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REGIONAL ACTION PLAN FOR PROMOTION OF COMBINED HEAT AND POWER PRODUCTION IN THE NEISSE-NISA-NYSA EURO-REGION

Energy research Centre of the Netherlands (ECN)

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1. Analysis of legal, administrative and regulatory barriers to CHP in the region.
2. Analysis of the available CHP potentials and technology options to be implemented.
3. Analysis of possible sources of financing CHP.
4. Regional workshops and training.
5. Regional Action Plan for Promotion of Combined Heat and Power Production in the ERN.

This document, the Regional Action Plan, has been published by ECN. The other project documents have been published by the project leader, SRC International CS s.r.o., and can be obtained from them.

Abstract

A regional action plan for the promotion of combined heat and power (CHP) has been developed for the Euro-region Neisse-Nisa-Nysa (ERN), a cross-border region covering part of Germany, the Czech Republic and Poland. CHP is well developed in the region but a large technical potential remains to be realised, hampered so far by various barriers. Therefore, this study aims to support regional authorities and stakeholders in the ERN in promoting CHP on regional level. Although national policy and programmes towards promotion of CHP are under development in all three countries, no actions have been undertaken on the local and regional level to implement concrete activities towards the penetration of CHP. This Action Plan is meant to help regional stakeholders to develop regional instruments that will lead to increase of the CHP potential in the region, thereby leading to an improvement both energy efficiency and environmental protection.

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ABBREVIATIONS

AIJ/JI	Activities Implemented Jointly / Joint Implementation
CEA	Czech Energy Agency
CEEC	Central and Eastern European Countries
CHP	Combined Heat and Power
DH	District Heating
EC	European Commission
EKIS	Energy Consulting and Information Centre of the CEA
ERO	Energy Regulatory Office
ERN	Euro region Neisse-Nisa-Nysa
ESCO	Energy Service Company
ESF	Energy Savings Fund (Phare)
EU	European Union
FI	Financing Institutions
GW	Gigawatt
HOB	Heat Only Boiler
HPA	Heat Purchase Agreement
IPP	Independent Power Producer
IPPC	Integrated Pollution and Prevention Control
IRR	Internal Rate of Return
KAPE	Polish National Energy Conservation Agency
MF	Ministry of Finance of the Czech Republic
MIT	Ministry of Industry and Trade of the Czech Republic
MoE	Ministry of the Environment of the Czech Republic
MW	Megawatt
NGO	Non-Governmental Organisation
NPV	Net Present Value
NUTS	Nomenclature of Territorial Units for Statistics
PJ	Petajoule
PPA	Power Purchase Agreement
REAS	Regional Power Distribution Company
RES	Renewable Energy Sources
RD&D	Research, Development and Demonstration
RUE	Rational Use of Energy
SEF	State Environmental Fund (of the Czech Republic)
SF	Structural Funds (of the European Commission)
SME	Small and Medium-sized Companies
TPF	Third Party Financing

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SUMMARY

The Action Plan presents a regional CHP (Combined Heat and Power) strategy for the Euro-region Neisse-Nisa-Nysa (ERN). This cross-border region, established as Euro-region in 1991, is part of the former Black Triangle region, the border area of Germany, the Czech Republic and Poland. Heavy industrialisation and use of coal as the sole energy source has caused damage to the environment as well as to the health of the population. Therefore, protection of the environment and improvement of energy efficiency remain an important issue in this area, leading to the development of this regional CHP Action Plan.

The project consortium has developed an Action Plan within the framework and possibilities of regional and local energy policy by addressing regional barriers towards CHP in the Euro-region. The main objectives of the CHP Action Plan are therefore:

1. To contribute to sustainable energy supply (clean, efficient and reliable) in the ERN as a whole and in the national regions in particular by increasing the share of CHP utilisation.
2. To contribute to the realisation of EU and national objectives for CHP through regional actions.

Before drafting the Action Plan, a thorough analysis of technical and economic potential of CHP in the region was carried out. CHP is already well developed in the ERN but a large technical potential remains to be realised. This is mainly the case in district heating systems, public buildings with a constant heat demand such as hospitals, and in industry. The economic potential for CHP strongly depends on the situation of the energy market, such as feed-in prices for electricity supply to the grid and fuel prices. The liberalisation of the energy market in all three countries has led to a decrease in new CHP projects developed in recent years. This liberalisation, in combination with overcapacity of power production units, resulted in low electricity prices. This development hampers further growth of the CHP potential in the ERN.

Other barriers of importance identified so far are:

- Institutional barriers:
  - Inadequate institutional framework on the local level, energy programmes and agencies promoting CHP only exist on the national level.
  - Lack of regional energy plans or energy supply concepts.
  - Lack of priority among municipal and regional authorities for energy matters in comparison to other issues such as infrastructure and environment (e.g. waste water treatment).
- Barriers related to administrative procedures:
  - Complicated procedures towards the construction of CHP plants: extensive planning and building procedures have to be followed before the construction of a CHP plant is approved.
- Barriers related to financing:
  - Lack of public financial resources for energy conservation projects.
  - Difficult access to commercial financing (little confidence of banks in energy projects).
  - Lack of knowledge among target groups in developing bankable project proposals and business plans.
  - Relatively high investment risks of energy projects, among others because of fluctuating energy prices.

After analysing barriers, potentials and national policy and regulatory framework, the following activities have been determined to reach the objectives of the Action Plan.

1. Supporting regional energy planning and municipal energy concepts, particularly the role of CHP.
2. Improving institutional capacity for energy planning and the promotion of energy efficiency, renewable energy and CHP, particularly through the establishment of regional energy agencies.
3. Improving the access and availability of regional financing mechanisms, giving regional target groups the possibility to have more financial resources at their disposal and increase their capacity to use these financial mechanisms.
4. Providing information on CHP and awareness raising, providing target groups with the necessary information about CHP.
5. Improving cross-border co-operation in the framework of the ERN and the EU, increasing cross-border co-operation and making use of European funds.

The Action Plan will address regional barriers and opportunities, as barriers related to national or EU policy cannot be influenced with a regional approach. E.g. specific CHP instruments as feed-in tariffs can only be introduced nationally. What this Action Plan can do is to focus on regional instruments, such as increasing capacity of regional authorities in the field of energy efficiency and CHP and help in the development of regional energy planning, realising the opportunities for CHP still available in the ERN. The need of strengthening regional capacity in energy policy is growing, and therefore, this action plan can also provide guidance for national governments in transferring part of their competence to regional authorities.

1. INTRODUCTION

1.1 CHP in the Neisse-Nisa-Nysa Euro-region (ERN)

The Neisse-Nisa-Nysa Euro-region (ERN) is a union of three bordering countries in the heart of Europe including the adjoining areas of the Polish Republic, the Czech Republic and the Federal Republic of Germany established in 1991. At present, the external border of the European Union runs through this region. The ERN has been established to provide a framework for transboundary co-operation to tackle common problems.[1]

The energy sector in the region is still partly based on fossil fuels (mostly coal). It has on average a low efficiency and in some parts also significant adverse environmental impacts. Combined heat and power (CHP) is a key option in improving energy efficiency because CHP involves the simultaneous production of thermal and electric energy from the same primary energy source. CHP gives energy savings of 20-40% and a reduction of up to 50% in CO_2 emissions, compared to the separated production of heat and electricity. Therefore, the European Union and the three countries in the ERN have developed their own CHP policy.

In the ERN, a substantial potential for CHP development exists. However, CHP in the region faces substantial barriers, which have prevented a further penetration of this technology in recent years. Although energy policy and regulation is still mainly the responsibility of the national governments, in both Poland and the Czech Republic a decentralisation process is ongoing. It is therefore important that on regional level action will be taken to create the conditions for CHP and to promote this technology.

1.2 This project

To support this process of regional promotion and planning, the European Commission financed a SAVE action 'Regional Action Plan for Promotion of Combined Heat and Power Production in the ERN' (project No.: 4.1031/P/00-22/2000). This project has delivered:

1. Analysis of legal, administrative and regulatory barriers to CHP in the region.
2. Analysis of the available CHP potentials and technology options to be implemented.
3. Analysis of possible sources of financing CHP.
4. Regional workshops and training.
5. Regional Action Plan for Promotion of Combined Heat and Power Production in the ERN (this document).[2]

[1] See http://www.Euro-region-nisa.cz/en/main.html.

[2] This document, the regional Action Plan, contains the actions to be taken for promotion of CHP in the ERN and also includes an analysis of barriers to CHP in the region, the available CHP potential and possible sources of financing.

The scheme below shows the consortium.

