized there will be a significant problem with transmitting the electricity generated to other areas because of low grid capacity.

The problem with grid is not so acute with CHP units because they are usually build in district heating or industrial sites where there is already grid connection. PV developments are too small to have any impact on the netwrok. It is difficult to say where there will be problems with biomass projects as it will depend where they are constructed.

Preliminary conclusions from DINEMO project acknowledge that there are numerous technical problems for the integration of DG and that *"radically new development of the electric power networks is required, mainly in terms of management and improvement of the power accumulation capabilities"* (BSREC 2007, p. 24). It is suggested that emphasis should be on: (i) new systems of protection and automation, (ii) remote monitoring, decentralized dispatch and control, (iii) special interfaces, and (iv) storages. Nevertheless, more detailed studies on the implications and needs related to wider DG integration to the electricity grid is needed.

6.4. ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

One of the main benefits of DG is that it provides an opportunity for electricity generation that is less harmful to environment and to human health by utilizing local, renewable sources or less polluting conventional ones such as natural gas, which leads to the decrease of resource depletion, pollution and CO_2 emissions. This is especially true taking into account the high share of coal in Bulgarian electricity generation mix and its high sulphur and ash content. However, it should also be mentioned that although DG technologies are considered more environmentally benign than the traditional ones, there are still environmental impacts, such as habitats destruction, increased birds mortality rates, deforestation. That is why an Environmental Impact Assessment (EIA) should be conducted for the problematic cases and the precautionary principle should be adopted in all cases when there might be irreversible deterioration of environmental quality.

At present, in Bulgaria there are growing concerns about the rapidly increasing number of proposals for hydro power plants and for some of the projects related to the construction of wind parks. For instance, due to the existing preferential tariffs and small installation costs now there are several hundred project proposals submitted for approval at the Regional Environmental Protection Inspectorates. Some of the projects are for construction at sites located at protected areas or with vulnerable ecosystems but still some of them are granted authorization.

There was a heated public debate on the protection of Kresna gorge[18] and after numerous protests of environmental NGO the Minister of Environment and Waters put a ban for two years on the construction of HPP in the area. This move was welcomed by the NGOs. However, some investors suggest that as it became apparent that this is a business with very good returns, the ban came to discourage the current investors and when it will be lifted firms that are with connections to the current authorities will be able to build their HPP.

The other area of concern are for wind farms development at the Black Sea coast because of their possible negative impact on migratory birds. Sme of the sites are part of on one of the two major bird migratory routes passing through Bulgaria, called Via Pontica. Some of the projects are already heavily criticized by environmental NGOs in Bulgaria. There was also a negative position regarding the projects by the well-known international nature protection organizations, such as BirdLife international. The growing negative opinion among the environmental NGOs regarding the renewables and particularly hydro and wind should indicate that there is a need of more transparent Environmental Impact Assessment procedures and early involvement of stakeholders in the process.

Although biomass electricity generation in Bulgaria is not developed yet it should also be treated carefully so that it does not lead to deforestation in some regions. That is why the opportunities for the utilization of wood waste from industrial processes and agriculture residues should be exploited first.

As for the social barriers at present, there are no serious protests from the local population against the installation of DG units. However, the main constraint is the low awareness and interest of the general population in DG technologies.

[18] The Kresna Gorge is situated in the Southeast part of Bulgaria. Due to the specific climatic conditions, i.e. it is on the border of continental and Mediterranean climatic zones, and relief, i.e. between two mountains and along a river, it hosts abundant in species rare habitats and is important biological corridor (Save Kresna Gorge 2007).

6.5. NUCLEAR POWER AS A MAJOR BARRIER TO DISTRIBUTED GENERATION IN BULGARIA?

When the present research was initiated in 2002 the importance of nuclear power in Bulgaria was decreasing with the ongoing plans for the closure of four of the six units at the Kozloduy NPP and many experts considered that a construction of new units is very expensive, risky and unlikely to happen. However, by the end of 2006 the place of nuclear power in Bulgarian energy mix was reconsidered and with the support of Bulgarian government, most parties and population the plans for the construction of a second nuclear power – Belene NPP, plan are now advancing quickly. These developments will inevitably have a negative impact on the decentralized electricity generation path and also reveals the strong bias towards large-scale centralized projects. In this light a brief introduction to the issues related to nuclear energy in Bulgaria is presented. For more information please refer to Miladinova (2006).

As was discussed in Section 2.2 nuclear energy has a considerable share in Bulgaria's electricity generation – 41% in 2005. At present Bulgaria has one operating nuclear power plant which is situated close to the town of Kozloduy on the Danube River. The closure of four of the small units (440 MW each) at Kozloduy NPP after strong instance from the European Union was skilfully used by the nuclear lobby to gain large support from population for the construction of a second NPP. The nuclear energy development was presented as issue of national pride and the EU demands as an attempt to deprive the country if its key position of energy hub of the Balkans.

In December 2002 the Bulgarian Council of Ministers decided to reopen the Belene NPP project and, after preliminary studies in April 2005, a final decision to build two 1 GW units was taken. The construction of the Belene NPP was initiated at the end of 1981 but the project was put on hold in 1992 (Parsons E&C – Europe Ltd. 2004). This happened after protests of the local community and environmental organisations, the negative opinion of the general population, and the lack of financing. Another important factor for the shelving of the project were concerns regarding seismic safety of the site which were raised by researchers at the Bulgarian Academy of Sciences.

In 2006 the Russian Atomstroyexport JSC won a tender for the contractor responsible for design, construction and commissioning of the two units, which will be Russian VVER design, and for fuel supply and nuclear waste management. The foreseen project financing is about EUR 3 billion (Kirkova 2005) although some experts argue that it will reach EUR 5 billion (Kaschiev 2005b). If all these money are spent on the reduction of energy intensity and DG promotion the positive effect might be considerable.

The main argument for the construction of Belene NPP is that according to some scenarios (NEK 2004a) existing capacity will not be sufficient to cover domestic electricity needs and exports in short to medium-term. This will lead to a decline or stopping of the electricity exports and the country will lose its key position of a major electricity exporter in the Balkans. In an official study, called Bulgarian Power Sector Least-Cost Development Plan (2004-2020) (NEK 2004a) prepared by the National Electric Company, it was calculated that the 2007-2010 period will be critical for Bulgarian energy system and new capacities totalling 1.6 GW should be constructed by then. According to all possible scenarios the commissioning of between 1 GW and 2 GW new nuclear capacity during the 2010-2015 period is essential in order to meet growing electricity demand and to comply with the international environmental agreements to which Bulgaria is a party. On a regional level it is estimated that Bulgaria can export between 5 and 7 TWh annually and that the price of electricity generated in Bulgaria will be competitive on the regional market in the next 10-15 years.

The justification of the need for new capacity on such a scale is heavily criticised by many experts (Brunwasser *et al.* 2004; Dimitrov 2005; Kaschiev 2005a). The NEK's calculations also contradict studies by the World Bank, RWE Rheinbraun and the Bulgarian energy consulting firm Totem Engineering according to which new large capacity will be need at about 2014-15 (Kaschiev 2005b). There are also arguments against the reasoning that the project will ensure the leading electricity exporting position of Bulgaria on the regional electricity market. In general, it is difficult to predict the development of electricity demand and of electricity markets in the region as some of the countries are still in transition or are starting market reforms and others are members of or joining the EU and its market.

There is no space to rehearse all the arguments for and against the construction of Belene NPP but, there is one other very important characteristic of the whole process which should not be ignored. First, this is the negative attitude of the Government regarding the provision of information for the project and the lack of inclusion of stakeholders in the decisions related to it. Second, there is a strong resistance by the public authorities for providing information on the project (The Access Initiative 2004). This resulted in several appeals to the Supreme Administrative Court against a number of government institutions. Third, Parsons E&C Europe Ltd was chosen to carry out the Environmental Impact and the Techno - Economic Assessments without public tender as is legally required. Moreover, it was paid US$ 8 million for the job and experts claim that the amount could be 70-80 times less if the evaluation was prepared by local experts who have much lower hour rates and are better aware about the issues (Kaschiev 2005b). Fourth, the positive EIA was approved by the Minister of Environmental Protection although it was heavily criticized by environmentalists and experts according to whom it did not include research on the risk of serious accidents, terrorist attacks, seismic activity and other issues (The Access Initiative 2004). There is also no evaluation of the whole fuel cycle including the management of radioactive waste and spent fuel.

However, the Government seems determined to continue with the project possibly even at the cost of state guarantees or long-term purchasing agreements which taking into account the size of the project might be harmful to the economic development of the country. Despite the criticisms of the project and the disbelief of many international experts, if sufficient funding is ensured the renaissance of nuclear electricity generation will become a reality in Bulgaria. If this happens the prospects of DG will be very limited and the only driving force behind increase of DG share might be the EU requirements that the country has adopted.

6.6. SUMMARY

The list of barriers to DG in Bulgaria is rather long which explains their low contribution to electricity generation in Bulgaria. Until DG is with low priority, there are: uncertainties and inconsistencies in the policy framework to increase the investment risk; contradicting legal texts that provide opportunities for DSO/TSO to prevent DG connection; complicated and long administrative procedures; lack of clear support; difficulties with the reward system; limited support to initial investments and funding of R&D; and many other, it can be expected that DG will not have high penetration in Bulgaria. Based on the overview of the barriers in Bulgaria as presented in the text above and overview of the international experience a comprehensive framework for improvement of the policy framework for DG technologies support in Bulgaria is proposed in the next concluding chapter.

7. CONCLUSION: RECOMMENDATIONS AND SCENARIOS FOR THE PROMOTION OF DISTRIBUTED GENERATION IN BULGARIA

In the previous chapters a detailed analysis of the integration of DG into Bulgarian energy system, of the public policy that aim to facilitate its uptake and its limitations, and of the barriers was presented. In this final chapter the basic requirements that should be adopted in order to provide investors and other stakeholders with enabling environment, equal opportunities and limitation of possible negative impacts of DG are described. The chapter concludes with the description of several possible scenarios of DG futures and discussion of the available policy options and their implications depending on possible objectives that the Bulgarian Government aims at achieving with its DG policy.

7.1. BENEFITS AND POTENTIAL FOR DG IN BULGARIA

DG can be beneficial to Bulgarian society, economy, environment, and sovereignty in many ways. With proper support mechanisms DG equipment industries can be created and can provide market niche for Bulgarian firms. DG generation can also be an alternative to the poor quality coal that is used for power generation in Bulgaria and in this way decrease the harmful emissions. Biomass DG developments can support the rural development and provide employment to the most vulnerable segment of population – rural population and minorities. DG can also offer grid enhancement functions as DG electricity is usually fed into medium or low voltage networks which, due to insufficient investments in grid rehabilitation, suffer from severe problems with power quality (with voltage variations at some places between 160-170V instead of required 220V ± 5%). Although Bulgarian electric grid is rather well developed, there are some huts and remote houses where DG can provide off-gird electricity. Increased shares of DG can decrease energy import dependency which at present is very high.

In Section 2.7.1 it was shown that there is significant potential for renewables in Bulgaria, i.e. for biomass, wind, solar and for some hydro. Nevertheless, it is obvious that the country is lagging behind in terms of utilization of this potential, i.e. there are a number of countries with much lower potential and higher shares of the resource in their energy mix (for example Denmark and Germany for photovoltaics, Germany for wind), There are also considerable opportunities for introduction of CHP units in district heating companies, for municipal buildings and new large-scale building developments, and in industries.

7.2. POLICY, REGULATORY AND ADMINISTRATIVE RECOMMENDATIONS

In the recent years there were considerable advancements in the public policy related to DG in Bulgaria and a general framework was established but there are still many policy and regulatory barriers (see Chapter 6) and problems with the support mechanisms (see Chapters 3 and 6) that need to be resolved. If the increase of the share of DG is a priority for the Bulgarian Government, ambitious but achievable targets should be adopted combined with strong commitment, measures for their accomplishment improved and new ones developed. Recommendations to tackle these issues are provided in the following text. Special emphasis should be placed on the elimination of the administrative barriers as they were identified as one of the main limitation by the investors.

7.2.1. Long-lasting, Binding and Clear Policy and Legal Framework

The perceived risk of DG investments is closely related to the existing policy environment. Therefore, the creation of a long-term, stable and clear framework is a main precondition for stimulating investments in the area. In this respect strategic approach towards DG coupled with a strong Government commitment. To facilitate the uptake of DG technologies the existing supporting mechanisms should be strengthened and new ones proposed for the policyareas that lack sufficient support (such as financial and fiscal instruments).

Ambitious but achievable targets are important element of a holistic approach towards increased DG shares. The existing indicative targets for renewable electricity generation came under EU accession pressure and, based on the present research, there is no strong commitment for their accomplishment. If the Bulgarian Government wants more developments in DG area it should reconsider the importance and the role of these targets, even though indicative, and possibly adopt additional ones for the individual technologies, including CHP. It is important that once targets are adopted accompanying measures for their achievement are developed and enforced, that the progress is regularly followed and if needed further policy instruments adopted.