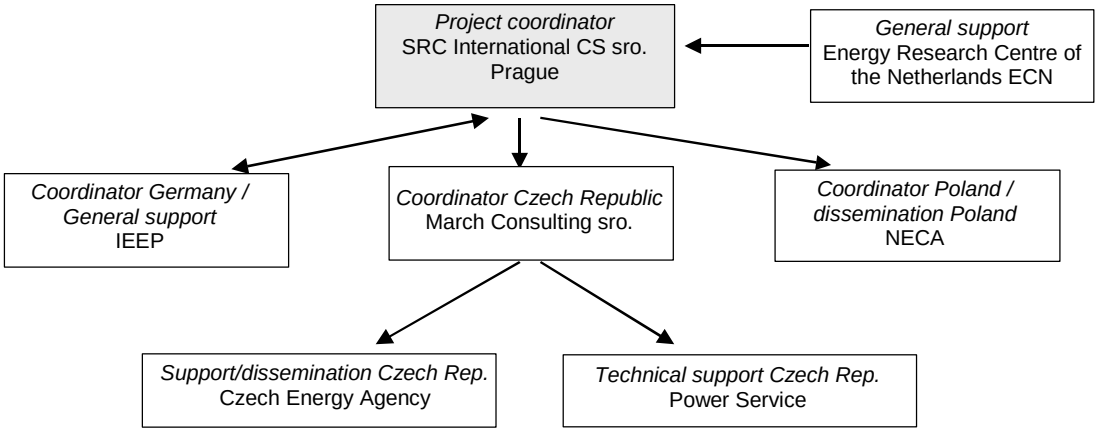

Figure 1.1 *The CHP Action Plan project consortium*

The Action Plan aims to support regional actors in the ERN in developing initiatives to promote CHP. It analyses the options and identifies concrete actions that can be taken on the short and mid term, most likely the period July 2002 until December 2005. The Action Plan can also be read as the summary of the background reports. The Action Plan will be available both in English and in the three national languages to provide regional stakeholders with a strategy for regional action towards CHP.

The ERN can benefit from the CHP Action Plan in different ways. First of all, through CHP energy efficiency of heat production will be increased in a suitable way by producing power for local or regional use. This way, energy consumers have their own power source at their disposal and are not merely dependent on large power producers and, especially when this electricity is produced for own use, CHP can save costs for the final users. A more general benefit of the CHP Action plan should be that regional energy planning and strategies will come on the agenda of regional authorities and municipalities. The CHP Action Plan presents one of the first examples of regional energy plans in this region and can be of help in the development of future energy planning and last but not least, raise awareness for energy conservation on the regional and local level.

The Action Plan has the following structure: the first chapters describe the region (Chapter 2), the target groups and Action Plan objectives (Chapter 3), the potential and barriers to CHP (Chapter 4). Chapters 5 and 6 analyse the policy and regulatory framework relevant for CHP (both EU and national framework). Chapters 7 to 10 describe the key actions of the Action Plan into detail, based on the information given in the aforementioned chapters. Chapter 11 gives an analysis of the possible impacts of the Action Plan in the ERN. All key actions are summarised in Chapter 12.

2. THE EURO-REGION NEISSE-NISA-NYSA

2.1 Introduction

The Euro-region Neisse-Nisa-Nysa (ERN) is the first cross-border collaboration region in CEECs, which has been officially funded in December 1991. The ERN covers a part of the three European countries: Germany, the Czech Republic and Poland. The total territory of the ERN is 11,366 km^2, of which 3,444 km^2 (30.3%) belongs to Poland, 3,545 km^2 (31.2%) to the Czech Republic and 4,377 km^2 (38.5%) to Germany. The total population of the ERN is 1,610 thousand inhabitants, of which 437 thousand (27.1%) lives in Poland, 479 thousand (29.8%) is in the Czech Republic and 694 thousand (43.1%) in Germany.

The ERN is a part of the Black Triangle Region in Europe, where a very high level of natural resources utilisation and a high level of pollution of the environment exists. This has resulted in very serious health problems for the population, and high damage of the environment and infrastructure. Therefore, protection of the environment and improvement of structure of energy supply and energy efficiency is one of the top priority issues in activities of the ERN.

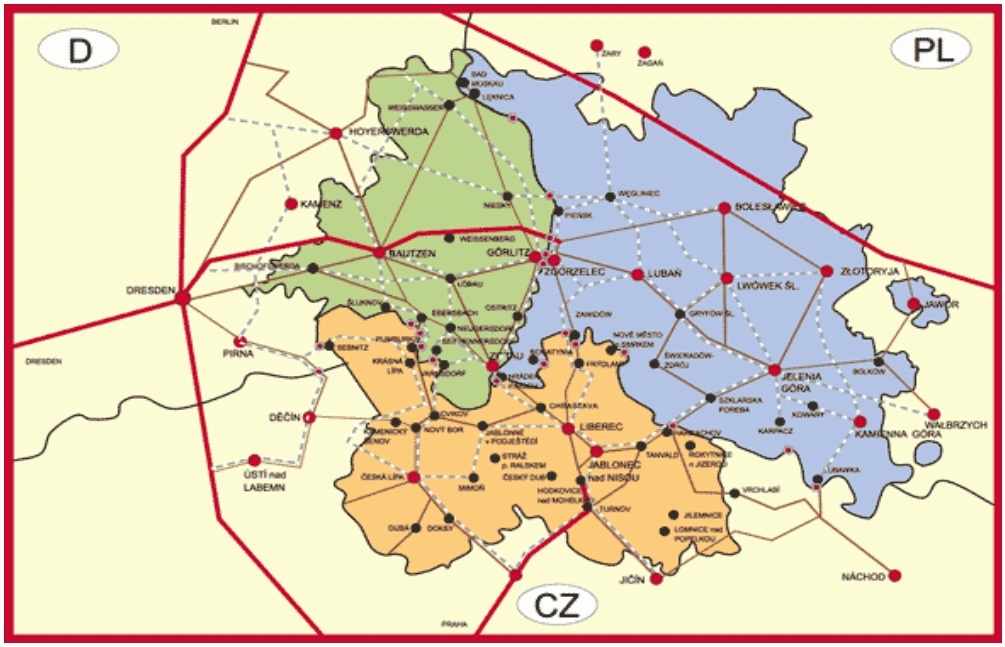

Figure 2.1 *Map of the Euro-region Neisse-Nisa-Nysa (ERN)*

2.2 Energy supply in the ERN

The *Czech* part of the ERN has been a traditional user of coal from coal mining areas in Northern Bohemia for a long period, both for district and local heating. It is mostly a low quality brown coal, which covers still a large part of energy demand by small-scale consumers (about 1/3), including households. The natural gas supply system is still under development, which in the first phase replaced the town gas and after that also step-by-step solid and liquid fuels. District heating systems in many cities still use coal and heavy fuel oil that are fired in heat only boiler plants and only few larger public and industrial CHP plants and some small-sized CHP units are operated in the region. An improvement of the current situation will require fuel switching, refurbishment of boiler plants and implementation of CHP technology. In addition, rehabilitation of district heating piping and switch from steam systems to hot water systems will

be the option for improvement of energy efficiency in district heating as well as its economic viability. The region is also rich in local renewable energy sources, including biomass but their wider use has not started yet.

The *Polish* part of the region is formed by 50 communities and 9 intermediary administrations (districts) that are responsible for infrastructure servicing a number of communities (health care centres, some intermediary schools, roads, heat supply). The heat supply systems are strictly divided into district heating for settlements constructed after the World War II and local boilers for single family houses, public administration and services. The area of ERN in Poland is very rich in health care resorts related to the local thermal water resources. Usually buildings in these resorts were equipped with own coal-fired boilers producing high level of pollution. The reduction of emissions in the whole area started with closing several industrial plants (pulp and paper factories) and modernisation of brown coal fired CHP plant in Turow. Development of the natural gas network is not supported by the state and depends on existing local demand nevertheless penetration of gas into the region has progressed recently. The region is also rich in local renewable energy sources, including biomass.

In the *German* part of the ERN, brown coal was used as the most important source of energy, until the early nineties. Crude brown coal or brown coal briquettes were used in most industrial and commercial systems without flue gas desulphurisation systems. In the rural area, brown coal was also the main source of energy in households. In larger cities, the supply was completed by coal-fired district heating and town gas networks. The situation did not differ from that one in the Czech and Polish parts of the ERN. Since 1990, brown coal has been step by step replaced to a large extent by natural gas and oil. Parallel to this re-equipment and extensive measures for energy conservation were carried out. Uneconomic systems of the industry were shut down as a result of the reform of the regional economy. Heat only boiler plants were partly replaced by CHP plants. The main power station of the region in Hagenwerder was shut down at the end of 1997. There are suitable conditions for the use of non-traditional electricity production technology within the German section of the ERN and areas with wind-powered power stations are gradually being established there.

It is expected that a electricity connection line will be constructed from Hrádek nad Nisou (the Czech Republic) - Zittau (Germany) - Varnsdorf (the Czech Republic) and Kiesdorf (Germany) - Mikolow (Poland) in order to ensure reserve supplies of electricity for the Šluknov Spur and the possibility of two-way electricity exchanges.

2.3 Euro-region administrative structure and activities

The ERN was established upon the initiative of the community associations in the border area as a cross-border interest group that is active in the border regions of the individual countries and as such it celebrated its inauguration in May 1991 in Zittau. The basis of the establishment of this organisation was recognition of the fact that the border region's existing problems could only be solved if the areas acted together, especially involving those people who live in the region. The ERN formally consists of three community associations of municipalities, cities and regions that have agreed to modify their co-operation upon the basis of individual specific conditions, which have been adapted to the organisational forms. The supreme bodies are the Council and the Presidium. Membership of these bodies is achieved by election within the individual community associations, which also consist of elected members.

The ERN has offices in Zittau, Liberec and Jelenia Gora which function as executive bodies and which are directly governed by the Presidium. The offices are central outlet points and they supervise project activities from an organisational perspective.

Table 2.1 *Main ERN contact points*

Secretariat of Germany	Secretariat of the Czech Republic	Secretariat of Poland
Kommunalgemeinschaft EUROREGION NEISSE Rathenaustrasse 18a 0-2700 Zittau tel: +49 3583 57500 fax: +49 3583 522524	Regionální sdružení EUROREGION NISA U jezu 2, POB 390, 460 31 Liberec tel: +420 48 5226272 fax:+420 48 5226273	Stowarzyszenie gmin polskych EUROREGIONU NYSA Ul. 1.maja 57 58500 Jelenia Gora tel: +48 75 7522045 fax: +48 75 7522045

The project activities are based on the priorities that are set by the regional and local governments in the ERN. Examples of activities / programmes are:

- Territorial planning and zoning.
- Maintenance and improvement of the environment.
- Promotion of the economic growth and raising of the living standards of the region's inhabitants.
- Development and improvement of the cross border infrastructure.
- Development of public transport and tourism in the border regions.
- Development of culture and protection of the cultural heritage.
- Improvements of the relationships between people and co-operation in the social and humanitarian areas.

The development of the CHP Action Plan should increase the interest and awareness for energy planning and energy conservation by presenting tools for the promotion of CHP in the region. The development of this Action Plan on the level of the ERN should enable the exchange of information between major stakeholders of the three national regions. Such co-operation on the ERN level can strengthen initiatives of isolated stakeholders over the border and increase their successful implementation.

3. TARGET GROUPS AND OBJECTIVES OF THE ACTION PLAN

3.1 Regional target groups of the CHP Action Plan

The CHP Action Plan is *to be adopted by regional authorities* planning their activities in the field of CHP promotion:

- Aimed at own (public) institutions - aiming at increase of CHP in the public sector.
- Aimed at the private sector - promoting CHP investments and information and awareness.

The main identified target groups of regional CHP policy and of the CHP Action Plan are:

- Euro-region administration in the Czech, Polish and German part of the ERN.
- Regional and local authorities responsible for regional and local energy and environmental policy, these can be municipalities and district authorities. These are the policy makers and should eventually adopt the target set for the regional policy.
- Electricity, gas, and district heating companies in the region.
- Regional Economic Chambers, Associations of Entrepreneurs and also individual firms.
- Potential investors, these could be regional administrations and municipalities (owners of public buildings), district utilities (heat producers and suppliers), industries and services with own heat sources, and ESCO's.
- Financial institutions, these will play an important role in project development in the region because a large part of financing will come from private financing.
- Other government agencies (e.g. national & regional energy and environmental agencies).
- Universities and research institutes.
- NGO's.

3.2 Regional objectives

This section addresses the scope of the promotion of CHP in regional and local energy policy, regional energy plans and concepts. It builds on the description of the existing policy of the EU, and energy policies on the national and regional level. The recommendations comply with existing EU and national policy and regulation. The main objectives of the regional CHP policy and of the CHP Action Plan are the following:

1. *To contribute to sustainable energy supply (clean, efficient and reliable) in the ERN as a whole and in the national regions in particular by increasing the share of CHP utilisation.*
2. *To contribute to the realisation of EU and national objectives for CHP through regional actions.*

The main objectives can be broken down in *specific objectives* as follows:

1. To enhance technology transfer and investment in new technology.
2. To contribute to improvement of reliability of energy supply in the region.
3. To support penetration of renewables in CHP production, particularly the local biomass resources.
4. To support an increase of energy efficiency in supply and demand.
5. To contribute to energy self-sufficiency in ERN and in micro-regions.
6. To promote economic activities in the region and creation of new jobs.

This can be achieved through the following main actions, which are further elaborated in the following chapters of this Action Plan:

- To secure regional and local promotion of CHP.
- To secure the full consideration of the CHP option in energy investments and energy planning in the region.

Given the different situation of CHP in all three national parts of the ERN and the uncertain developments of CHP caused by energy market liberalisation, common quantitative targets have not been set in this Action Plan.

The structure of the CHP Action Plan is presented in Figure 3.1. For the development of regional objectives and targets, the potential for CHP, implemented case studies and the analysed barriers to CHP will have to be studied. Then these regional objectives and targets are translated into possible regional actions resulting into a selected number of key actions and possibilities for Euro-region and EU co-operation.

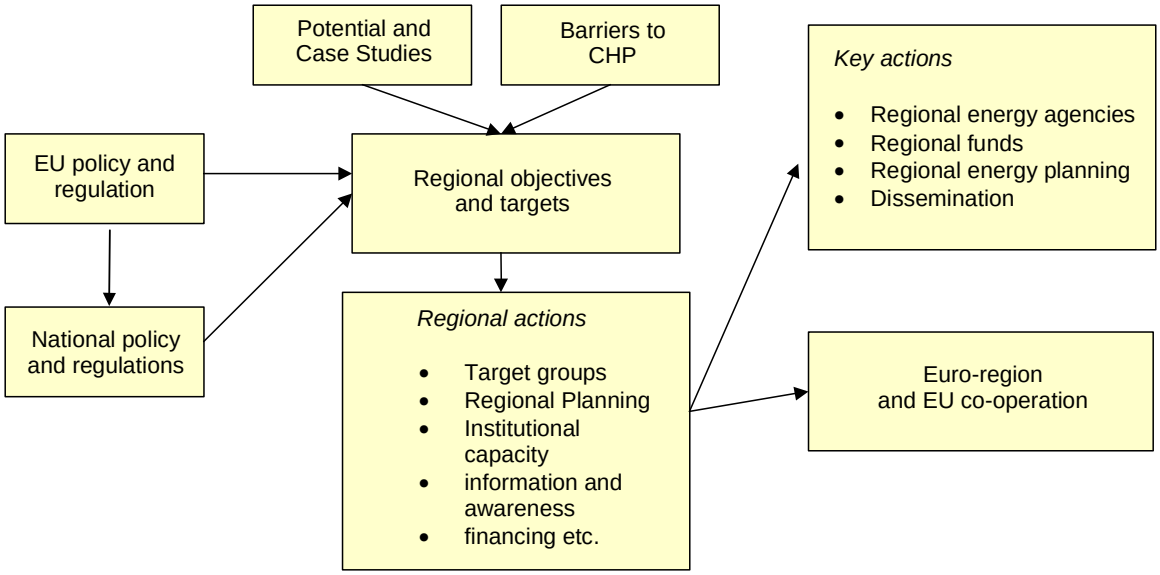

Figure 3.1 *Structure of the CHP Action Plan*

In the following chapters the potentials of CHP and the barriers towards CHP (Chapter 4) and the national policy and regulatory framework (Chapter 5) will be analysed. After that the following activities for the CHP Action Plan have been proposed:

1. Supporting regional energy planning and municipal energy concepts, particularly the role of CHP (*Chapter 6*).
2. Improving institutional capacity for energy planning and the promotion of energy efficiency, renewable energy and CHP, particularly through the establishment of regional energy agencies (*Chapter 7*).
3. Improving the access and availability of regional financing mechanisms, giving regional target groups the possibility to have more financial resources at their disposal and increase their capacity to use these financial mechanisms (*Chapter 8*).
4. Providing information on CHP and awareness raising, providing target groups with the necessary information about CHP (*Chapter 9*).
5. Improving cross-border co-operation in the framework of the ERN and the EU, increasing cross-border co-operation and making use of European funds (*Chapter 10*).

4. POTENTIAL FOR CHP IN THE EURO-REGION AND BARRIERS TO ITS IMPLEMENTATION

This chapter contains a summary of the analysis of both technical and economic potential of new CHP in the ERN, including:

- Current situation of CHP utilisation, divided over sectors such as industry, district heating systems, public offices, hospitals, educational facilities, sports facilities, etc.
- The technical potential of CHP.
- The economic potential of CHP.
- The description of typical successful CHP projects in case studies, one per each part of the ERN.

4.1 Czech Republic

4.1.1 Current situation of CHP utilisation

In the Czech part of the ERN, similar like in the Czech Republic as a whole, the combined heat and power production was traditionally connected with large district heating (DH) networks and with industrial plants. These CHP plants were either coal or heavy fuel fired CHP plants with a steam cycle arrangement in which a steam boiler fed a steam turbine and part of the steam was supplied to final consumers via the steam DH network. In 1970s and 1980s smaller DH networks were built in many cities to supply heat in new living districts. Due to financial reasons (limited investment sources) no new CHP plant was built in this period and all new heat sources connected to new DH networks were mostly coal fired or oil fired HOBs (heat only boilers). Only after 1990, new small-sized CHP plants have penetrated the market.