The ways the targets are to be achieved are to be laid down in general overarching strategies or long-term programmes and detailed short-term action plans. While such documents already exist in Bulgaria they are often abolished or not implemented at all which does not send good signals to investors. Good examples of such documents are available from all across Europe with the Strategy on the German Government on the Use of Off-shore Wind Energy (BMU

2002) and the Spanish Renewable Energy Plan (2005-2010) (EC 2005b) being illustration of comprehensive and forward-looking approach. Apart from targets another important element of such documents are clear and measurable objectives and regular monitoring of their progress. In addition, the increase of DG can be beneficial for other areas as well. Therefore, its promotion should be an integral part of other strategic documents related, for example, to environmental protection, industry development, and job creation.

The introduction of regional targets might also be considered in a long-term. Discussion on such was initiated in the UK and regional renewable energy assessment prepared (OXERA Environmental and ARUP Economics & Planning 2002). They were not adopted but the local authorities were engaged in the discussions which turned very fruitful as it raised their awareness (Boardman pers comm 2007).

Although the basic legal prerequisites for supporting DG, such as obligatory connection and electricity purchasing and preferential tariffs, are in place, changes in several acts are needed. The limitations were discussed in detail in Section 6.1, page 112. There are several inconsistencies or unclear provisions in the existing legislation that allow DSO/TSO to prevent connection, charge high connection fees, and delay connection. Therefore clear rules, procedures, deadlines that cannot be endlessly extended, and penalties for non-compliance should be developed. The shallow model for connection costs provides fair playing field for small generators and therefore might be preferred a option. The costs for connection to the grid should be born by the DSO/TSO while ensuring that clear methodology provides evaluation of economic benefits for the DSO/TSO of the auxiliary services provided by DG and the remaining costs are passed to the final consumers and are not an additional burden to the DSO/TSO. Other serious barriers to DG in Bulgaria are related to the insecurity of the financial support system; the high number of authorizations required and of authorities involved; and lack of inclusion of DG in the planning policy. These were discussed on several occasions in the thesis and recommendations to overcome them are proposed in further sections of this Chapter.

When changes in the legislation are made, inclusion in the process and consultation with a broad group of stakeholders, such as project developers, investors, local authorities, DSO/TSO, and NGOs, is essential as they are well aware of the possible problems or conflicts during the investment process. Such approach, but with more limited participation of different groups of stakeholders, was taken when the new law on renewable energy was prepared which is a step in a positive direction. However, the opinions expressed at such consultations should be taken into account and if there is a significant difference between the standings of the various stakeholders they should be reconciled and win-win models sought.

An important element is that the secondary legislation is prepared simultaneously or shortly after the framework one and possibly by the same or similar committee or team of experts. This provides for better consistency and fewer conflicts between different pieces of legislation that exist at the moment (as was shown in Section 6.1.5, page 116). It is also important that the implications and possible contradictions with legal acts from other areas, such as local planning or environmental protection that might be relevant are also considered and modified, if necessary.

7.2.2. Mechanisms to Decrease the Administrative Burden

At present, administrative procedures related to DG in Bulgaria are encumbering and time consuming. Investors in DG are required to obtain up to 15 authorizations (out of 20 related to DG) and to deal with a maximum of about 22 public actors and institutions (out of 35 are engaged in some way in DG process). This in terms of administrative lead time might take from 4 months for small-scale photovoltaic installations to about 3 years for HPP of more than 5 MW (and these figures do not include possible delays beyond legally set deadlines). This environment strongly discourages those interested in developing DG and therefore streamlining is necessary. Reduction of administrative burden is also required by Art. 6 (1) of Directive 77/2001/EC on the promotion of renewables which the Bulgarian Government is obliged to transpose and implement. According to it Member States or competent authorities shall evaluate the existing legislative and regulatory framework with the view of: (i) reducing the regulatory and non-regulatory barriers, (ii) streamlining and expediting procedures at the appropriate administrative level, and (iii) ensure that the rules are objective, transparent and non-discriminatory.

Significant improvements are possible and can be achieved in several ways. In the short and medium-term several measures can be taken at a very low or minimal cost for the Government. These include: (i) bundling of administrative authorizations and steps, (ii) levying the need for certain authorizations for small generators, (iii) developing 'fast track' procedures, (iv) decreasing the administrative time for issuing of the authorizations and introducing penalties for delays, and (v) establishing or using of the existing structures to provide information, advice and support on the various permits. In long-term the establishment of one-stop authorisation agency that provides information and deals with DG relevant procedures might be considered. Corruption exists and is clearly another limiting factor related to administrative procedures that needs to be tackled.

Based on the analysis provided in Section 5.2, page 88, bundling of several procedures can be considered. For example, instead of submitting application for design visa, provisional project proposal, coordination approval of the investment proposal, and construction permit the documents required can be split, for example, between two authorizations – design visa (where preliminary proposal on the project is also submitted for consultation) and approval of investment process which should include permission for the start of construction works. At present, the construction permit is issued along with the approval of investment proposal only if it is requested by the investors. The procedures for electricity connection can also be bundled and the contract can be proposed together with the results from the connection study. There are also significant opportunities for the reduction or even abolishment, in some cases, of planning procedures which at present cause significant delays (see Section 7.2.3, page 141). The options for the improvement of EIA and Complex permit procedures are discussed in the following text.

In Section 5.2, page 88 the concrete steps for issuing of individual permits were described. It is implausible to have as much as 13 steps for one authorization (as is the case with Complex permit) and therefore a decrease of their number is urgently needed. Differentiation based on the size of units is also needed. However, to decrease the burden on small projects they might be exempted from some permits. The size of the installations should be decided after detailed study on the conditions for Bulgaria and a stakeholders consultation.

For several procedures it was mentioned that there is a need for consultation with other interested authorities that are not so relevant to DG, such as health or fire and safety authorities (see Section 5.2, page 88). Waiting for a positive answer additionally slows down the process. Therefore, it might be useful to follow the example of other EU countries, such as Germany, where the notion of ‘presumption of consent’ is used, i.e. if the authority does not provide an answer within the legally set deadline then it is assumed that it does not have any objections regarding the project (BMU 2003).

Small units installed by consumers should be exempted from authorization. In the years to come this will not be a problem for the management of the grid as the number and the size of these installations is very small. However, when their share increases this approach might be reconsidered. For example, in the UK there is no need for a prior consent from the DSO to connect to the network when domestic microgeneration unit is installed (Ofgem 2006). Once the unit is put into operation the installers should only notify the DSO. The same approach is also applied in Austria where, for example, small-scale CHP installation with capacity of up to 0.5 MW, depending on the Länder, should only notify the connection and no authorizations are required (E.V.A. and ÖEKV 2003).

The administrative time for decision once all the documents are submitted should be decreased and if the results of the investigations show that there is compliance with the requirements and there is no opposition from interested stakeholders the authorities should be obliged to provide positive answer to the permit request. This approach of 'bounded consent' is practiced in Germany and has facilitated the investment process in renewable technologies (BMU 2003). Also once all documents are submitted the administrative time for obtaining of permit should be decreased. For example, after a positive study is submitted to the authorities, it takes a substaintail amount of time for the final decision of the relevant authoritiy to be taken, i.e. at least 5 months for the issue of Complex permit and at least 3 months - for EIA. At present, delays from these and other legally set deadlines are a very common practice and therefore administrative sanctions toprovide additional guarantee that the legal requirements are met, should also be introduced.

Another mechanism that will promote DG technologies in Bulgaria and support the investment process is the establishment of an agency with the main functions to provide information on the administrative procedures and support in the preparation of the various documents required. These can be carried out by a newly established organization or alternatively by one of the existing agencies, i.e. the Energy Efficiency Agency (EEA), the InvestBulgaria Agency, or the Bulgarian Small and Medium Enterprises Promotion Agency (for more details see Subsection 3.2.3, page 52). The EEA is the most experienced in dealing with DG projects.

In long-term the establishment of a one - stop authorisation agency that is to provide information and authorizations for most of the procedures, such as those for resource use and environmental protection, might be sought. This will undoubtedly ease the administrative burden and provide enabling climate for investment in DG. An example of such agency is the Bundesamt für Seeschifffahrt und Hydrographie which serves as a one-stop agency for support to off-shore wind development in Germany (EC 2005b).

7.2.3. Planning Policy

At present, DG is not included in the regional and local development plans in Bulgaria. If the Government aims at increasing DG share it should consider its integration in these plans. As short-term measures, two possibilities can be considered both of which are practiced in Germany. First, for areas outside of settlements and nature protected areas, DG projects might be granted consent *per se*, i.e. without the need of spatial planning authorizations (BMU 2003). The so called ‘installations privileged in outer areas’ that fall under this category are HPP, wind farms, biogas installations and in certain cases large biomass installations. Second, local authorities can also designate areas for DG developments where lengthy authorization procedure is not needed. A similar approach was also developed in Sweden and the UK. In Sweden, areas, called ‘areas of national interest for wind’, are designated for wind developments (EC 2005b). In a long-term, the Government might consider setting up of regional targets on the share of DG in the electricity or energy mix. For the development of DG projects within the urban areas the procedures for construction permit and environmental assessment might be sufficient and therefore no other authorizations are needed as is the case in Germany.

To develop such approach and integrate DG in the regional planning thus facilitating the investment in DG a zoning of the country shall be considered. This includes creating of a map of the areas appropriate for DG developments by excluding the nature conservation areas, historic and landscape sites of special value, airports, and settlements. This shall be combined with data on the potential and electricity grid capacity. Within these zones the authorization procedures can be eased, i.e. no planning and environmental protection permits shall be required. If investors want to develop projects outside these areas they should be subject to more detailed evaluation of the impacts. Moreover, such zoning can address the growing concerns that DG in Bulgaria in its present development is not sustainable and environmentally friendly. Example of some consideration for the preparation of a zoning for wind onshore are presented in Table 13, below.

Table 13. Main criteria for onshore wind zoning of a country, based on Dutch planning practice

Criteria for zoning\importance of the factor	preferential	restrictive	exclusion
Wind speed	x	x	-
- local wind speed measurements by weather stations - wind speed map of Bulgaria: 40-80 m above ground level - statistics of electricity productions by wind turbines when available.			
Nature and wildlife	N/A	X	X
- a map of nature and wildlife areas to be excluded and/or avoided for wind energy (possibly with some distinction for units below/above 10 MW) - a map of important birds' migration, foraging and brooding routes/areas.			
Landscape and infrastructure	x	x	x
- map of areas to be excluded from wind energy on landscape grounds (possibly with a distinction for units below/above 10 MW) - map of areas/locations (large scale landscape and/or large scale infrastructure and /or industrial zones) with possibilities for large scale wind energy developments, above 10 MW.			
Other	x	x	x
Connection to electricity grid Local zoning aspects (distance form houses, airports, other wind turbines/parks)			

Contributed by: Arend Bosma, energy policy advisor, Province Zuid-Holland, The Netherlands

X – means very important criteria, x – important, N/A - not relevant.

7.2.4. Policy for the Promotion of Microgeneration

The promotion of a highly distributed electricity generation at households level is not among the Bulgarian Government priorities and there are no policy measures for it. One of the main reasons behind this is the inability of Bulgarian households to co-finance the installation of DG units at their homes and the lack of public funds. There is also low awareness about these technologies, and considerable budget constraints.

At present, there are mostly heat generation applications, especially solar thermal and heat pumps. Some small photovoltaics installations are available at locations where the is no gird connection, such as mountain huts, but also, at one village – Gorno Osenovo in Pirin mountain where photovoltaics are used for street lightning. There are also small-scale hydro power turbines used for mountain huts.

Apart form these applications the share of small-scale DG will possibly remain very low if no measures are taken. If the Bulgarian Government wants to reverse this trend, it can support DG at consumers level by providing grants or preferential loans, as in many EU countries or by setting up requirements for its incorporation into new build, as is planned in the UK. At the beginning, an obligation on share of renewables or cogeneration can be applied for large developments (such as in Merton, UK). If significant advancement is to be sought an initial investment support scheme is needed. Nevertheless, it is important that first demand reduction standards are set so that energy is not wasted.

PV panel at Macedonia hut, Rila mountain, Bulgaria
Photo: G. Miladinova

Obligation on the contribution of microgeneration in a new build is adopted in some parts in the UK. The Borough of Merton was the first to lead the example in 2003 when the local Council decided to impose an obligation on all new non-residential development above 1,000 m^2 to have at least 10% renewable energy of the predicted energy requirements (Hewitt 2006). The idea was taken quickly aboard by other Councils and the number of boroughs and cities where the rule is applied or is under consideration is rapidly growing (was about 160 in February 2007[19]). There are different requirements regarding the size of developments and the share of renewable energy, with the most progressive requiring 30% renewables in all new build.