One large CHP plant (220,0 MW_{th} and 12,0 MW_e) and one municipal waste incineration plant working in CHP mode (24 MW_{th} + 2,5 MW_e) and 31 small-sized CHP plants were operated in 2000 in the Czech part of the ERN. The total installed power output was 6.4 MW and heat output was 9.0 MW. All small-sized CHP units have been installed after 1995. Most CHP units have a capacity between 50 to 250 kW_e. The boom in installation of the CHP units in the last few years is mostly connected with the promotion policy of the government supporting new installations through investment subsidies and also with very active marketing policy of CHP equipment by producers and suppliers. Many of recently installed CHP units received investment grants of 20 to 30% of the total costs of the technology from either the Czech Energy Agency or from the State Environmental Fund. From the technological point of view, all small- and medium-sized CHP units are based on natural gas or biogas engines. Of a total of 31 units, 9 are installed in district heating systems and 8 in industry. Other sectors with newly installed CHP units are public buildings, swimming pools, and waste water treatment plants.

4.1.2 Potential for CHP technology

Besides sectors where CHP technology has already been installed, potential for further development in CHP in the Czech part of the ERN can also be found in public buildings with a relatively high electricity and heat consumption. These are mainly hospitals and sport facilities that can use the produced electricity for own consumption.

Within this study, two potentials of CHP are considered: technical and economic potential:

- The *technical potential* of CHP includes all technically feasible options. It is limited mainly by the technical conditions of conversion of primary energy to exploitable energy carrier (power and heat), as well by legal and environmental restrictions.
- The *economic potential* is the part of the technical potential, for which it is economically viable to apply CHP at given conditions, which are influenced by economic, fiscal and legislative conditions, government energy and economic policy, investment and operational costs, access to capital, interest rates, etc.

Technical potential for CHP

In the Czech part of ERN, the technical potential of CHP was evaluated through a bottom-up approach based on a database containing information on individual heat sources with a capacity higher than 200 kW (based on the registers of emission sources - REZZO). According to this information the heat sources were divided into categories according to sector and capacity utilisation time. The capacity of proposed CHP plants connected to these sources was also evaluated.

The evaluation has been carried out for two scenarios representing the lower and higher margin of the technical potential:

- Scenario 1 - installation of CHP units to existing natural gas-fired heat sources. In this case, CHP units are operated as base-load sources, while existing gas boilers cover peak demand.
- Scenario 2 - installation of CHP units to existing natural gas-fired heat sources *plus* installation of CHP unit to existing heat sources, considering fuel switching and availability of gas network. In this case, it is considered to install CHP units to existing natural gas-fired heat sources *and* install CHP units in sources where it is necessary to switch the heat source fully/partially to natural gas. In this case natural gas network must be available on the site. Fuel switch is possible in case of coal or oil-fired sources or heat exchanger stations connected to DH network at sites where a gas network is already available.

Table 4.1 *Technical potential of CHP - power capacity [kW_e] by sector*

	Scenario 1 - CHP in existing gas units	Scenario 2 - CHP in existing units + fuel switch of coal units
Industry	78,900	180,000
District heating sources	46,800	72,700
Health care facilities	10,900	13,900
Public/commercial services	3,600	6,400
Educational facilities	600	1,300
Swimming pools	0	800
Other	800	3,900
Total	141,600	279,000

The technical potential for CHP in the Czech part of the ERN ranges between 140 and 280 MW_e, which could meet about 50-100% of total power demand in the region. The largest technical potential can be found in industry and district heating. The technical potential in the district heating sector is relatively high, but given the uncertainties connected to liberalisation of the electricity market (and over-capacity in the Czech power sector) these investments are currently very uncertain.

Economic potential for CHP

To get a clear view of the economic potential of CHP options in the Czech part of the Euroregion, a detailed analysis of five different case studies (based on real alternatives) was undertaken. Through this analysis it was possible to analyse what factors influence the viability of CHP projects. The following five projects were considered:

1. CHP in a swimming pool additional to a gas boiler (own consumption of electricity).
2. CHP in a swimming pool additional to heat supply from a DH network (own consumption of electricity).
3. CHP in a HOB plant, own consumption of electricity, heat to DH network.
4. CHP in HOB plant, electricity supplied to the grid (baseline tariff), heat to DH network.
5. CHP in HOB plant, electricity supplied to the grid (peak tariff), heat to DH network.

Calculations of economic parameters (NPV and IRR) and a sensitivity analysis showed that only projects no. 2 and 3 (with own consumption of electricity) were economically viable. The analysis of the five case studies showed that:

1. CHP projects are much more sensitive to changes in feed-in price of electricity and fuel price than to investment costs and discount rate.
2. Use of small CHP units is viable in the cases where produced heat and power is for own use of the operator of CHP unit. This is caused by low feed-in prices for electricity. In this case, CHP units should be dimensioned to baseline demand for electricity.
3. Full (or partial) replacement of heat supply from district heating network and use of produced electricity for own use proved to be extremely viable from the point of view of the CHP operator (discounted payback time approx. 5 years). However, in this case there is a negative impact on the DH source and network operator, which is not considered.
4. Installation of CHP unit designed for the supply of produced electricity into the public grid did not prove to be economically viable due to low feed-in prices of electricity, both in base and peak tariff.[3] These projects become economically viable only when both base-load and peak electricity tariffs are increased by at least 30%.
5. Because the investment costs for CHP do not affect the viability of the project very significantly, the investment subsidies for CHP projects make sense only to CHP projects that are very close to breakeven point or in order to decrease investor's risk. Therefore, support of CHP projects by subsidising the feed-in price of electricity may prove to be more effective than subsidising investment costs.

From the case studies above we can see that not all recently implemented CHP projects can be expected to be successful as the economic performance regards. All projects of recently implemented CHP units can be roughly grouped in three categories by the level of their economic performance:

- Highly successful projects: swimming pools and wastewater treatment plants, which are installations with a constant heat demand over the year without major changes.
- Successful projects: hospitals, social care centres, industry, and municipal services. Within these categories industrial companies are viewed as most risky as they are much more depending on economic prosperity than public services. Most of the installations in this category have a constant base load heat demand over the year, but major changes between summer and winter. Dimensioning CHP on base load can lead to a successful project.
- Unsuccessful or problematic projects: district-heating systems.[4] Heavy fluctuations between summer and winter heat demand, many systems over-dimensioned. Therefore, the problem with dimensioning the CHP unit occurs and selling excess power to the grid is not always economic and highly uncertain given electricity price fluctuations.

[3] The use of CHP as peak source is closer to viability breakpoint. The breakpoint lies approximately at 1.45 CZK/kWh for baseline electricity and 2.50 for peak electricity because of less operational hours in case of peak supply (exchange rate 32 CZK/€).

[4] Only installation of CHP units in existing DH systems have been considered. No 'green field' projects have been analysed given the relatively exhausted potential for DH systems in the Czech part of the ERN.

The above given order is based on relative economic performance, comparable to each other. The actual energy market development determines the real economic performance of the projects.

4.2 Poland

4.2.1 Current situation of CHP utilisation

In total, 4 CHP installations have been identified in the Polish part of the ERN. Two of them are old coal-fired steam-cycle installations constructed together with industrial factories: a textile factory in Kamienna Gora and a pulp factory in Jelenia Gora. Both installations were designed for industrial purposes, where waste heat was fed into the municipal district heating networks. Due to bankruptcy of both factories, the CHP plants have been overtaken by municipalities and are now operated by municipal district heating companies. Both installations are obsolete and also oversized in comparison to the local heat demand because industrial demand has collapsed and no new industrial activity is expected.

Two new CHP installations have been constructed during last three years. One is located in the chemical factory of Wizow nearby the Boleslawiec city and the second one is located in the Waste Water Treatment Plant in Jedrzychowice nearby Zgorzelec. Both plants are not connected to a district heating system.

4.2.2 Potential for CHP technology

Technical potential for CHP technology

In Poland limited data were available on regional level. The technical CHP potential for the Polish part of the ERN was, therefore, roughly estimated for a number of sectors:

- *Housing (district heating systems)* - One of the unfavourable features of the Polish DH networks as regards of the future implementation of CHP in cities is that tap water heating in the housing stock is done by local heaters and not by DH. This situation causes very low demand for heat in the summer season. Estimation for this demand in the district heating systems amounts to about 4% of the peak load, e.g. *10 MW_{th}* in total.
- *Health care facilities* - The health care system consists of 18 hospitals and 75 smaller health care facilities (of which 61 are operated permanently). The heat demand of facilities operated permanently is estimated at 10 MW_{th} for hospitals and 6 MW_{th} for other facilities. Demand for tap water heating reaches 15% (heat demand *2.5 MW_{th}*).
- *Wastewater treatment plants* - All 33 municipalities are equipped with wastewater treatment plants, but only few of them were constructed according to the EU environmental standards. When assuming that 20 wastewater treatment plants in the region will fulfil environmental requirements in the future and they will be eligible from the technical point of view for installation of CHP unit, the thermal potential is estimated at *8 MW_{th}*.
- *Municipal waste landfills* - Utilisation of biogas is possible in case of up to 10 largest municipal solid waste landfills. The potential of power capacity for all of them is estimated at *1.5 MW_e*, while the heat consumption from these sources depends on very limited local heat demand.
- *Educational facilities* - Localisation of CHP plants in educational facilities can be assessed in case of an existence of swimming pools, which secure the stable heat demand all over the year. The total heat demand to be installed in CHP units is estimated at *0.5 MW_{th}*.
- *Tourist facilities* - In this sector there are about 500 buildings of which 40 are hotels. There is an estimated number of 10 facilities having constant heat demand, where hot tap water demand can be stable during the whole year on the level of about 50 kW_{th}, which makes *0.5 MW_{th}* in total for this sector in the Polish part of the ERN.

- *Agriculture*- Application of CHP in agriculture has not yet been applied in Poland. Therefore an estimated CHP potential for this sector is based on the German experience (in relation to number of inhabitants) and accounts to approx. *4 MW_{th}*.
- *Industry*- Installation of CHP units in this sector can be independent of regional energy planning due to own heat and power demand. Exceptions are industrial plants connected to the municipal district heating systems. The developments of the region show a decrease in industrial activities, such as the closure of the pulp factory in Jelenia Gora. It is assumed that 4 to 10 facilities with a capacity of 10-20 MW_{th} can be installed in this sector in the region. This makes estimation for the whole sector in the range of *40 MW_{th} - 200 MW_{th}*. Uncertainty about industrial developments causes that the estimation of the CHP potential in this region is very uncertain and the range is wide.

Table 4.2 summarises the findings for the Polish part of the ERN and shows that the manufacturing industry has the largest potential for CHP and this is consistent with the outcomes of the analysis for the Czech part of ERN.

Table 4.2 *Technical potential of CHP in the Polish part of the ERN*

Sector	Electric potential [MW_e]	Thermal potential [MW_{th}]
District heating systems	5	10
Health care facilities	1.25	2.5
Waste water treatment plants	4	8
Solid waste landfills	0.5	1.5
Education facilities	0.5	0.5
Tourist facilities	0.2	0.4
Agriculture	2	4
Industry	15 - 28	40 - 200
Total	28.5 - 41	67 - 237

Economic potential for CHP

The current conditions for power purchase and the price of natural gas are not favourable for CHP in Poland. The only successful project designed for small CHP plant (140 kW_e) in the Polish part of the ERN uses produced power and heat in own premises thereby avoiding power and heat purchase. The project received high (up to 50%) investment grant.

4.3 Germany

4.3.1 Current situation of CHP utilisation

In the German part of the ERN, CHP plants are operated by municipal utilities, regional energy providers as well as private operators. Table 4.3 clarifies the energy providers within the German part of the ERN.

Table 4.3 *Energy providers of the German part of the ERN*

Municipal providers	Regional providers
Energie- und Wasserwerke Bautzen GmbH	Energie Sachsen Brandenburg AG (ENVIA)
Municipal utilities Hoyerswerda GmbH	Energieversorgung Sachsen Ost AG (ESAG)
Municipal utilities Niesky GmbH	
Municipal utilities Zittau GmbH	
Municipal utilities Weißwasser GmbH	
Technische Werke Ostritz GmbH	
Municipal utilities Görlitz AG	
Municipal utilities Löbau GmbH	
Municipal utilities Oberland/ Ebersbach	

Energie Sachsen Brandenburg AG does not operate any CHP plant in the ERN. However, the regional supplier ESAG operates two CHP facilities, the adventure and resort pool parks located in Großschönau (Löbau/ Zittau county) and Kirschau (Bautzen county). The majority of CHP plants in the region are operated by municipal utilities. The reason is that CHP plants allow for a simultaneous supply of electrical energy and heat to customers and thus CHP plants offer the most efficient way to deliver both given the existing heat and power demand. Table 4.4 shows all CHP operated by municipalities in the region.

Table 4.4 *CHP units operated by municipalities in the German part of the ERN*

Provider	Site	Engine output		Boiler/ turbine		Fuel
		[kW_{th}]	[kW_e]	[kW_{th}]	[kW_e]	
MU Görlitz	Königshufen	9,000	7,000	36,900		Nat. gas
MU Görlitz	Rauschwalde	2,000	1,200	9,200		Nat. gas
MU Görlitz	Weinhübel	3,600	1,440	15,000		Nat. gas
MU Zittau	Friedensstraße	4,800	5,000	18,000		Nat. gas/ oil
MU Zittau	Heating plant	Feeding thermal energy from sewage gas incineration from sewage treatment plant				Sewage gas
MU Weißwasser	Chopinstraße	3 x 2,400	3 x 2,800	3 x 3,000	3 x 1,500	Nat. gas

Besides municipalities, CHP plants are in part used by smaller companies as well as by private operators to generate electricity and heat. These facilities primarily supply heat for space heating during the wintertime and during seasonal transition periods, and for tap water heating. The electric energy generated by these plants is utilised to cover the needs of the owner, while the remainder is fed into the network of the regional provider, ESAG. These energy portions are compensated in accordance with the German CHP Act (KWK-Gesetz). Most of the CHP units operated in the region have a capacity up to 500 kW, one larger (800 kW) unit is operated in Ostritz. Natural gas is the commonly used fuel, in some units heating oil is still used. The switch to biogas is considered in some units.

4.3.2 Potential for CHP technology

Technical potential for CHP technology

The assessment on the CHP potential is based on identification of typical CHP projects and estimation of the replication potentials by sector. All assessments are based on the assumption that the CHP facility is operating economically. The selected application areas for assessing economic heat supply through CHP were:

- Private homes
- Multi-family houses
- Hospitals
- Agricultural farms
- Hotel facilities.

Table 4.5 summarises the results of analysis of the technical potential of CHP in the German part of the ERN.

Table 4.5 *Technical potential of CHP in the German part of the ERN*

Sector	Technology	Fuel	Unit capacity	Operation mode	Electrical capacity [kW_e]	Heat capacity [kWth]
Family homes	Spark ignition / injection engine	Natural gas	50-250 kW_{el} 70-300 kW_{th}	power-oriented, self-sufficiency.	30.250 – 60.500	42.250 – 84.500
Multi-family homes	Spark ignition / injection engine	Natural gas	50-250 kW_{el} 70-300 kW_{th}	power-oriented, self-sufficiency.	142.000 – 285.000	200.000 – 400.000
Hospitals	Injection engine	Natural gas or liquid gas	200-300 kW_{el} 250-400 kW_{th}	power-oriented, self-sufficiency and emergency backup.	1.190	2.140
Agricultural farms	Spark ignition or diesel engines	Biogas or plant oils	20 - 40 kW_{el} 30 - 60 kW_{th}	partly power-oriented by self-sufficiency needs; mainly feeding into public networks.	1.850	3.080
Hotel facilities	Spark ignition / injection engine	Natural gas	5 - 50 kW_{el} 8 - 70 kW_{th}	power-oriented, self-sufficiency.	130	280
TOTAL					175.420 – 348.670	247.750 – 490.000

Economic potential for CHP technology

As shown in Table 4.5 is a large technical potential for a substantial increase of CHP in the German part of the region within the next years. The extent of the economically viable supply potential is, however, reduced in each potential application area by dividing the output into basic and peak loads. For the economically required number of utilisation hours, between 4,000 and 5,000 hours, approximately 70% of the heat potential remains for the CHP, while the other 30% are covered by the peaking capacity boilers.

Actually, no new CHP plants have been installed in the region under review since 1995, and some existing plants were even taken out of operation. This was mainly attributable to the fact that the liberalization of energy markets within the European Union would have rendered the operation of these plants inefficient under their conditions.

Only recent legal changes (CHP [KWK] Act and Renewable Energy Act [EEG], including power generation from biomass) as well as economic changes (higher energy prices on the world market) make the economic operation of CHP a possibility in the region under review (see also Chapter 5).

4.4 Case studies

To illustrate successful CHP projects in the ERN, 3 typical projects have been identified, one for every country in the ERN.

Swimming pool (Liberec)
• 25 meter pool. • Heat and electricity for own use in addition to peak heat supply from district heating. • Gas-engine 143 kW_e + 206 kWt. • Total energy efficiency 87.4%. • Operating hours 8000 hours/year.

Results	Conclusion
• Net present value: 8.829.000 CZK. • Internal rate of return: 26%. • Profitability index: 136%. • Discounted payback time: 5 years.	The project is viable from the point of view of the investor, with a simple payback time of approx. 5 years mainly as a result of relatively high heat price supplied from the DH network, which could not compete with heat produced by CHP. The project economic viability is not very sensitive to all main parameters +/- 40%. This is a typical fully commercial project.

Figure 4.1 *CHP Case study swimming pool Liberec, Czech Republic*

Chemical Factory Wizow/Boleslawiec
The CHP unit includes a gas turbine (SOLARIS) with an electric capacity of 4.1 MW_e and thermal capacity of 28 MW_{th}. This unit was constructed in 1999 by an independent power producer (Polish Energy Partners) based on PPA and HPA with the factory Wizow.

Results	Conclusion
• Electricity price 43 Euro/MWh. • Capacity price 33000 Euro/$MW_{th.}$ • Heat prices 8,3 Euro/GJ. • Profitability based on 20 years long PPA and HPA with the factory.	The project is viable from the point of view of the investor, but is sensitive with regard to the standing of the factory. No additional market for heat supply is available. The distance to the city of Boleslawiec is to long, and its DH system has a low constant heat demand (< 1 MW). The price of electricity is 10 Euro/MWh lower than the price offered by the regional utility. This was main reason for the factory to conclude a long term PPA.