The British Government followed the Merton example and included provisions in *Planning Policy Statement 22 (PPS22): Renewable Energy* (ODPM 2004) and further strengthened its commitments in the proposed *Supplement to Planning Policy Statement 1, PPS: Planning and Climate Change* (Department for Communities and Local Government 2006b). In the latter, a provision that the local authorities are to '*ensure that a significant proportion of the energy supply of substantial new development is gained on-site*' (Department for Communities and Local Government, 2006, p.19) is included. 'Significant proportion' is defined as at least 10% until more detailed evaluations are available. Another significant development is the proposed

[19]For regularly updated list: http://themertonrule.org/list-of-boroughs

Government plan for "zero carbon housing" according to which all houses should be zero carbon after 2016 (Department for Communities and Local Government 2006a).

7.3. RECOMMENDATIONS FOR FINANCIAL AND FISCAL SUPPORT MECHANISMS

In chapters 5 and 6 it was revealed that the economic limitations are one of the most important impeding factors to DG penetration. Therefore, along with the establishment of a consistent, long-term and legally binding policy framework it is essential that the Bulgarian Government ensures that there are sufficient financial stimuli for the investments in DG technologies. This can be done through the support: (i) of the product, i.e. preferential tarrifs for electricity and/or heat generated or quotas for their share in the fuel mix, (ii) of the initial investment, or (iii) fiscal measures targeted at different phases of project cycle. These three approaches are discussed in the following text.

7.3.1. Stable DG Electricity Reward Scheme

Differentiated feed-in tariffs is the main financial mechanism for DG support in Bulgaria and in a number of European countries. In Bulgaria there were considerable problems with the design and implementation of the tariffs which were deterring investors in certain technologies. Notably there were no preferential tariffs for biomass and solar electricity generation until January 2007 while those for hydro were set in 2004, and the tariffs were not fixed over period of time. Gradually the gaps were filled out and the system has been considerably improved. At present, the major remaining problem is the lack of methodology or clarity how much the tariffs will be in the years to follow but this should also be solved once a regulation in which the exact amount of tariffs over a 12 - year period for renewables and 8 - year period for high-efficient CHP is adopted as is legally required.

With the recent improvements in the scheme and Bulgarian accession to the EU that placed the country in the spotlights of investors the number of DG projects in a pipeline increased dramatically. On this background it is surprising that the Government is still considering change of the support scheme with two alternatives being tabled. First, the adoption of a 'market-based system' (possibly a kind of renewable obligation) after 2011 as is required by the Law on Energy. Second, there were also even discussions for a change to a single tariff for all technologies when the draft Energy Strategy has been discussed in 2007 but this was abolished in later drafts. It is important that the confidence of the investors is high in the support system and that it ensures that they will have the returns calculated during the project development phase. Therefore, continuous discussions of possible changes of the support mechanism may not be a proper approach.

As for the suitability of the different support systems there is a long ongoing international debate between the proponents and opponents of the two main options: feed-in tariffs and quota system. However, according to the conclusions of the third Forum of the European Network on Energy Research (Haas *et al.* 2004), which are based on the experience from seventeen European countries, there is “no universally applicable ‘best’ support mechanisms or policy” but what is more important is clear governmental commitment, excellent design and continuous monitoring, long-term stability and continuity. The support to electricity price is essential but should also be combined with a mix of policy instruments. In addition, the system should: (i) take into account for the differences in the market uptake of the various DG technologies supported, providing sufficient support for technologies at early stages of development, but at the same time avoiding windfall profits for those close to markets or already competitive, (ii) make distinction between existing units (that are fully depreciated) and new ones, and (iii) provide security in investments by being set for sufficiently, but not indefinite, long-term (Haas *et al.* 2004).

Choosing which system to be used is based on the governmental priorities and the local conditions (see more discussion on possible scenarios according to priorities in Section 7.7 below). However, if high share of DG is desired the Bulgarian Government should consider further improvements in the existing preferential tariffs schemes or if quota (or obligation) system is adopted consider the shortcomings of the existing ones, such as the Renewable Obligation in the UK.

For a successful feed-in scheme a number of components are needed. First, it is essential that, in order to provide opportunity for different technologies to reach markets the tariffs, are differentiated and based on actual generation cost. Second, they are set up over fixed period. In Germany it is as follows: 15 years - for renovated hydropower plants with a capacity of 5 to 150 MW; 30 years - for hydropower plants smaller than 5 MW; no fixed period for wind; 20 years - for all other technologies (IEA 2005). For comparison, the draft Law on Renewables establishes that in Bulgaria the period will be 12 years for all technologies. Third, the tariff for newly commissioned plants should be reduced annually to provide stronger incentives for cost reductions. The annual digression factors in Germany are: 6.5% for open land photovoltaic installations; 5% for building integrated photovoltaic installations; 2% for wind power plants; 1.5% for biomass - fuelled plants; and 1% for geothermal plants (IEA 2005). Finally, no public budgets should be involved and all costs should be born by consumers. In addition, to prevent high costs for some supplier the Germany Feed-in Act requires all electricity suppliers to have the same share of electricity from renewable energy in their fuel mix at any time.

Setting up of an obligation on the suppliers or consumers to source an increasing proportion of electricity from renewables is the other support scheme used in several EU countries, e.g. United Kingdom, Poland, Sweden, Italy and Flanders and Walloon regions of Belgium (EC 2005b). The main elements of the UK system are: (i) setting up of an obligation for the share of DG to all suppliers, (ii) developing a system for proof that electricity comes from eligible sources, (iii) developing a system for trading of the certificates, and (iv) setting up of a buy-out price that does not allow the certificates to increase beyond certain level and offers possibility for meeting the obligation if there are not sufficient volume of the certificates. The mechanism provides a market-based approach and encourages the investments in the most cost-effective technologies. However, based on the UK experience the obligation has a number of disadvantages. The scheme favours the cheapest options and other technologies remain underdeveloped. It also provides excessive assistance to certain established technologies, which leads to windfall profits. The UK Renewable Obligation (RO) favours large-scale technologies and if it is not modified it is very complicated for small generators. It does not provide enough security of investments as the price is not known in advance and because of the design the share should always be below the targets as if they are reached the system will collapse.

In order to improve the UK renewable obligation a number of modifications were proposed by the UK Department of Trade and Industry (DTI 2006). If the Bulgarian Government decides to adopt similar system it is advisable that it draws on the UK or other countries' experience. The main modifications proposed for the UK RO are: (i) banding of certificates, i.e. for a MWh several certificates (ROCs) or only a fraction might be issued ,depending on the technology, (ii) agents are allowed to act on behalf of smaller generators (below and equal to 50 kW) and to amalgamate the output, and (iii) removal of the requirement for sale and buyback agreements for renewable generators (DTI 2006). Another way for 'correcting' the failures of the RO would be combining the RO with feed-in tariffs for the technologies that cannot compete economically. Such approach is adopted in Italy (EC 2005b).

7.3.2. Support of the Initial Investment

The initial investment costs are a major barrier that significantly limits the uptake of DG technologies in Bulgaria as discussed in Section 5, page 75. Investors report that it is very difficult to obtain credits if they do not have securities that can be several times higher than the amount of the credit requested. In this environment investors which have other business as a main or have international partners with good credit rating are those who develop DG projects in Bulgaria. This limits seriously the uptake of small-scale DG technologies and gears the investment flows towards large-scale developments (i.e. hydro of about 5 MW and wind farms) or towards the purchasing of cheap second-hand installations.

Therefore it is important that some form of support for the initial investment is provided that can help banks to better price the risks associated with DG project and stimulate the development of DG market niche. However, public funds are very limited in Bulgaria and it is not realistic to plan that significant state funding will be available as is in some European countries, such as the UK's Low Carbon Buildings Programme, Large-scale PV Demonstration Project, Bio-energy Capital Grant Scheme, and the Marine Renewables Deployment Fund. For Bulgaria, it is more likely that the financial sources needed might come from international donors and private investments, if an enabling environment is created. Positively, the EBRD created a credit line for the promotion of energy efficiency in industry and of renewable energy sources for which the support is divided in two parts: grants and credit securities that come from international donors; and loans - from local banks. Nevertheless, the lack of public funds does not mean that the Government should not consider the introduction, in a medium or long-term, of a grant scheme for small-scale technologies that are not market competitive.

With the EU accession the EU Structural and Cohesion funds might turn into an important source of financing for DG projects. How these funds are utilized depends on the priorities laid down for each EU Member State in their National Strategic Reference Framework (NSRF) document (currently for 2007-2013), in the specific multiregional and sectoral Operational Programmes (OP), and the regional development programs. However, based on author's unpublished review of the NSRF and OP of the Vishegrad counties (Hungary, Poland, the Czech Republic and Slovakia) distributed generation is not considered as a priority area and the funding dedicated to it is limited. Another concern is that the EU funds usually do not provide the whole amount but require matching funds to be provided from the state or local budgets. This might be a considerable limitation to the extent to which Bulgaria can utilize the EU funding. However, this is also, an important opportunity for the State to use its limited resources that can be multiplied with the European Community support.

Partial financing under Joint Implementation (JI) mechanism[20] is becoming a promising opportunity for DG projects. Bulgarian Government has signed Memorandums of Understanding and Agreements to host JI projects with the Netherlands, Austria, Prototype Carbon Fund, Switzerland, and Denmark and has established a separate unit (called JI Projects Sector and National Focal Point on Climate Change on Prototype Carbon Fund) within the Ministry of Environmental Protection and Waters to deal with JI projects. In order further to facilitate such projects the change of procedure for the examining of projects from 'track-two' JI projects to 'track one' is planned which in practical terms will mean that the validation of proposals can be carried out in Bulgaria at significantly lower price (Official 2006). This change requires specific actions to be taken and structures developed at the Ministry of Environment and Waters and although the change was envisaged for 2006, by June 2007 there were no developments.

Map of the first JI project in Bulgaria, Photo: G. Miladinova

The transformation of Bulgarian economy after 1990s led to a sharp decline in greenhouse gases and surplus quotas (or Assigned Amount Units - AAUs) that the country can possibly sell AAUs to other industrialized countries (Annex I Parties) under the Emissions Trading Kyoto mechanism[21]. A proposal for the design of a Green Investment Scheme, which will ensure that the revenues from this trading are spend in a sustainable way, has been prepared by the World Bank (WB 2004). It suggests that of the total 200 million tones surplus emission credits that are estimated to be available for the country over 2008-2012 period, a fraction, or 25 million tones of AAUs, are sold and the revenues used to fund sustainable energy projects. If a tone of AAUs costs between USD 4 and USD 7 then a pot of USD 100 million to USD

[20] Joint Implementation is a mechanism under the Kyoto Protocol which allows Annex I Parties, i.e. an industrialized country, to receive emissions reduction units when it helps to finance projects that reduce net emissions in another Annex I country.

[21] Emissions Trading is another mechanism under the Kyoto Protocol that allows Annex I Parties to purchase units from other Annex I Parties and use them towards meeting their emissions targets under the Protocol.

175 million would be available for sustainable energy projects which could provide substantial opportunity also for the development of DG market niche (WB 2004). However, there have not been further developments on this issue and it is very unlikely that it would be operational in the near future (Official 2006).

7.3.3. Tax Relief Schemes

Another approach for stimulation of DG investments is to levy certain taxes on profits, technology imports, or initial investment costs. In Bulgaria such approach is applied only for large scale investments, i.e. VAT levy for large-scale projects (see Section 3.2.1). There were provisions on import taxes in the Law on Energy and Energy Efficiency from 1999 but they were abolished (again Section 3.2.1). Adoption of some tax incentives for small-scale electricity generation in Bulgaria might be a useful, though not primary, instrument for DG support. Another important aspect of tax relief schemes is that they should create a level playing field for all technologies. The existing practice of large-scale projects support is not a step in this direction and if some projects (such as those for coal or nuclear power plants) benefit from tax reductions, this should be well acknowledged and the amounts made public.

There are different approaches applied by the national government regarding the preferential taxes or tax relieves for the investments in DG technologies. For instance, in Greece there is 100% tax relief of the total investment cost for renewables. In the Netherlands the investment in certain technologies (energy efficient assets and renewable energy technologies) can be deducted from taxable profit up to a percentage of investment costs (in 2005, this percentage was 44 %) (IEA 2005). In Ireland the corporate equity investments in certain renewable energy projects (hydro, solar, wind power and biomass) are eligible for tax relief in the form of a deduction from a company's profits for an investment in new ordinary shares in a qualifying company. The relief is capped at 50% of all capital expenditure (excluding land), net of grants, on a single project up to £ 7.5M. Complete tax exemption from natural resource and ground rent is applied for small hydro power plants (below 5 MW) in Norway (IEA 2005). In the UK the Enhanced Capital Allowance Scheme enables businesses to claim 100% first year capital allowances on investments in energy saving technologies and products, including CHP from DG ones (Carbon Trust n.d.).

7.3.4. R&D Support

The support for research and development of new and emerging technologies is essential as they are not at a stage that can be competitive at markets but in the future can be a base for a prospective market niche that can give competitive advantage to the country in technologies that will possible gain increasing importance. However, DG research is not well supported by the Bulgarian Government. For example, the National Innovation Fund provided only EUR 0.6M for DG projects for year and a half (two rounds in 2005 and one in 2006). This amount is minuscule compared to the other EU countries.

Majority of EU and EEA countries provide significant R&D support for DG technologies. For example, there are several programmes and initiatives that support DG R&D in the United Kingdom. The Low Carbon Innovation Programme (LCIP) aims to accelerate the development of new and emerging energy efficiency and low carbon technologies. It was launched in 2003 and is to run until 1 June 2008 with GBP 75M funding provided over the initial three year period (Glaze 2006). Another initiative that provide funding for R&D and networking in the UK is the Sustainable Power Generation and Supply (SUPERGEN). The initiative was launched in 2001 and was allocated about GBP 30M funding in total. Funding for DG research can also be obtained from the Energy Research Councils. For 2005/2006 the spending on energy research per annum was GBP 40M with a little more than 30% going to distributed energy research. The total funding was increased to GBP 70M for 2007/2008.

To change the present situation in Bulgaria several steps are important. First, although the Bulgarian Government may not be able to dedicate such large funds to DG technologies however if the development of DG is a priority it shall consider the increasing and earmarking of the amounts available the National Innovative Fund and the National Science Fund. Second, the participation of Bulgarian research organizations in internationally funded projects shall also encourage by providing support for the preparation of application documents and also matching grants if no 100% funding is possible. Third, the research capacity should also be enhanced, for example, by the creation of networks of experts that collaborate on DG issues and by funding of an exchange of senior and young researchers within the country, and with established foreign research institutes and universities. This can be done by providing funding from the existing initiatives, and through the provision of information about the EU or other sources of funding. Last, but not in importance, incentives for business shall also be placed to participate in DG research and development.

7.4. INFORMATION BASED MEASURES

There is limited information available about the benefits and potential for investment in DG as discussed in Sections 3.2.4 and 6.2.3. The main issues that should be considered are: (i) limited information to support investors, (ii) limited institutional capacity and lack of sufficient number of experts, engineers and technicians, and (iii) low awareness among the general population.

To address the lack of information the Government can support studies on the potential for DG at level different regions of the country and the development of resource maps or detailed GIS database which should include various other limiting factors (as outlined in Table 13, page 142). The development of guidelines on the administrative procedures will provide a needed assistance to investors. A database on the possible municipal DG projects that can be financed under public-private partnership schemes can provide a link between budget-constrain municipalities and investors. Once all these are prepared dissemination is needed. There are many channels that can be used, including printing publications and brochures, developing website, press releases and announcements on conferences, seminars and exhibitions.

As the high initial investment costs are a serious limitation to DG penetration in Bulgaria and the Government has limited resources, it can support the building of expertise within the Bulgarian banking sector on how to evaluate the risk of such projects. Another information-based mechanism that can be of significant help is a preparation of information packages on the possibilities for project financing under various EU funds and other foreign sources and initiatives.

The implementation of the measures to tackle the lack of information can be entrusted to an agency, such as the Energy Efficiency Agency, or to a private consultant. In addition, for the facilitation of project developers and better dissemination of the information regarding distributed generation potential, information centres should be established, for example, in the biggest cities. Alternatively, the network of Municipal Energy Agencies can be supported and used for dissemination activities. Information on DG potential should be prepared and made available to investors. A positive example in this aspect is the website of the Energy Efficiency Agency which already provides some information for the investors but the activities and information can be further elaborated.

The development of institutional capacity of public administration and DG training courses for engineers and technicians is essential. The former can be dealt by the Government though increase of the budget of the relevant authorities, sending their experts to courses, conferences and other exchanges of experience; and improvement of the cooperation between the different institutions. For the latter the possibilities are more limited but development should follow from the growth of the DG market niche. Some measures that can be applied are: provision of financial expert for exchange of experts; development by some of agencies, for example the EEA, of training courses for engineers and technicians; encouragement of universities to develop curricula and facilitating of the dialogue between industry and research institutions and universities.

As was mentioned in Section 6.4 there are no significant social barriers but for one very important which is the low awareness and the lack of understanding of the benefits of DG from the general public. In order to overcome this limitation education campaigns should be developed and information disseminated though various channels.

7.5. MEASURES FOR OVERCOMING TECHNICAL LIMITATIONS

There is little information and no detailed studies on the possible technical limitations and revealing them was not the aim on this research. However, several policy measures can be proposed based on the information from interviews with stakeholders and international experience. In a short-term it is important that: (i) standards and clear rules for connection are developed, and (ii) the grid in the areas where the potential is the highest, such as the Northern part of the Black Sea Coast, is enhanced. In a long-term a strategy for the development of electrical grid that will accommodate the growing importance of DG is necessary.

The legal base that is relevant to DG grid connection should be clarified and all the opportunities that at present are used to postpone or deny grid access should be removed. Unified procedures and standards for grid connection can be developed by the Regulator or the DSO/TSO can be encouraged or required to prepare such.

An example for centralized planning of the grid that considers DG is the Spanish *Planning of Electricity and Gas Sectors: Development of the Transport Networks 2002-2011* (IEA 2005). In it attention is placed on the construction of power lines to connect renewable units and combined cycle power plants. The plan also promotes the building of natural gas pipelines to provide fuel for CHP and combined cycle plants. According to it, wind power plants should reach 13 GW installed capacity in 2011 and combined cycle plants - 15 GW. For the fulfilment of the plan EUR 2.7 B for electricity and EUR 5.2 B for natural gas network were earmarked.

7.6. MEASURES FOR OVERCOMING ENVIRONMENTAL BARRIERS

Environmental NGOs suggest that DG at present is developing in unsustainable and environmentally friendly way. On the other hand investors identify the procedures related to environmental protection as one of the most problematic ones. It is important that DG does not lead to environmental degradation and there should be procedures to ensure that this is not the case. Still, there are solutions that can decrease the burden on the investors and transparency and better inclusion of interested parties concerns.

Fish passage, Arda river
Photo: G. Miladinova

Some of the short-term measures that will facilitate the integration of environmental considerations in the DG decision making are: (i) applying the precautionary principle in projects ambiguous from environmental and social point, (ii) improvement of the procedure for EIA and Complex permit by elaborating more detailed requirements for screening of projects, (iii) monitoring of the operations of the existing units so there is a compliance with EIA or Complex permit recommendations, (iv) initiating and supporting research to evaluate the environmental effects of DG in Bulgaria and to serve as a base for zoning of the country, and (v) early involvement in the projects' development of interested stakeholders so that the experience and knowledge of experts can be considered and possible negative impacts avoided.

The following medium to long-term measures to better integrate environmental considerations might be considered: (i) designating areas where DG development is permissible as will be discussed in the following section, (ii) setting up of a Fund where fees for EIA are to be collected and from which after a tender experts team to conduct EIA are to be selected. The latter will decrease the influence the investors on the EIA outcomes.

The development of clear guidelines and a list of installations (based on capacity and/or number of turbines) of when projects are subject of EIA screening or Complex permit. EIA and Complex permit procedures can be simplified for smaller installations. In addition, fewer characteristics of the environment can be studied when projects are smaller.

Examples of simplified EIA or Complex permit procedures can be drawn up from the experience of other EU countries. In Germany the type of procedure is differentiated according to the number of wind turbines installed: for 1 or 2 turbines - no authorization; from 3 to 5 turbines - a site specify preliminary examination of the need of EIA, no public consultation; from 6 to 19 turbines – general preliminary examination of the need of EIA with inclusion of the public; 20 and over installations – complete EIA (BMU 2003). For biogas installations authorization is needed for units above 1 MW thermal output or 10 tones daily fermentation output. For biogas units above 50 MW thermal output emission permit and compulsory EIA with public consultation is required. For other biomass installations the threshold is 10 MW above which preliminary EIA is required, above 50 MW thermal capacity a regular EIA procedures is to be followed. For units below 10 MW either simplified procedure without preliminary EIA should be undergone or no procedure at all. In the UK EIA is required for power plants with a thermal output of more than 50 MW and is usually not required from small conventional units (Communities and Local Government 1999). EIA is likely to be required for hydro power plants with capacity above 5 MW and wind developments of 5 or more turbines or more than 5 MW.

7.7. DG FUTURES – SCENARIOS, POLICY OBJECTIVES, OUTCOMES

Different DG futures can be expected depending on the priorities of Bulgarian Government and the instruments and resources it dedicates to achieve them. In this section five possible scenarios are discussed which are developed by the author and are based on the research in Bulgaria and analysis of the international experience. The scenarios are speculative and aim to show based on different aims what type of policy mix is needed and implications might be expected. They are intent to provide various options from which the Government can make informed choice. It is up to the Government to decide which path is the preferred one.

As DG can play a role to the achievement of different policy objectives, one of the key elements of the scenarios is what are the perceived Government aims and what contribution to them the Government would like to have from increased DG shares. Based on this the scenarios focus on: (i) present policies, (ii) high share of DG, (iii) high employment and social justice, (iv) market-based approach, and (v) optimal. The present scenario describes what are the possible implications of the current governmental objectives and policy. High share of DG presumes that low carbon economy and reduced dependency is the main motivation of the Government, while in the following scenario Government aims at more jobs at local level and equality. When the market-based approach is adopted Government leaves up to the markets to determine DG deployment. Finally, the optimal scenario is a combination, but also, a compromise of the benefits DG can offer and their cost.

Further, in order to move from rhetoric to real action a set of policy instruments is needed. The one that is proposed under each scenario is the author's selection which is inspired by an overview of the best practices in Europe, analysis of the problems encountered with some existing support mechanisms, and 'reality check' whether they are suitable for the local, Bulgarian circumstances. In addition, the general framework that has been proposed in the first part of conclusions should set the basic conditions if any developments under the proposed scenarios are sought.

Each of the scenarios will inevitably has different outcomes or implications in terms of share of DG, predominant type of DG technology, economic and environmental costs for the society, job creation and local development, and security of supply. The author has tried to foresee the various implications resulting from each scenario but these are speculative ones. With the EU accession Bulgarian Government also participates in the definition of a broader EU context and policy. Therefore the DG objectives it adopts will also have impacts on its behaviour at the EU negotiation table. This is also briefly discussed in the subsection on implications to each scenario.

7.7.1. Present Policies

Government Aims

At present, based on the conclusions of the research (i.e. Section 6.5, page 132), but also, on the signed in January 2008 agreements between Bulgaria and Russia for the construction of a second nuclear power plant at Belene and of the South Stream natural gas pipeline, it can be concluded that there is a strong tendency towards the realization of large-scale energy projects. There are also plans for the construction of additional coal-fuelled capacities. These projects are motivated by inspirations for the reestablishment of Bulgarian role as the biggest exporter of electricity in the Balkans. It also demonstrates the desire of the Government to have independent of EU energy policy and to be key partner to the Russian Federation. In addition, there are plans for bundling of the largest energy assets, i.e. the nuclear and largest coal power plants (NPP Kozloduy and TPP Maritza East 2), the biggest coal mines (Maritza

East complex), the electricity and natural gas transmission system operators (i.e. The National Electricity Company and Bulgargaz Holding) in one megaholding which will have the dent to provide financing for these large-scale projects.

Achieving a high share of DG is not high in the policy agenda, with the policy for its wider penetration driven mainly by the EU accession obligations. Bulgaria remains one of the countries with the highest energy intensities in EU. However, the potential for energy demand reduction is not utilized and the consumption is on a constant rise. In addition, the reduction of greenhouse gas emissions in order to fulfil Bulgaria's Kyoto Protocol obligation is not a priority for the Government as due to the economic downfall the country is well below its 1990 levels (or about 50% in 2003 while the 'Kyoto' obligation for Bulgaria is 8% (Energy Institute JSC 2005)).

Policy to Promote DG

At present, preferential feed-in tariffs are used with obligatory connection and purchase of DG electricity. Very limited initial investment support is available. There are plans for the change of the system to renewables obligation after 2011. There are a number of constraints that prevent higher penetration of DG. Detailed analysis of current policy was included in Chapter 3 and of the barriers in Chapter 6.

Implications

In the short to medium-term there will be developments mainly in wind, hydro and possibly biomass but there is no clarity of what promotional system will be applied after 2011 and this might lead to some stagnation of the market with the approaching of that year. There will be very limited developments in photovoltaics sector and CHP units will possibly be installed only if there are additional benefits, i.e. if the steam generated is needed in some industrial processes. Microgeneration will be almost zero. If no improvement of the EIA procedure is introduced there might be negative environmental impacts.

In a longer perspective if the nuclear and coal power plants planned are put into operation there will be overcapacity in the system and if not all of it is exported, there may not be a need of more electricity generation which will inevitably lead to smaller number of new DG capacities added. The perspective of having four 1 GW units of nuclear power and several large-scale coal-fuelled units might cause significant problems with the balancing of electricity system.