Figure 4.2 *CHP case study chemical factory Wizow / Boleslawice, Poland*

Garbage dumping site Kunnersdorf, Niederschlesischer Oberlausitzkreis
• Year of construction: 1993. • Manufacturer: MWM (engine), Stempfort (entire plant). • Annual hours of operation: 5900 (in 2000); 5200 (in 2001). • Composition of garbage gas: 50% CH_4, 1% O_2.

Results	Conclusion
• Investment costs: 750.000 Euro. Discounted payback time: earnings are to be used only for operation and maintenance.	At the garbage dumping site Kunnersdorf a combined heat and power unit is running using the sewage gas as fuel. Its electrical power is approximately 420 kW and its thermal power roughly 700 kW. In the ERN it is the only garbage dumping site running a CHP.

Figure 4.3 *CHP case study garbage dumping site, Kunnersdorf, Germany*

4.5 Barriers to CHP

This section presents a summary of key barriers to the further increase in CHP based heat and power production in the ERN. Many barriers on the national level are common in all three countries and in the whole region. Specific attention is given to the country/region specific barriers.

4.5.1 Overview barriers on national level

Several barriers to CHP exist at national level in all three countries of the ERN. Although these barriers cannot be influenced through a regional approach, they are shortly addressed as they are of major importance to implementation of CHP projects. The main national barriers are:

- Lacking national strategy for promotion of CHP, which can be reflected in the regional energy concepts and promotion policy on the regional level.
- Pricing policy of energy carriers and distortion of tariffs (this has been mainly the case of the Czech Republic).
- Surplus in electricity production and supply on the national level, limiting the possibility for CHP units to sell electricity to the national grid at a profitable price.
- Present and possible future drop in heat demand as a result of energy efficiency improvement and economic reconstruction (move towards less energy-intensive industries).
- Uncertainties connected to the ongoing liberalisation of the electricity market, mainly:
  - Access to the grid and grid connections (also connected to regulations).
  - Low pay-back tariffs for electricity from CHP delivered to the grid in the base load.
  - Uncertainty about the impact of the new energy related legislation (mainly Czech Republic and Poland).
  - Legislation to promote CHP within the new market structure still under development, in Germany only older CHP plants receive support, not certain what new instruments will bring.

4.5.2 Barriers on regional and local level

Three types of barriers to CHP can be identified on the regional and project level, all related to the decision-making and project development process.

1. Barriers related to decision making and institutional capacity

- Inadequate institutional framework on the local level, energy programmes and agencies promoting CHP only exist on the national level.
- Non-existing regional energy plans or energy supply concepts.
- Lack of awareness of energy conservation in general and the possibilities of CHP technology in specific.
- Lack of priority among municipal and regional authorities for energy matters in comparison to other issues such as infrastructure and environment (e.g. waste water treatment).
- No monitoring system available to measure energy use on municipal level.

2. Barriers related to administrative procedures

- Complicated procedures towards the construction of CHP plants: a complete planning and building procedure has to be followed before the construction of a CHP plant is approved. In additional several expert opinions and permissions of several organisations are needed, making the approval procedure time consuming.

3. Barriers related to financing

- Lack of public financial resources for energy conservation projects.
- Difficult access to commercial financing (little confidence of banks in energy projects).
- Lack of knowledge among target groups in developing bankable project proposals and business plans.
- Banks miss a long-term view on investment opportunities in the energy efficiency sector.
- Energy projects have relatively high investment risks, although depending on specific sectors, and therefore limited sources of appropriate commercial financing available (or high interest rates for energy related projects).
- Little possibility for municipalities and other public institutions to finance projects from energy savings and allowing multi-annual financing, making energy conservation projects in the public sector less attractive. However, this is gradually changing as new regulations in the Czech Republic allow for such financial constructions.

It can be concluded that regional and project level barriers are connected to the whole decision making and project development process of a CHP project. It starts with lack of awareness and the existence of suitable energy strategies, continuing with complicated administrative procedures and problems with seeking financial sources. Therefore, the CHP Action Plan will have to touch upon all barriers in this project development process to have beneficial impact on CHP in the region.

4.6 General conclusions on potential and barriers to CHP in the ERN

The analysis of the CHP potential in the ERN shows that:

- In all 3 national parts of the ERN there is a high technical potential and significant economic potential for future development of CHP (see Table 4.6).
- The potential in the German part of the ERN is considerably higher than in other 2 parts. However, this is given by the fact that a large potential has been estimated in decentralised CHP applications in residential buildings, while in the Czech and Polish parts, CHP units have been considered as additional sources to existing district heating sources.
- Due the low industrial output and separate hot water heating by natural gas, the CHP potential remains the lowest in the Polish part of the ERN.

Table 4.6 *Comparison of technical potential of CHP estimated in each part of the ERN*

Part of the Euro region	Electric potential [MW_e]	Thermal potential [MW_{th}]
Czech Republic	142 - 279	195 - 378
Poland	29 - 41	67 - 236
Germany	175 - 349	248 - 490

Based on the potential in the ERN it can be concluded that:

- Despite the high technical potential of CHP, the economically viable part of this potential is limited due to many barriers among which the most important are the current feed-in prices for electricity.
- The most economically viable CHP projects are those that produce electricity for own use and are dimensioned for baseline use.
- CHP units producing electricity for the grid are extremely sensitive to changes in feed-in prices, both for baseline and peak demand.
- The theoretically highest potential exists in the industrial sector, but due to decreasing industrial output and uncertainty about the future of these companies, investments here remain uncertain.
- The most viable projects for CHP heat use are at location where a stable heat demand is assured during the whole year, e.g. swimming pools and hospitals.
- Replacement of heat supply from district heating network and use of produced electricity can be viable for the operator of a CHP, but not for the existing DH system (loosing clients) and remaining with an over-dimensioned system.
- The large difference between technical and economic potential is illustrated by the German situation. There is an enormous technical potential but no new CHP plants have been commissioned since 1995.

Based on the barriers and the economic analyses of single projects we can conclude that the development of new CHP projects in the ERN is mainly limited by the:

- Lack of public and private sources for new CHP projects.
- Complicated administrative procedures delaying the preparation of CHP energy projects.
- Liberalisation of the national energy markets, which makes investments in CHP very uncertain given the relatively low and fluctuating electricity prices.

The following chapters will analyse the possibilities to overcome these barriers by proposing several instruments applicable on the level of the ERN. But first the current legislative and policy framework on EU, national and regional level will be described.

5. POLICY AND REGULATION AT THE EU AND NATIONAL LEVEL

This chapter gives an overview of existing CHP or CHP related policy and regulation on the EU and national policy levels. Although this policy and regulation cannot be influenced on the regional level, it determines the scope of measures that can be taken on the regional and local level.

5.1 European Union policy and regulation related to CHP

5.1.1 The role of CHP in EU energy policy

The energy policy of the European Union has developed along three main tracks, namely:

1. Security of energy supply and decreasing import dependence of energy sources. In November 2000 a Commission Green Paper was published, stating that the import dependence of the EU could increase from 50% today to 70% in 2030 (including all fossil fuel types).
2. Competition and completion of the Internal (Energy) Market. The energy market liberalisation started with the adoption of the EU electricity and gas Directives. In March 2001, the Commission adopted a proposal for accelerated liberalisation of the electricity and gas markets. This proposal should:
   - Ensure fairer access to electricity and gas networks.
   - Completing liberalisation of electricity and gas markets by 2007.
   - Propose additional measures/legislation to promote CHP and renewable energy sources in the new market environment.
3. Environmental protection and climate change. The most important target in the field of climate change is the reduction of greenhouse gas emissions in the European Union by 8% relative to 1990 levels in the period 2008-2012.

Although CHP contributes to all three objectives, the current prospects for CHP in the EU are on the whole not good, mainly as result of the impacts of the liberalisation of the electricity market on prices and other conditions for CHP. However, a number of developments on the level of EU policy and regulation might improve these conditions, particularly the accelerated liberalisation of the gas market and the improved regulation for grid access. In addition, within EU renewable and environmental legislation, Member States will probably gain new opportunities for national support schemes for CHP. The implementation of these policy instruments, however, remains the responsibility of individual Member States. This section provides an overview.

5.1.2 CHP policy of the EU

Within the framework of the European Union legislation, CHP is mostly captured under the heading of Energy Efficiency and Climate Change. The integration of environmental aspects and sustainable development into energy policy also leads to stronger emphasis on energy conservation. The key document in the field of CHP related policy is the 'Community strategy to promote combined heat and power (CHP) and to dismantle barriers to its development' (*COM (97) 514 final*). In this document an indicative target of doubling the contribution of CHP in the EU by the year 2010 (leading from the current share of 9% to 18%) is given. Main responsibilities remain with the Member States, but both EU and Member States should actively promote CHP by removing barriers to the market. CHP promotion could include among others the use of financial and fiscal instruments, negotiated agreements with industry and services sector and

support for research and technological development. The CHP target of 18% is reaffirmed in the 'Action Plan to Improve Energy Efficiency in the EC' (*COM, 2000; 247 final*). This action plan aims at the reduction of the energy intensity in the EU until 2010 by one percentage point per year.