The close ties with the Russian Federation will also mean increased and very high energy dependency on one country. These are also not well coordinated with the other EU Member States. Furthermore, the South Stream natural gas pipeline is a direct competitor to the EU supported Nabucco project that aims to diversify natural gas supplies and decrease the dependency on Russia. Therefore, this initiative of Bulgarian Government may not be well accepted at the EU level. The concentration of the energy assets and activities in the planned energy holding may not be in line with the EU objection for competitive energy markets and unbundling of energy monopolies. This shall also be considered in the light of the forthcoming third package on energy liberalization to be proposed by the Commission. In addition, the obligations under the Renewables Electricity Directive 77/2001/EC and possibly the forthcoming new Renewables Directive may not be met and infringement procedures against the country might be initiated by the Commission.

7.7.2. High share of DG

Government Aims

Under this scenario the Government priorities are low CO_2 emissions and decreased energy dependency and to achieve these a significant increase of the contribution of DG to electricity generation is strongly supported. The Government also aims at establishing Bulgaria as a frontrunner country from the twelve new member states capitalizing on its DG potential to create a ‘green and sustainable’ image ofhte country and to promote it as a good place for investments in high-technologies.

Policy to Promote DG

The main policy instrument that can be used for a short and medium-term to provide for rather rapid increase of DG share is differentiated feed-in tariffs that are decreasing over time to stimulate technology development and market learning. This approach has proven to be successful by the German and Spanish experience. To decrease the up-front cost short or long-term loans are needed. In Bulgaria they can be provided by private banks with governmental loan guarantee facility by the EU Structural Funds. Mechanisms to support industry development, such as preferential taxes, reduced red type, and loans for SMEs, and raise the awareness of various stakeholders, i.e. banks, public administration, investors, local communities and general population, are also essential.

Implications

Under this scenario rapid increase of DG might be expected with technologies, such as wind, hydro, landfill gas, and biomass and natural gas CHP contributing to a significant part of electricity generation. The composition of the mix of DG technologies and their share in energy generation will largely on the levels at which the preferential tariffs are set. These developments will inevitably lead to decreased dependency on energy imports. As DG will displace some of the coal power plants CO_2 and other harmful emissions decline can be expected. It will lead to jobs creation and local development. However, significant support of the Government is needed to provide incentives for the initial investment costs and funds for other sectors will have to be reduced. Also negative impacts on the population, especially on the poor and vulnerable segments, can be expected as the price of electricity might increase significantly due to the fact that the DSO/TSO will transfer the costs for the feed-in tarrifs to the final consumers. Additional and possibly significant expenditures might be needed for technical upgrades and improved management of the grid so that it can accommodate feeding of large volumes of electricity into the distribution network and also from areas where there are no sufficient grid capacity. Environmental derogation can be expected especially if no proper system for the evaluation of the impacts, and compliance monitoring is established.

7.7.3. High Employment and Social Justice Scenario

Government Aims

In this scenario the main Government aim is to create more jobs and equality, and to develop rural areas. The main elements to achieve it are: promotion of labour intensive technologies; support to industry development; and education and training. The main DG source that can provide for this is biomass due to its high technical potential, relatively equal regional distribution, and high labour requirements. He other DG technologies can also contribute but to more limited extent.

Taking into account the low cost of labour, availability of metal refining industries, and the fact that the region still has underdeveloped DG niche but good potential, the Bulgarian Government might also aim at the development of DG equipment manufacturing industry. This can deliver even more job opportunities, and can make the country a major exporter of DG equipment to the Balkans, Turkey, and EU. Bulgaria has traditions in the production of generators and turbines and there are opportunities for the establishment of businesses, or growing of the existing, for the production of components for HPP and CHP units. There are also possibilities for the development of photovoltaic manufacturing plants and even some parts for wind turbines.

This scenario can also contribute to the Government social equity objectives by providing jobs for the poorest. Biomass can be planted on lands that are not cultivated creating local opportunities for farmers and people in the rural areas. The introduction of biomass and natural gas CHP in cities and for municipal buildings can decrease the price of heat for consumers and thus assist poor households. However, it will not be feasible to introduce CHP in most of the rural settlements as people there use individual stoves fuelled with cheap wood or coal.

Policy to Promote DG

The scenario will require a better targeting of the policy at certain technologies, e.g. biomass electricity generation and biomass CHP, biomass co-firing, and at the development of local industries. The financing support mechanism should preferably be a combination of differentiated feed-in tariffs (with inclusion of biomass co-firing) and kick-start industry subsidy programmes. The establishment of a facility that will provide grants for the development of biomass plantations and biogas use is needed with a full utilization of the EU financial support coming under the Structural Funds, but also, from other initiatives is essential. Grants should be preferred than loans as the population living in the rural areas is predominately with very low incomes and the loans will further burden it. However, careful consideration of the EU legislation on the state aid prohibition exemptions for renewable energy technology is needed so that this is not being against the free market rules. Training can also contribute to improvement of the situation in these areas.

Also important are the measures for training and acquiring of the skills needed. The Government will need to strengthen the existing Agencies or create new one that should be able to provide information and organize trainings, to ensure that there are structures that provide training at local level, and to support the development of curricula of university and research institutes and their cooperation with industry.

Implications

As the most labour intensive, biomass-fuelled DG technologies will undergo the greatest increase, and depending on the instruments implemented, it can be expected that the other sources will have important contribution. Industries that provide equipment for Bulgarian, but also, foreign markets are likely to be established and possibly will be owned by big foreign firms and also some Bulgarian. There will be CO_2 reductions and some coal power plants will be displaced. However, this development might have negative impacts on forestry if proper management and monitoring of the quantities taken is not implemented, which based on the present situation proves to be a really considerable problem. With increased number of biomass plantation there might be negative impacts on biodiversity.

Along with the positive impacts of local development and job creation there might be some negative social implications due to possible increase of price of electricity due to the feed-in tariffs. To compensate partially for this CHP at district heating and for individual buildings can provide cheaper heat in urban areas and decrease the bills at Municipality building. However, this might lead to a need for the development or enhancement of the heating distribution network.

7.7.4. Market-based Scenario

Government Aims

The Bulgarian Government might also decide to adopt liberal approach leaving the markets to dictate DG deployment. In theory markets will deliver security of energy system and will promote the cheapest DG technologies. The investment risk should be born by the private sector but it is very important that a level playing field between the different technologies is established. In addition, internalization of externalities should be envisaged but it should also be achieved through market-based instruments.

Policy to Promote DG

A market-based approach preconceives very little governmental intervention, limited to the elimination of the obstacles to free markets. The instrument that will provide some uptake of DG and is market-based is the introduction of quotas for electricity generated from DG sources. This will not lead to high DG shares but will promote the cheapest technologies and the use of the best sites available. Additional, support for the DG technologies that have not reached markets might be justified as this will create future market opportunities. Depending on the involvement the Government wants, these can come from research and development grants.

Implications

Under this scenario DG share will increase gradually and insignificantly with wind, hydro and landfill gas being the technologies with highest contribution.

From an environmental perspective this scenario will lead to some decrease of CO2 emissions and some replacement of coal but only by the cheapest DG that can compete with it. There might be negatives impacts on environment as the sites with best potential for wind and to some extent for hydro are in nature protection sensitive areas.

The social benefits that DG can offer will not be harnessed but the price of electricity for the final consumer will not be significantly affected as in the 'high DG' scenario.

The technical implications might come from the fact that there will be a lot of wind electricity generation in area that are not close to consumers or are with poor network capacity (i.e. along the Black Sea coast). In this case grid enhancements will be needed.

As the share of DG will most probably be low the Bulgarian Government will also try to negotiate lower target at EU level. The current targets may not be reached.

7.7.5. Optimal Scenario

Government Aims

The optimal scenario is the scenario in which the Government decides to have a maximum benefit of the opportunities DG can offer but at a reasonable costs and minimum negative environmental implications. The objectives are increased shares of DG leading to low CO_2 emissions of electricity and heat generation with decreased dependency on fuel imports, high employment in DG sector and rural development. The Government complies with the EU obligations, and provides front running example. However, the costs for the society are relatively low and the risk is born by the investors.

Policy to Promote DG

In the scenario the financial support scheme is a combination between obligation for the mature technologies, such as hydro, wind and possibly landfill gas, and feed-in tariffs for these in early development stage or undeveloped in Bulgaria, such as biomass and photovoltaics. Initial investment is supported with short or long-term loans and measures to increase biomass, i.e. grants for plantations, are introduced in order to achieve the objectives of local development and job creation. Information-based mechanisms are used to raise the awareness of investors, public administration, financial institutions, and general public.

Implications

Under this scenario there will be increased in DG technologies, especially the most mature and labour intensive ones. These are most likely to be wind, hydro, biomass and landfill gas.

The environmental benefits include again reduction of CO_2 and other harmful substances emissions as some coal power plants are displaced. Still, negative impacts are possible due to wind and hydro placed at environmentally sensitive areas, however, these might be mitigated by careful planning and stringent monitoring of the compliance. There are also risks of biodiversity reduction in the lands where biomass is grown.

Because the financial support measures are determined in a way that they do not pose a significant burden, the cost of electricity for final consumers increases but within a reasonable boundaries. This is compensated with the creation of new work places, DG industry development and the reduction of heat costs due to the installation of CHP units at DH companies, municipal buildings and small communities.

To meet the increased share of DG there will be a need for grid enhancement, including at the Black Sea coast area where a large load from wind power generation can be expected, and introduction of management system that can coordinate the increase intermittence of the system. Heat networks will have to be developed in some areas.

7.8. CONCLUSIONS

Distributed electricity generation (DG) or production of electricity and heat close to consumers, or even by consumers themselves, can help our society on its way towards achieving sustainable development by contributing to all three of its pillars – social, environmental, and economic. DG can be beneficial for Bulgaria by stimulating economic growth, local development, job creation, leading to decreased impacts on environmental protection and to greater energy independence. DG can be viable alternative for Bulgaria, but so far, has been exploited very much. The aim of this research has been to identify the reasons for this phenomenon, and to propose a policy framework for an increased DG contribution. In order to do this, a detailed study of the public policy goals, instruments, and authorities involved has been carried out. This has been followed by identification and analysis of the main barriers. The policy, regulatory, administrative and economic constraints were studied in great detail, and environmental, social and technical once briefly touched upon. The research has been based on extensive literature review, interviews with a number of experts, investors, and other stakeholders, and a questionnaire for investors in DG, and has been carried out between October 2003 and February 2008. Most of the data are updated as of May 2007.

The research has proven that there is a significant and unexploited potential, and that the level of DG penetration in Bulgaria is very small (apart from hydro power). The potential for biomass, wind and solar is significant and there are still some opportunities for new small-scale hydro power units. Although a number of natural gas-fuelled CHP units were installed by the largest district heating companies (DHC) in Bulgaria, there still significant unexplored potential for introduction of CHP in more DHC, for municipal buildings and new large-scale building developments, and in industries.

In terms of the policy and regulatory framework, there have been significant developments towards adoption of DG policy goals and support mechanisms. The priorities regarding DG are set out in several documents, that are often abolished, and include the inspiration to reach the EU negotiated target on the share of renewables, but there is limited attention to CHP. However, the rhetoric included in these documents is not substantiated, and it is obvious that the Government is prioritising large-scale generation from nuclear and coal. There are also a number of regulatory and legal barriers, such as the lack of a strategic approach and policy implementation, policy inconsistencies and contradicting legal texts, lack of security in the support instruments, lack of policy on micorogeneration, and insufficient state capacity to monitor compliance. These prevent wider introduction of DG, create insecurity in investments in DG, and give incentives to large-scale energy generation investments rather than DG. The instruments used are limited mainly to support for DG grid connection and at preferential tariffs, and are not sufficient to create an enabling environment. It such is the aim by the Government, there should be a combination of a range of policy instruments, such as financial, fiscal, nodality, and planning instruments to offer a coherent, long lasting and predictable policy mix to support DG.

The economic barriers come from the lack of financing for DG projects, and due to market failures and insufficient action of the Government to limit their impact. Although there are positive developments, such as improvement of the feed-in tariffs and the provision of loans and grants under an EBRD credit line, there are still many problems, such as a failure completely to internalise externalities which puts disadvantage DG, problems with the reward system and limited financing for the initial investment as well as for research and development, possibility for unfair treatment of DG by the existing monopolies, and the lack of sufficient high-quality information. The authorizations needed for a DG unit to start operation are numerous, complicated, and require a lot of time and efforts from investors. Corruption further limits the interest of investors in DG.

Another significant limitation is also the lack of qualified experts in the public administration, and of of engineers, who understand the specifics of these technologies and technicians to carry out maintenance and retrofitting of units. There are also indications that certain DG can also lead to environmental problems, therefore careful consideration of all impacts and monitoring of operations is needed. There is not sufficient information on the possible technical barriers, but it is expected that the main ones in Bulgaria will come from the lack of sufficient grid capacity in some areas, and can thus be resolved by adequate investment.