5.1.3 EU legislation related to CHP

In the *Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market* (2001/77/EC), an indicative target is presented increasing the contribution of RES in electricity production from the current 14% to 22% EU-wide. The Directive enables Member States to develop several support schemes and ensure non-discriminatory access of RES electricity to the distribution and transmission grid. This Directive will also apply to biomass fuelled CHP installations.

In the *draft Directive on energy performance of buildings COM (2001) 226 final*, potential savings of energy used in the building sector for heating, hot water, cooling and lighting are estimated at a cost-effective 22% to the year 2010. DH and DC networks and CHP for individual buildings and groups of buildings are mentioned as a means to help to improve a building's overall energy performance. Increased use of CHP in the building sector could make a major contribution to meeting the indicative Community target of doubling the total share for CHP electricity production to 18% by 2010. Article 4 of the draft directive obliges member states to ensure that the CHP option is assessed for new buildings with surface areas over 1000 m^2 before the building permit is granted.

In the field of environmental protection the following legislation is worth mentioning:

- Directive (2001/80/EC) '*on the limitation of emissions of certain pollutants into the air from large combustion plants*' (LCP Directive), which is an amendment of Directive 88/609/EEC. According to Article 6, the technical and economic feasibility of CHP in new power plants should be examined. The CHP option should be implemented in the given installation when economically feasible. This Directive only applies to combustion plants with a thermal output of 50 MW or more.
- The *Council Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC)* sets common rules on permitting of industrial installations and aims to integrate control of all environmental impacts of these installations. Permits must take into account the whole environmental performance of the plant, i.e. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, risk management etc. The permits must be based on the concept of BAT (Best Available Technologies), which is defined in Article 2 of the Directive. As from October 1999 the directive applies to all new installations, as well as existing installations that intend to carry out changes that may have significant negative impact of the environment. Existing installations have been granted an additional 8 years although some Member States have shortened this period. The aforementioned LCP directive recognises that CHP is BAT.

In the field of taxation and state aid, the following two Directives provide a framework for potential support of CHP in the EU Member States:

- Proposal for a *Council Directive restructuring the Community framework for the taxation of energy products* COM (97) 30 final. This proposal will include:
  - Broadening the application of taxation to coal, natural gas and electricity, imposing minimum tax rates on all energy products.
  - Including the possibility of tax reductions / exemptions for CHP and electricity from RES.

- In order to prevent potential conflict between the promotion of CHP and RES and measures taken by Member States that might be interpreted as state aid the 'Community guidelines on State aid for environmental protection' (2001/C37/03) have come into force (applicable until the end of 2007). These guidelines clarify to what extent investment and operational aid to undertakings in the field of CHP will be allowed. Point 24 states that Member State action to promote CHP is encouraged by the Commission 'given the major advantages for the environment'. Furthermore, the guidelines include possibilities for:
  - Support to investments in CHP when fulfilling certain requirements such as 'a particularly high conversion efficiency'.
  - Operating aid, limited to compensating for extra production costs by comparison with the market prices of the relevant products or services (up to a period of five years).

Finally, discussion has started on the development of a *Draft directive for the promotion of CHP*. The expected contents as stated in 'Background Document on Legislative Action to promote CHP' (2001) are the following:

- Definition and certification of CHP. A common definition of CHP will provide a baseline for the transposition of the Directive into national law and allow monitoring of results. A definition on the basis of energy efficiency criteria is likely.
- National targets for increased use of CHP. The current discussion tends to focus on indicative targets for each Member State.
- Grid system issues. This section is expected to lay down conditions for interaction of CHP units with the electricity grid, thereby creating a non-discriminatory and transparent regulatory framework.
- Administrative procedures: objective, non-discriminatory and transparent rules in licensing and permitting, removing practical barriers to the implementation of CHP projects.
- Special provisions for certain types of CHP (e.g. from renewable energy sources).

5.2 National policies related to CHP

5.2.1 Czech Republic

National policy and regulation has the biggest impact on the development of CHP compared to the EU and regional level. Energy and environmental legislation and policy is being harmonised with the EU and predominately established at the national level. The most relevant policy document is the State Energy Policy of January 2000. The Energy Policy states the support to promotion of CHP as one of the tools for improvement of energy efficiency and reduction of emissions of pollutants. Nevertheless, no objectives or specific target for the share of CHP in gross electricity production has been set yet.

The State Programme for Promotion of Energy Efficiency and Wider Use of Renewables provides support to small-sized CHP installations though the Czech Energy Agency and the State Environmental Fund. CHP projects can apply for an investment grant or a soft loan scheme.

5.2.2 Poland

The major task of the Polish energy policy is the creation of conditions for its membership of the European Union, especially harmonisation of instruments related to the internal energy market. Secondly, a decrease in economic dependence on hard coal to a level economically and financially reasonable is foreseen. Also the natural gas supply dominance from Russia will be decreased through development of co-operation with Western Europe and Scandinavia.

In the official energy policy, CHP as well as renewable energy sources are considered more as a long-term rather than a short-term option. Favourable solutions for RES and CHP have been

suggested wherever the legislator desired to ease the conditions for the creation of local energy markets, competitions and third party access. There is also a concept of an independent energy producer, who may supply energy from renewable sources or from CHP.

5.2.3 Germany

The general energy planning in Germany is carried out on the level of public / private firms. Currently, no national energy concept exists. Up to now, Germany exclusively restricts to support energy efficient and environmentally friendly technologies (e.g. KWK-Ausbaugesetz (CHP-Upgrade Law)) and displacement of single energy production technologies (e.g. exit from nuclear energy).

The energy policy of Germany focussed for a long time on a further development of nuclear energy and other large-scale power plants. The actual federal government, however, regards the CHP-technology as essential instrument to protect the climate and to further increase energy efficiency. This development shall be supported by the revised CHP-Upgrade Law (KWK-Ausbaugesetz), which came into force in April 2002.

In principle, a number of legal promotion instruments exist for CHP technology. However, considerable restrictions also exist for all of them depending on operator, size of the equipment and degree of energy efficiency:

- The freeing from and reduction of the level of energy and mineral oil tax, respectively, is granted only for small-sized (up to 2 MW) and highly efficient equipment ($\eta \geq 70\%$ or 60%).
- When using renewable energy carriers in a CHP plant, the fixed fees for feeding are lowered when the equipment size gets higher.
- The brown coal protection clause (EnWG) will hinder the upgrade of CHP-equipment in Germany up to December 10, 2002.

5.3 National regulatory framework

5.3.1 Czech Republic

In Czech legislation the following regulations influencing CHP projects can be distinguished:

- Energy legislation, particularly the new Energy Act and Energy Management Act.
- Price and tariff regulations.
- Tax regulations.
- Environmental regulations.
- Authorisation for construction (see regional regulatory framework).

Energy Act and Energy Management Act

There are two main energy related acts in force, which have a general application for subsectors of the energy sector including district heating and CHP:

- Act No. 458/2000 Coll. on Terms of Enterprise Activities and Execution of State Administration in Energy Branches and on Changes in other Acts (hereinafter Energy Act).
- Act No. 406/2000 Coll. on Energy Management (hereinafter Energy Management Act).

For selected kinds of investments the *Energy Act* introduced *state authorisation*. In case of power and heat production the authorisation concerns the construction of generation units of electricity with total installed capacity of 30 MW and more and heat units with total thermal output of 30 MW and more. Thus, construction of large-scale CHP units must be approved by the Ministry of Industry and Trade.

In addition, the Energy Act requires *a licence to be issued by the Energy Regulation Office* for a determined period separately for generation of electricity, production and distribution of thermal energy. The licences are issued for at least 25 years. Thus more than one licence is needed to operate the CHP plant that sells power and heat to third parties. This license is not required for plants producing heat and/or electricity for own consumption or supplying heat to consumers within the same premises.

According to the Energy Act, producers that operate a CHP plant have the priority right of power transport via power transmission and distribution systems if they apply for this transport and if it is technically feasible.

The Energy Act does not specify any conditions for setting payback tariffs for electricity from CHP plants. The minimal pay-back tariffs have been set by the *Price decision of the Energy Regulatory Office* No. 1/2002 of 27 November 2001 which sets the of electricity prices and prices of related services (Table 5.1).

Table 5.1 *Minimal pay-back tariffs of electricity generated from CHP and RES*[5]

	Minimal pay-back tariff [CZK/kWh]
CHP plant up to 5 MW_e*	1.13
CHP plant more than 5 MW_e*	0.97
Utilisation of biomass**	2.50
Utilisation of biogas**	2.50

The *Energy Management Act* introduced the following major regulations relevant to district heating and CHP:

- Minimal energy efficiency requirements of CHP production and heat transmission and distribution.
- Mandatory energy audit of CHP plants with annual energy consumption > 35,000 GJ.
- The CHP option has to be assessed as to its technical feasibility and appropriateness and its cost-effectiveness in the energy audit. This energy audit is mandatory for all heat sources above 5 MW of installed thermal input in case of construction of new unit or rehabilitation of the existing one.