In Chapter 7 a comprehensive framework for improvement of the policy framework for the support of DG technologies in Bulgaria is proposed, based on the overview of the barriers in the country and an overview of international experience. The most urgent measures that need to be undertaken to increase the DG share are: (i) placing DG high on the policy agenda, (ii) correcting the limitations of the existing support mechanisms, in particular the feed-in tariffs and connection rules, (iii) decreasing the administrative burden and inclusion of DG in planning policy to ease the authorization process, (iv) developing support for the initial investments and the creation of a stable investment environment, (v) improved information on the potential and opportunities for investment support, and wider dissemination of DG benefits, (vi) better inclusion of stakeholders in the process, and (vii) promoting manufacturing of DG components in Bulgaria.

This thesis concludes with five scenarios which are offered based on the research, and depending on what aims the Bulgarian Government may wish to achieve by DG promotion. These are: (i) present policies, (ii) high share of DG, (iii) high employment and social justice, (iv) market-based approach, and (v) optimal. Each of them focuses on particular aspects obvious from their names, and describes what policy mix is needed, and what implications can be expected. The optimal scenario combines maximum benefits from DG, in terms of low CO_2 emissions from electricity and heat generation, decreased dependency on fuel imports, and high employment both in the DG sector and rural development, at reasonable cost and minimal negative environmental implications. This requires introduction of a number of instruments and the use by Government to all available resources, limitation of the barriers, and building on international experience but tailored to Bulgarian conditions. DG is an effort of many interested parties and the Bulgarian Government needs to look far and facilitate for cooperation, dialogue, and the support of investors, NGOs, EC and international organizations.

ANNEX I. BASIC CHARACTERISTICS OF THE BULGARIAN ENERGY SECTOR

Table 14. Energy use trends in Bulgaria

	year	1990	1995	2000	2001	2002	2003	2004	2005e
TPES	ktoe	28,820	23,530	19,227	19,470	19,205	19,604	20,441	21,030
Coal	%	*32%*	*33%*	*35%*	*37%*	*34%*	*38%*	*39%*	*39%*
Oil	%	*34%*	*27%*	*22%*	*21%*	*23%*	*24%*	*24%*	*25%*
Natural gas	%	*19%*	*19%*	*15%*	*14%*	*13%*	*13%*	*13%*	*13%*
Nuclear energy	%	*N/A*	*N/A*	*26%*	*27%*	*28%*	*23%*	*22%*	*20%*
Hydro energy	%	*N/A*	*N/A*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*
Electricity (export)	%	*N/A*	*N/A*	*-2%*	*-3%*	*-3%*	*-2%*	*-2%*	*-2%*
Wood etc.	%	*1%*	*1%*	*3%*	*3%*	*3%*	*4%*	*4%*	*4%*
TPES/pppGDP[22]	ktoe/$95p	0.520	0.480	0.445	0.433	0.407	0.399	0.395	0.386
TFC	ktoe	17,640	12,150	8,435	8,414	8,521	9,179	9,678	10,127
TFC/pppGDP	ktoe/$95p	0.316	0.249	0.195	0.187	0.181	0.187	0.187	0.186
TFC/TPES	%	0.610	0.52	0.439	0.432	0.444	0.468	0.474	0.482

Sources: (IEA 2004b) - for the data for 1990 and 1995, (MEER 2005) - for 2000 and onwards

Table 15. Basic electricity generation indicators

Indicator (GWh)	1990	1995	2000	2001	2002	2003	2004	2005e
Electricity Generation, *of which:*	42 141	41 789	40 927	43 969	42 701	42 554	41 515	42 872
NPP	*35%*	*42%*	*48%*	*44%*	*47%*	*41%*	*41%*	*42%*
TPP	*61%*	*55%*	*44%*	*51%*	*46%*	*52%*	*52%*	*51%*
HPP and PSHPP	*4%*	*3%*	*7%*	*5%*	*6%*	*8%*	*8%*	*7%*
Export/Import Balance	-3790	160	4620	6 925	6 925	5 489	5 879	5 700
Domestic Supply	45 931	41 629	36 307	37 044	35 776	37 065	35 636	37 172
Transmission & distribution losses	4 443	5 426	6 290	6 126	6 151	5 948	5 082	4 980
Consumption of electricity by sectors:								
Industry Sector	18 552	12 167	13096	13555	13795	15035	15340	15762
Agriculture	994	537	166	163	166	177	152	156
Commerce and Public Services	945	1 454	2 366	2 330	2 045	1 915	2 094	2 152
Residential	10 474	10 956	9 858	9 751	9 306	9 303	8 773	9 050
Total for these sectors:	30 965	25 114	25 486	25 799	25 312	26 430	26 359	27 120

Note: Data from 2000 onwards for the final consumption of electricity exclude the transport sector. PSHPP stands for pumped storage HPP

Sources of data: (IEA 2004c) - for the data for 1990 and 1995, (MEER 2005) - for 2000 and onwards.

[22] In order to make comparative analyses on an international basis in determining the PEI and FEC possible, GDP is adjusted by a coefficient reflecting purchasing power of the BGL for 1995

Table 16. Specific prices for some fuels and energy carriers as of October 2005 (the efficiency of power plant and the externalities are not taken into consideration)

Type of fuel	Price	Specific heat of burning	Specific price
Average electricity price at daytime tariff for commercial consumers connected to medium voltage grid	0.12 BGN /KWh	-	139 BGN/Gcal
Biomass			
Wood sawdust	68.4 BGN/t	2700 kCal/kg	25 BGN/Gcal
Firewood (Sofia)	80.0 BGN/t	2700 kCal/kg	30 BGN/Gcal
Baled straw	104.4 BGN/t	3400 kCal/kg	31 BGN/Gcal
Briquettes and pellets from wood	186.0 BGN/t	4400 kCal/kg	42 BGN/Gcal
Fossil fuels			
Lignite wholesale for energy generation	15.6 BGN/t	~ 1600 kCal/kg	10 BGN/Gcal
Brown wholesale for energy generation	41.1 BGN/t	~ 2530 kCal/kg	16 BGN/Gcal
Anthracite wholesale for energy generation	102.5 BGN/t	~ 4185 kCal/kg	24 BGN/Gcal
Imported coal	150.0 BGN/t	6200 kCal/kg	24 BGN/Gcal
Natural gas for commercial consumers	439.0 10^3 BGN/nm^3	8000 kCal/10^3nm^3	55 BGN/Gcal
Heavy fuel oil (mazut)	780.0 BGN/t	9300 kCal/kg	84 BGN/Gcal

Sources: (EEA 2006), (NSI 2003)

Note: The prices are with included VAT and for biomass are for the city of Sofia.

The existing power plants efficiency and externalities are not taken into consideration.

1 Bulgarian lev (BGN) is approximately 0.5 EUR.

Table 17. Share of DG in electricity generation from RES and CHP in Bulgaria

Indicator	1990	1995	1999	2000	2001	2002	2003	2004	2005
Total Electricity Generation	42 141	41 789	38 248	40927	43 969	42 701	42 554	41 515	42 872
RES-electricity (el.) total	1 878	1 751	2 753	2 673	1 736	1 656	2 956	3 296	3 493
Share RES-el. total in el. generation	*4.5%*	*4.2%*	*7.2%*	*6.5%*	*3.9%*	*3.9%*	*6.9%*	*7.9%*	*8.1%*
Wind power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	3.0
Small-scale HPP	150	150	150	150	352	373	450	528	583
Share RES-el. below 10 MW in el. generation	*0.4%*	*0.4%*	*0.4%*	*0.4%*	*0.8%*	*0.9%*	*1.1%*	*1.3%*	*1.4%*
El. output-public CHP plants	7 385	5 574	3 475	3 795	4 054	3 610	N/A	N/A	N/A
El. output-autoproducer CHP plants	3 882	2 824	2 130	1 845	1 711	1 425	N/A	N/A	N/A
Total CHP	11 267	8 398	5 605	5 640	5 765	5 035	N/A	N/A	N/A
Share of CHP in el. generation	*26.7%*	*20.1%*	*14.7%*	*13.8%*	*13.1%*	*11.8%*	*N/A*	*N/A*	*N/A*

Sources of data: For RES BSREC calculations, for CHP (IEA 2004c) data for 2002 are preliminary, for electricity generation (IEA 2004c) and (MEER 2005)

Table 18. Potential for biomass waste in Bulgaria

Type of waste	Total Potential	Unused Potential	
	ktoe	ktoe	%
Forestry residues	1,110	510	46
Industrial waste	77	23	30
Agricultural plant waste	1,000	1,000	100
Agricultural animal waste	320	320	100
Landfill gas	68	68	100
Rapeseed oil and fat wastes	117	117	100
Total	2,692	2,038	76

Source: EEA 2006
Note: Data refers to use for heat, electricity generation or both.

Table 19. Theoretical potential for biomass use by regions

Type of waste/ Region		Urban & biological (PJ/year)	Industrial & wooden (PJ/year)	Municipal solid (PJ/year)	Firewood (PJ/year)	Natural fibres (PJ/year)	Agricultur e liquid (PJ/year)	Paper (PJ/year)	Total for the region	
									(PJ/year)	(ktoe/year)
North-West Region - Vidin		4.3	0.01	0.7	0.6	0.002	0.9	0.001	6.5	155.2
North Central Region Rousse		17.7	0.2	3.2	1.2	0.04	2.5	0.07	**24.9**	**594.7**
North-East Region - Varna		**25.5**	0.1	1.5	1.8	0.002	2.6	0.003	**31.4**	**750.0**
South-East Region - Bourgas		10.8	0.03	0.8	1.3	0.000	1.4	0.009	14.4	343.9
South Central Region - Plovdiv		15.1	0.1	**3.7**	**2.1**	0.01	**2.8**	0.2	**24.0**	**573.2**
South–West Region - Sofia		3.6	0.03	2.8	1.3	0.02	1.3	0.03	9.1	217.3
Total	(PJ/year)	**77.1**	0.4	**12.6**	**8.4**	0.1	11.4	0.3	**110.3**	**2 634.5**
	(ktoe/year)	**1 841.5**	9.6	**300.9**	**200.6**	2.4	272.3	7.2	**2 634.5**	

Source: (REC 2004)

Note: The highest values are in bold.

Table 20. Distribution of the technical potential for small hydro power plants in Bulgaria by regions

Region	Technical potential for small HPP (GWh/year)
Sofia - city	16
Burgas	76
Varna	13
Lovech	117
Montana	196
Plovdiv	79
Ruse	41
Sofia - region	177
Haskovo	41
Total for the country:	**756**

Source: Energoproekt 1994, cited in EEA 2006

Table 21. Locations with high potential for wind energy in Bulgaria (wind speed measured at 10 m above ground (in brackets extrapolations for 50m)

Location	**Description**
In the central Mountainous region and on the Black Sea	Average wind speed of 7 m/s recorded in these areas (8.8 m/s)
Peak Musala, Southwest	Wind speed 7.6m/s (9.5 m/s)
Peak Botev, Central Bulgaria	Wind speed 9.1m/s (> 11 m/s)
Peak Cherni vrah, Near Sofia.	Wind speed 9.3m/s (> 11 m/s)
Peak Murgash, North of Sofia	Wind speed 10.3m/s (>12 m/s)
Ahtopol, East, near by Black Sea	Wind speed 4.6m/s (5.8 m/s)
Obzor, East, near by Black Sea	Wind speed 4.6m/s (5.8 m/s)
Emine, East, near by Black Sea	Wind speed 4.6m/s (5.8 m/s)
Cape Kaliakra, Northeast, near by Black Sea	Wind speed 6.7m/s (8.4 m/s)

Source: (Black & Veatch *et al.* 2003)

Table 22. Potential for biomass-fuelled CHP, excluding biomass already exploited for energy production

Type of biomass	Estimated available resource in the long-term, >10 years	Estimated potential biomass CHP (installed capacity, MW)		
	PJ	MW fuel	MW electric	MW thermal
Agricultural residues	10	460	114	228
Wood processing	30	1380	342	683
Energy crops	5	230	57	114
Waste	35	1610	398	797
Sewage	10	460	114	228
Other	5	230	57	114
Total	95	4370	1082	2163

Source: (CRES *et al.* 2003)

ANNEX II. ADIMINISTRATIVE PROCEDURES

1. Land use and planning - related procedures

Change in designation of agricultural lands and forestry lands

Table 23. Procedure for changing of designation of agricultural lands

	Procedure	Authority	Timeframe	Legal base
1	Submitting application for change of land status	Mayor of the Municipality	30 days	Art. 20a
2	The Mayor forwards the request to the relevant Commission	Committee to the regional directorates Agriculture and Forests (for land up to 5ha and the land is within the borders of settlements) Committee for the Farm Lands (all other cases)	30 days	Art. 17 (1)
3	Notification of the changes	Cadastre authority	7 days	Art. 25

Source of data: Law for the Preservation of Agricultural Lands (LPAL) (National Assembly 1996, last amend. 2003)

Table 24. Procedure for changing of the designation of forestry lands

	Procedure	Authority	Timeframe	Legal base
1	Request for a preliminary consultations regarding the change	Director of the NFD	1-month	Art. 14b
2	Application	Director of the NFD	?	Art. 14c (1)
3	Proposal for a decision	Committee, appointed by the Director of the NFD	1 month	Art. 14c (3)
4	Final decisision	Council of Ministers on the proposal of the Minister of Agriculture and Forestry (for forests with area of more than 100dca) the Minister of Agriculture and Forests on the proposal of the Director of the National Forestry Directorate (NFD) (for forests with area below than 100dca)	?	Art. 14a

Source of data: Law on Forestry (LF), (National Assembly 1997, last amend. 2003)

Change of detailed regional development plans

Table 25. Procedure for changing of a Detailed Territory Development Plan (PUP)*

	Procedure	Authority	Timeframe	Legal base
1	Application (if the investor wants a draft plan for changes of PUP these may be included in the application)	Municipal Mayor	14 days	Art. 135 (3) from ZUT
2	Additional process	Chief Architect may ask expert committee to make preliminary decision on the application	1 month	Art. 135 (3) from ZUT
3	Development of proposal for detailed development plan	Can be initiated on the proposal of investor after approval of the Municipal Mayor	No deadline	Art. 124 (2)
	?? For development of PUP public procurement procedure should be followed			Art. 126
4	Decision on initiation of procedure for changes in the PUP	Municipal Mayor	No deadline	Art. 128 (1) and (3)
5	Public announcement of draft PUP	Interested stakeholders	14 days for its contestation	Art. 128 (5)
6	Consultation with other institutions and approval of draft PUP	Interested institutions for consultation, Municipal (or National) Expert Committee for approval	1 month to decide	Art 128 (7) and (8)
	Additional procedure: If the draft PUP is rejected or returned for changes, the procedure should be repeated			Art 128 (10)
7	Final decision	Municipal Mayor (for local projects); or Regional Governor (projects for more than 1 municipality or of regional importance); or Minister of Regional Development and Public Works (projects for more than 1 region or of national importance)	14 days	Art. 129 (2) and (3)
8	Final decision – projects concerning transport and technical infrastructure	Minister of Regional Development and Public Works	1 month	Art. 129 (4)

Source of data: Law on Spatial Development, (National Assembly 2001, last amend. 2006)

*Note: the procedure is for projects that have a scope of less than 3 districts or are of properties beyond the borders of urban areas (Art. 128 (3). LSpD), which is the case of most DG projects. Otherwise the procedures are more complicated.

2. <u>Procedures related to construction</u>

Table 26. Procedures related to construction

	Procedure	Authority	Timeframe	Legal base
<u>Design visa</u>				
1	Submition of a written request	Chief municipal architect	14 days	Art. 140 of LSpD
<u>Provisional project proposal consultation</u>				
2	Submition of a written request	Chief municipal architect District Governor (for projects concerning more than 1 municipality) Minister of Regional Development and Public Works (for projects with national importance)	1 month	Art. 141 (1), (6), and (7) LSpD
<u>Coordination and approval of investment project</u>				
3	Coordination and consulting of the technical or working investment project	Chief municipal architect District Governor (for projects concerning more than 1 municipality) Minister of Regional Development and Public Works (for projects with national importance)	1 month (if prepared by the investor) or 7 days (if by licenced firm)	Art. 142 (6) 1-2 and Art. 144 (3)
<u>Construction permit</u>				
4	Applicaion	Chief municipal architect Municipal Council and Chief architect of the region (for regional projects)	7 days	Art. 148 (3)
5	Notification of relevant stakeholders / possibility for legal contesting the decision	Stakeholders	14 days	Art. 149
<u>Permit for the start of operation</u>				
6	Application	Director, Directorate for National Construction Supervision (DNCS)	7 working days	Art. 177 (2)
7	The Director of DNCS appoints special committee	Committee	10 to 20 days	Art. 6 of Regulation 2
8	Chairperson of the committee prepares and signs a minutes	Committee	5 days after the last meeting	Art. 17 (1) of Regulation 2
9	Decision	Director, DNCS	5 days	

Sources of data: Art. 139 of Law on Spatial Development (LSpD), (National Assembly 2001, last amend. 2006); Regulation 2 (MRDPW 2003, last amend. 2005)

3.

Environmental protection - related procedures

Table 27. Procedure for assessment of the need for Environmental Impact Assessment (EIA) or 'complex permit'

	Procedure	Authority	Timeframe	Legal base
1	Application	Project developer		Art. 5
2	Decision on whether the project is subject to EIA or complex permit procedures	Director of RIEW Or Minister of MOEW (if more than one RIEW are concerned)	14 days	Art. 5
3	Additional process: Completion of file if information is missing	Project developer (the time under row 2 is stopped)	N/A	Art. 5?
4	EIA screening and decision on the need of complete EIA	Competent authority (as in row 2)	1 month	Art. (8)
5	Announcement of the decision	Competent authority (as in row 2)	3 days	Art. (8)

Source of data: Regulation on EIA (Council of Ministers 2003, last amend. 2006)

Table 28. Procedure for the decision on EIA

	Procedure	Authority	Timeframe	Legal base
1	Submitting of EIA report	Project developer		Art. 96 (1)
2	Decision on whether all legal requirements are met	Director of RIEW Or Minister of MOEW (if more than one RIEW are concerned)	14 days	Art. 96 (6)
3	Public hearing	Project developer, competent authorities (as in row 2), and regional authorities Interested stakeholders	Announcement at least 30 days in advance	Art. 97
4	Submission minutes of the public hearing and the comments of the interested stakeholders	Investor to the competent authorities (as in row 2)		Art. 99 (1)
5	Decision – positive or negative on the EIA	Competent authority (as in row 2)	3 months	Art. 99 (2)
6	Announcement of the decision	Competent authority (as in row 2)	7 days	Art. 99 (4)
7	Contestation of the decision	Interested stakeholders	14 days	Art. 99 (6)

Source of data: Law on Environmental Protection (LEP), (National Assembly 2002, last amend. 2006)

<u>Complex permit (Integrated Pollution Prevention and Control (IPPC) permit)</u>

Table 29. Procedure for issuing 'complex permit'

	Procedure	Authority	Timeframe	Legal base
1	Application to be verified by the competent authorities	Executive Environment Agency (EEnA)	45 days	Art. 10 (1)
2	Additional process: Completion of file if information is missing	Project developer	30 days	Art. 10 (4)
3	Onsite inspections to verify the data supplied	MOEW, EEnA or RIEW (additional to1 or no??)	Within 30 days	Art. 10 (3)

	Procedure	Authority	Timeframe	Legal base
4	Public announcement of the application. (simultaneously to row 1, within 14 days of the submission of application)	Competent authority	Within 14 days	(Art. 11) ?
5	Comments by the interested parties (simultaneously to row 1)	Interested parties	30 days	(Art. 11)
6	Technical review	EEnA	N/A	
7	After 6 EEnA coordinates the report with other institutions	Interested institutions	within 30 days	(Art. 15 (1))
8	Notification of the applicant and municipality of the outcomes of the consultation	EEnA	7 days	Art. 15 (2) and (3)
9	Public disposal of the application	Municipality	30 days	Art. 126 of Env Act
10	Comments by investor (Simultaneous to row 9)	Investor	30 days	Art. 126 of Env Act
11	Decision	Minister of Environmental Protection and Waters	5 months (after the end of public consul.)	Art. 127(1)1
12	Issue of the permit, announcement via mass media	Competent authority (as row 11)	14 days	Art. 127 (2)
13	Contestation of the decision	Interested parties	14 days	Art. 127 (3)

Source of data: Law on Environmental Protection (LEP), (National Assembly 2002, last amend. 2006)

4. <u>Resource use - related procedures</u>

Table 30. Procedure for issuing permits for water and water body use

	Procedure	Authority	Timeframe	Legal base
1	Application to be verified by the competent authorities	Minister of Environment and Waters[1] or Basin Directorate Director[2]	1 month	Art. 61(2) WL
2	Additional process: Completion of file if information is missing	Project developer	14 days	Art. 61(3)
3	Note to the Municipal Mayor	As in row 1, Municipal Mayor	3 days	Art. 62a. (4)
4	Comments by parties interested	interested parties	14 days	Art. 64 (1)
5	Issue of the permit	competent authority (as row 1)	14 days	Art. 67 (1)
6	Additional process: If objection of interested parties, Committee decides	Appointed by the competent authority Committee	1 month	Art. 67 (2)
7	Notification of the applicant	competent authority (as row 1)	10 days	(Art. 70)

Source of data: Law on Waters (LW), (National Assembly 1999, last amend. 2006)

Note: ([1]) application to the Minister of Environment and Waters: for water extraction or water body use of certain big dam complexes and significant dams (Art. 52. (1) 2. aa, LW); or transfer of waters between river basins (Art. 51 (1) 2.b, LW).

([2]) Basin Directorate Director – all other cases.

5. Electricity/heat generation - related procedures;

Table 31. Procedure for requesting a study for conditions for connection to electricity grid and signing of connection contract

	Procedure	Actor / institution	Timeframe	Legal base
1	Request for a study on the conditions and way of connecting to electricity grid and preliminary contract	Applicant		
2	Additional process – if the TSO decides to redirect the request to the DSO	TSO/DSO	1 month	(Art. 50, (3)).
3	Additional process – Request for additional information	DSO/TSO	No later than 14 days after the submission of request	Art. 56, (5)
4	Additional process – Completion of the request	Applicant	1 month after requested	Art. 56, (6)
5	Additional questions	TSO/DSO to the applicant	14 days for response per each	Art. 56, (4)
6	Elaboration of the study / Preliminary contract proposed	TSO DSO	90 days [1] 30 days [1]	Art. 56, (1) 2
7	Application for a contract for connection to electricity grid	Applicant		
8	Contract for connection to electricity grid	DSO/TSO	60 days	Art. 57. (2)
9	Applicant signs the contract	Applicant	within 2 years[2]	Art. 58

Source of data: Regulation 6 from 9.06.2004, (MEER 2004c)

Note: ([1]) this deadline is prolonged with the periods described in rows 3, 4 and 5 of the Table. ([2]) After the expiration of this period a new request for study and contract should be filed.

Table 32. Procedure for issuing of a licence for electricity generation and for electricity and heat generation

	Procedure	Actor / institution	Timeframe	Legal base
1	Request for licence submitted to the State Energy and Water Regulatory Commission (SWERC)	Applicant		
2	Consideration of the application	SWERC	45 days	Art. 8 (4) 1 of Reg. on licencing Art. 39 (1), of Statue of the SEWRC
3	Request for commencement of exercising of licensed activity or modification	Applicant		
4	Decision on issuing of a permit for the commencement of exercising of licensed activity, for modification, or withdrawal of the licence	SWERC	30 days	Art. 22 (2) Reg. on licensing
5	Notification of the decision	SWERC	3 days	

Sources of data: Regulation on licensing (Council of Ministers 2004c) and Statue of the SEWRC (Council of Ministers 2004, last amend. 2005)

ANNEX III. QUESTIONNAIRE FOR INVESTORS

BARRIERS TO DECENTRALIZED ELECTRICITY GENERATION IN BULGARIA

(QUESTIONNAIRE FOR INVESTORS)

The data collected will be used for a PhD research, entitled:

Developing Sustainable Energy Systems: Policies, Barriers and Prospects for Distributed Electricity Generation in Bulgaria

PhD Student: Gergana Miladinova

Main supervisor Prof. Diana Urge-Vorsatz (Central European University, Budapest)

The questionnaire will be used SOLELY for the needs of the PhD research.

The information from all questionnaires will be summarized and no concrete data, which can be considered sensitive for you, will be made public. However, if you consider that some of the answers to the questions can be confidential and do not want to provide them please feel free not to answer them.

THANK YOU FOR YOUR COOPERATION!!!

For contact:

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1. DATA FOR THE INVESTOR

Firm	
Main activities	
Address	
Director	
Telephone	
Web site	
E-mail	
Name of the respondent	

2. DATA FOR THE INVESTMENT

Technical parameters

Type of renewable source or co-generation		
Type of technology		
Number of installed units		
Total installed electric (and thermal) capacity	kWe kWth	
Annual electric/heat output	MWh/year	
Annual operating time	h	
Efficiency of electricity (and heat) generation	%	
The unit is connected to grid at .. voltage	V	
The units are bought new or 'second hand'		
Location of the installations		

Financial data

Total investment	€ or BGL	
Costs of the project development phase (until the initiation of the construction works)	€ or BGL	
Equipment costs		
Construction works costs		
Anticipated period of return of the invesmnet		
Price at which electric (and thermal) energy is purchased	BGL/MWh	

3. PROJECT PHASES AND THEIR DURATION

At which phase is the project now (i.e. development, construction, production)	
Initiation of development phase (month, year)	
Initiation of construction works (month, year)	
Date of start of operation (month, year)	

For the different phases, please provide more detailed information on each phase and subphase. (This separation in phases is indicative but helps for better understanding of the whole process)

3.1. Project development phase

- **Subphase search/pre-feasibility** *(includes activities such as: search for a suitable site; choice of desired technology; rough determination of the available budget; measurement campaigns; accomplishment of one or more pre-feasibility studies)*

  How long the completion of this subphase took (in months) (please provide estimation, if concrete figure is not available):

  Main problems and how did you overcome them:

  Recommendations:

- **Subphase negotiation/development** *(includes activities such as: negotiating the terms of a contract; visits to the project site; hiring lawyers to draft contracts; evaluation of different financing schemes for the project; negotiations regarding loans; economic and technical feasibility studies; environmental impact and public enquiry)*

  How long the completion of this subphase took (in months) (please provide estimation, if concrete figure is not available):

  Main problems and how did you overcome them:

  Recommendations:

- **Subphase administrative procedures** *(includes all activities related to the obtaining of various licences, permits, concessions required)*

  How long the completion of this subphase took (in months) (please provide estimation, if concrete figure not available):

  (More detailed questions on this subphase are included further in the questionnaire)

3.2. Construction phase

How long the completion of this phase took (in months) (please provide estimation, if concrete figure not available):

Main problems *(such as: problems with construction works, with the existing infrastructure; due to the lack of qualified technicians)* and how did you overcome them:

Recommendations:

3.3. Phase of electricity/heat generation

Main problems *(i.e. technical problems which have led to stop of operation; maintenance costs and problems; problems with the purchasing of energy; problems with changes in the legal framework)* and how did you overcome them:

Recommendations:

4. SOURCES OF PROJECT FINANCING

How is your project financed?

Own capital	% or BGL or EUR	
Bank credit	% or BGL or EUR	
Preferential loan	% or BGL or EUR	
Other (please specify)	% or BGL or EUR	

If you have obtained credit please provide information from which bank/institution you took it and under what conditions (period, interest rate, grace period, requirements for credit securities)?

Do you know about the various opportunities for preferential credits in Bulgaria (such as BEEF, EBRD credit lines)? Do you think that they provide transparent and easy accessible opportunity for financing?

Did you have problems with ensuring the financing? If yes, please describe them

Did you have problems with the preparation of relevant documents? If yes, please describe them

How much time did the process took? Did you use external consultant?

Have you signed a contract for trading of the CO_2 emission reduction units, if any, under the Joint Implmentation scheme? If yes, what are the conditions?

Please provide your recommendations on how the process can be improved:

5. LICENCES, PERMITS AND CONCESSIONS

Please, fill in the table below by evaluating, as far as it is possible, the difficlty of obtaining the relevant documents.

To evaluate the difficulty please use the following scale:

0 - not relevant; 1 - no problem - quickly and cheap, 2 - requires preparation but is quick and cheap; 3 - normal; 4 - requires time and money but is obtainable; 5 - hardly possible to obtain - requires significant financial resources and time.

For the activities that were most problematic please give more explanations on the main problems. Please use the space below if necessary.

Please, if possible, provide information on how long was the process (from the beginning of preparation of documents until the relevant administrative document is issued).

Document	Difficulty	Problem	Duration
Permits related to the change of status of land			
Permits related to resources use			
Permit for water use and use of water site			
Concessions			
Other			
Documents related to the generation of electricity (heat)			
Request for a study of conditions and way of connecting to electricity grid			
Agreement/contract for connection to electricity grid			
Request for a study of conditions and way of connecting to thermal transmission grid			
Agreement/contract for connection to thermal transmission grid			
Permit from DKEWR			
Licence for electricity generation Licence for electricity and heat generation			
Other			
Permits related to environmental protection			
Environmental Impact Assessment (EIA, and also pre-EIA)			
Complex permit			
Permits related to construction			
Design visa			
Permit for construction			
Permit for entering in operation			
Other			

Please describe the procedures that you find most complicated and how did you solve the problems arising.

Did you receive enough information and support from the relevant public authorities?

Were the legally set time deadlines for issuing or the relevant administrative document respected? If not please give examples.

Did you use external consultant for the preparation of the necessary documents? If yes, are you satisfied with his/her services?

Please provide your recommendations on how the process can be improved:

6. TECHNICAL AND CONNECTION TO THE GIRD CONSTRAINTS

Did you have technical problems with the unit?

In case of CHP was it calculated well enough to meet the heat demand?

Did you have problems in fulfilling the procedures for connecting to electricity grid?

Do you think that the process is well regulated and that the existing rules and standards are clear and transparent?

Do you think that some of the requirements are not necessary?

Please provide your recommendations on how the process can be improved:

7. AVAILABILITY OF INFORMATION

How did you decide to invest in RES/CHP and from where and how did you obtain the necessary information?

Were you supported from governmental institution? If yes, by which?

If you had questions or problems related to the different procedures did you receive enough information in time?

8. LEGISLATIVE FRAMEWORK

Are you satisfied with the currently existing mechanisms for the support to renewable energy sources or co-generation.

	Yes/No	Problem	Recommendation
Preferential tarrifs			
Preferential connection			
Purchasing of electricity			
Investment subsidy (BEEF other)			
Other			

What changes would you recommend in the existing legislation?

9. BARRIERS

Please evaluate the importance of the various barriers (if they exist) and give your recommendations on how in your view they can be overcome.

For the evaluation of the importance please use the following scale:

1 it does not exist in Bulgaria

2 it is not a significant barrier

3 it is a significant barrier but can be easily overcome

4 very difficult to overcome

5 impossible to overcome

Barrier	Importance	Solution
Lack of national strategy for RES/CHP promotion		
Frequent changes of the regulations		
Lack of information on the potentials		
Lack of information regarding the investment process		

Barrier	Importance	Solution
Long administrative procedures		
Lack of financing		
High fuel price		
Connection to the grid		
Unfair competition from the existing monopolies		
Lack of experts		
Problems related to environmental protection		
Conflict with NGOs		
Conflict with local population		
Other		

THANK YOU!!!

ANNEX IV. LIST OF INTERVIEWEES

Respondents to the questionaire on Barriers to Distributed Generation in Bulgaria

	Expert (position) Firm/relevant activity	Type of communication
	HPP	
1	Evgeni Angelov (Director) Hydroekoenergo – TAC Ltd *Development and construction of microHPP, owner of HPPs*	Interview/Questionnaire 1/09/06
2	Bogan Siromahov *HPPs owner and project developer*	Interview/Questionnaire 18/08/06
3	Georgi Denkov (General manager) Delektra Hydro *Development and construction of HPPs, owner of HPPs*	Interview/Questionnaire 30/08/06
	Wind power	
4	Velizar Kiriakov (President) Association of Producers of Ecological Energy Also owner of several wind turbines	Interview/Questionnaire 22/08/06
5	Georgi Petkov, (Executive Director) Kaliakra Wind Power AD Krassimir Kostadinov (advisor) Mitsubishi Corporation Wind park developers and owners	Interview/Questionnaire 6/08/06
6	Stilian Burhanlarski, manager Eolica Bulgaria *Wind park developer and owner*	Interview/Questionnaire 21/09/06
7	Dimitar Donchev GEO power Ltd *Wind park developer and owner*	Interview 6/08/06
	PV	

8	Petar Ivanov EOS-Technologies *Developer pv systems*	Telephone interview 18/08/06
	Biomass	
9	Kostadin Madgarski (president) National Association for Transfer of Technologies *Biomass project developer*	Interview
	CHP	
10	Valio Duchev (Deputy Executive Director) District Heating Burgas EAD Generation of electricity, generation and distribution of heat	Email comm../ questionnaire
11	Ilia Nikolaev (Director) District Heating Varna EAD *Generation of electricity, generation and distribution of heat*	Interview/Questionnaire 22/08/06
12	Angel Angelov (Director) District Heating Vratza EAD *Generation of electricity, generation and distribution of heat*	Questionnaire 15/09/2006
13	Valentin Terziyski (Director Investment and Business Development) LM Impex Ltd *Owns several district heating companies*	Interview/ questionnaire 7/09/2006
14	Dimitar Dimitrov (Director) Dr Energy Systems *Developer co-generation installations, natural gas engines, landfill gas projects*	Interview 31/08/2006
15	Valentin Vassilev (Executive Director) District Heating Pravetz JSCo *Generation of electricity, generation and distribution of heat*	Telephone interview 14 and 25/09/06

List of experts with whom aspects relevant to DG were discussed on various occasions

(Note: The list is not exhaustive and includes the experts that have contributed with significant information or ideas during my research)

STATE INSTITUTIONS
Kostadinka Todorova (Head of Unit) Vladislava Georgieva (expert) Ministry of Energy and Energy Resources Meeting autumn 2005
Valko Koparanski Ministry of Environment and Waters, Climate Change and Policy Department Interview on the opportunities for JI co-financing, 09/2006
Kolio Kolev (Director) Michael Bulgarenski (chief expert) Nikolay Nikolov (chief expert) Krasimir Naydenov (Head of Department) Energy Efficiency Agency Number of meetings and discussions on the DG developments in Bulgaria, 2004-2007
Venelin Barosov Kinka Boneva Vasil Koutinchev State Energy and Water Regulatory Commission Administrative requirements related to DG
Ivan Gerginov (Executive Director) Bulgarian Energy Efficiency Fund (BEEF) Discussion on the activities and support provided by BEEF, 7/09/2006, SOFENA Workshop
Todor Kolev (Head of Unit, Preventive Actions) Regional Inspectorate of Environment and Waters – Varna Interview on the EIA and wind parks development in Varna region 23/08/2006
Nikolaj Nedialkov (senior expert, Protection of Biodiversity)

Regional Inspectorate of Environment and Waters – Varna Interview on the impacts of RES on biodiversity in Varna region 22/08/2006
Rossen Aleksov (expert) Regional Inspectorate of Environment and Waters – Blagoevgrad Informal discussion on the impacts of small HPP and the opportunities for small units in mountain huts in Blagoevgrad Region September 2007
Radoslav Stanchev (expert) Executive Agency of Environment Informal discussion on the impact of biodiversity of RES development projects January 2006
AGENCIES, CONSULTANCIES, FIRMS
Lulin Radulov (Director) Angel Nikolaev (expert) Black Sea Regional Energy Centre A number of discussions on policy and limitations to DG in Bulgaria during 2004 - 2007
Veneta Uzunova (Executive Secretary) COGEN – Bulgaria Interview, 08/2007
Assoc.Prof. Ivan Shishkov (Executive Director) Sofia Energy Agency – SOFENA Zdravko Georgiev (Deputy President) Association of Bulgarian Energy Agencies Discussion on the opportunities of DG and projects' funding, 2005-2007
Arjan Visser (country manager) Ecofys Bulgaria Discussions on the investment opportunities and barriers to DG development in Bulgaria September 2005, May 2006, June 2006
Svetoslav Nikolov (Deputy Executive Director) Overgas

Short discussion on the activities of Overgas regarding the promotion of small scale CHP units, May 2005 (?)
Jordan Ignatovski Energy consultant A number of discussions on policy and limitations to DG in Bulgaria during 2004 - 2007
RESEARCH ORGANIZATIONS
Prof. Petko Vitanov (Director) Assoc. Prof. Tzvetanka Toneva Central Laboratory of Solar Energy and New Energy Sources Bulgarian Academy of Sciences Feasibility of PV, policy needed and September 2005 and March 2007
Valden Georgiev (senior expert) Institute of Melioration and Mechanization Current RES policy and its historical development, September 2005
Assoc. Prof. Anastasia Krasteva (Vice Director) Technical University - Sofia Information on DGNET project, May 2005 (?)
NGOs
Ivan Hristov (officer) WWF Bulgaria A number of discussions on the consequences of RES on biodiversity protection, 2004-2007
Fidanka Bacheva-MacGrath (regional coordinator) CEE Bankwatch Network Environmental impact of DG, EBRD activities in Bulgaria
Irena Kostadinova (officer EU policy) Bulgarian Society for the Protection of Birds Wind turbines and their impact on birds' migration, 2006
INTERNATIONAL CONTRIBUTIONS

Karina Veum (Policy officer) European Commission, DG TREN, Unit D1 Information on the negotiations between the EU and Bulgaria regarding the RES - electricity Directive, Belgium, March-July 2006
Arend Bosma (energy policy advisor) Province Zuid-Holland, The Netherlands Extensive discussion on the penetration and opportunities for DG development in Bulgaria, Bulgaria, Belgium, 2006
Oliver Schäfer (Policy Director) European Renewable Energy Council Occasional discussions on renewable energy policy in the EU, Belgium, April, May 2006
Susanne Haefeli (expert CDM and JI) DNV (leading independent greenhouse gas verifier) Interview on the JI opportunities and how national governments can support the process, Norway, July 2005
Ulrich Jochimsen Netzwerk Dezentrale Energie Nutzung Discussion on the development of CHP technologies and policy in Europe, Spain, August 2005

REFERENCES

AEAF, Agency for Economic Analysis and Forecasting. 2003. *National plan for economic development of Bulgaria for the period 2000-2006. Revised version*. Sofia, AEAF.

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