Tax regulations

The existing tax regulations in the Czech Republic provide some incentives relevant to district heating and CHP projects, but only when combined with renewable energy. Examples are:

- Reduced import duties on renewable energy equipment.
- Five-year tax relief (income and property) for investment in renewable energy.
- Low VAT rate (5% instead of 22%) for small biomass installations.
- Exemption of property tax for 5 years for conversions of building heating systems from solid fuel to renewable energy.
- Reduced VAT rate of 5% paid by final consumer of biomass fuel as well as for heat (from biomass and fossil fuel).

[5] *General notes:*

- Tariffs can be applied only in case of electricity purchased by the regional distribution companies.
- Metering and tariff setting can be done separately for peak load and off peak load which differ by the level of tariff.
- Exchange rate 32 CZK/€.

Specific notes:

* Only electricity from CHP production when heat is supplied for heating or used in processes; if supplied volume of electricity is higher than agreed by 5% and more or lower by 15% and more the tariff is reduced to 734 CZK/MWh.

** Applicable for all electricity generation, including CHP plants; if less than 30% of generated electricity is supplied to the regional or transmission grid, reduced tariff by 50% can be applied.

In general, the basic VAT rate for goods amounts to 22%, which also holds for energy carriers. However, in the case of heat from district heating a reduced tax rate of 5% is applied.[6]

Environmental protection regulations

- *Act 211/1994 Coll. on protection of air against emissions of pollutants*, this act established emission standards for combustion installations with a unit installed capacity higher than 0.2 MW and financial penalties for non-compliance to the standards. In case of construction of new combustion installations or reconstruction of existing ones the Clean Air Act requires utilisation of best available technologies not exceeding reasonable costs and the measures should be implemented for gradual reduction of emissions.
- *The Act 212/1994 Coll. on state administration in air protection and charges for air pollution*. The Act sets:
  - Competence of state administration in air protection.
  - Charges for air pollution.
  - Provision of public information on air pollution.
- *Decree of the Ministry of the Environment No. 117/1997 Coll. and its amendment No. 97/2000 Coll*. Setting the emission limits and other conditions for operation of stationary combustion installations and for air protection.

Expected changes of the regulations on the national level

The major reason for expected changes of the regulations on the national level is to harmonise the Czech legislation with the EU. The following new Acts and amendments are under preparation:

- Building Act (expected to enter into force in 2003).
- Clean Air Act (expected to enter into force in 2003).
- Act on Integrated Prevention and Restriction of Pollution and Integrated Register of Pollution (expected to enter into force in 2003) -The Act on IPPC has recently been implemented in the Czech Republic.

5.3.2 Poland

The first regulation related to the purchase of electricity from IPPs was the Ministerial ordinance of 2 February 1999. This regulation introduced an obligation on energy undertakings (trading in electricity or heat) to purchase electricity and heat from certain small, independent, domestic power generators (of ≤ 5 MW) using non-conventional sources (including biogas and biomass). The ordinance attempts to establish a remuneration rate for qualifying energy by stating that obligation does not apply if:

- The price of the offered unit of electricity is higher than the highest price that is fixed in the tariff applicable for a unit of electricity for low-voltage customers.
- The price of the offered unit of heat is higher than the highest price offered for a unit of heat from other heat suppliers using conventional sources.

The Polish Grid Company analysed this ordinance and found it lacking clarity in many respects, i.e. in lacking territorial restrictions, lacking a mechanism for proportional division of costs, and not defining 'low-voltage'. Moreover, the grid company speculated that it was foreseeable that 'all generators (e.g., of CHP) may turn exclusively to one electricity trade undertaking (with the highest prices for customers connected at low voltage)', thereby raising the remuneration rate for CHP and consequently the burden for consumers.

On 15th December 2000, the Ministry of Economy introduced an Ordinance to the 1997 Energy Law, which specified conditions for the purchase of renewable electricity and electricity produced from CHP. For renewables the utilities must purchase 2.4% renewable electricity in 2001,

[6] Due to requirements of the EU the level of VAT should be a subject of levelling.

stepwise up to 7.5% in 2010. For cogeneration the obligation has been placed to buy electricity produced in cogeneration units with an efficiency greater than 65%.

Contracting of CHP and RES power
In the case that a CHP plant will produce surplus of power, and its average yearly efficiency is over 65% or when power is generated from renewable sources, this power must be purchased by the Regional Power Distribution Company (RPDC) with some exceptions:

- When over 25% of purchased power within RPDC comes from cogeneration, the RPDC has right to choose the best offer in terms of price.
- Prices for power produced in CHP units with capacity over 5 MW_e and 1 MW_{th} should be accepted by PERA. There is no fixed minimal purchase price but the prices accepted by PERA are maximum ones for each plant separately; prices for units with capacity less than 5 MW_e and 1 MW_{th} are agreed between producer and customer.
- When power is produced from a renewable source, the RPDC is obliged to purchase it based on the principle that up to 2,5% of total sale of power by RPDC should come from renewable sources. As some of RPDCs have reached the required level, they refuse the offers from local RES power producers. In that case the power producers can sell the power to other RPDC via the Renewable Energy Market.

Licence for power and heat generation
According to the Polish Energy Law, licence for power and heat generation and transmission is given by the President of Energy Regulatory Authority (PERA) to investors who would generate over 5 MW_e and over 1 MW_{th}, and:

- Are placed in Poland.
- Are in a positive financial situation allowing them correct operation of the activity.
- Are fulfilling technical conditions necessary to run the activity.
- Will employ appropriate staff.
- Have obtained from local administration general conditions for construction.

The application is also checked by PERA from the point of view of social interest and state energy policy. The investor who fulfils the above-mentioned criteria receives preliminary licence for power and heat generation and can start the construction process after obtaining a construction permit.

5.3.3 Germany

Specific CHP Legislation
In principle, the access of CHP plants to the public energy network is guaranteed, and the purchase of electric energy is regulated by law. In dependence on operator, size of plant and fuels used, remuneration for purchase is warranted. Promotions pursuant to the 2000 CHP-Law only consider equipment, which have been put into operation up to 1st January 2000.

On 25 January 2002 the German Parliament has passed the new German CHP Law. The 'Law on the Conservation, Modernisation and Development of Combined Heat and Power' ('*Gesetz für die Erhaltung, die Modernisierung und den Ausbau der Kraft-Wärme-Kopplung'*), which has come into force on 1 April 2002 and replacing the former CHP Law. The Law enacts a duty to connect certain types of CHP units to the grid and purchase their electricity exports to the public grid. On top of the agreed price for these exports, the operators of the units are entitled to obtain supplementary payments on each kWh exported as given in Table 5.2. The costs of these payments will be borne by the final electricity consumers, hence it is not considered as state aid. Furthermore, avoided grid use costs have to be rewarded back to them. The new Law thus increases the financial returns and therefore supports the continued operation and modernisation of already existing CHP plant regardless their size. It does not limit itself to support existing CHP plant. It also aims to encourage the installation of new small-scale CHP units up to 2 MW_e

capacity and applications based on fuel cell technology. For these types of CHP plant, the law foresees a particularly high supplementary payment over an extended period of time. The new law, however, does not support all sectors that could use CHP, as it ignores the enormous CHP potential present in the German industry. There will be hardly any incentive to construct new CHP plant beyond a capacity of 2 MW_e as the law provides just a small payment for these CHP plants. For small-scale CHP the supporting payments are much higher.

Table 5.2 *Supplementary payment for electricity exports to the public grid in Germany [€]*[7]

Plant type	2002	2003	2004	2005	2006	2007	2008	2009	2010
Existing old CHP plant (Start of operation before 31/12/89).	1.53	1.53	1.38	1.38	0.97				
Existing new CHP plant (Start of operation between 31/12/89 and the date when the new Law comes into effect).	1.53	1.53	1.38	1.38	1.23	1.23	0.82	0.56	
Modernised CHP plant (Start of operation after the new Law came into effect).	1.74	1.74	1.74	1.69	1.69	1.64	1.64	1.59	1.59
New small-scale CHP plant between >50 and 2000 kW_e.	2.56	2.56	2.40	2.40	2.25	2.25	2.10	2.10	1.94
New small-scale CHP plant ≤50 kW_e, which start continuous operation before the end of 2005, and fuel cell units.					5.11[8]				

Other legislation related to CHP

The procedure to apply for approval for CHP equipment pursuant to the building right and BImSchG (Bundes-Immissionsschutzgesetz/Federal Immission Protection Law) are uniquely regulated and planned. The conditions for a subsequent approval of the related network operator, however, are by far less precise. There is a risk of arbitrary determination and claims, which in individual cases may represent a risk for planned investments. A uniform prescription being valid for the whole country could minimise this risk. The procedure to apply for approval pursuant to BImSchG is not simplified for the CHP equipment. The efforts depend on type and size of the equipment and have to be executed at acceptable costs. The problem is that in many cases CHP equipment with renewable energy carriers cannot cope with the required limit values for air pollution or only at considerable costs. The authorities do not always take the tolerances for this equipment into account.

5.4 Regional regulatory competence

On the regional and local level, the installation of CHP units is influenced by a regional regulatory framework, related to planning and building permissions.

5.4.1 Czech Republic

In the Czech Republic a permission procedure for any type of building or structure is carried out by the local office of the Building Authority which is a part of the town council or the community council. The procedure consists of two parts:

- Legal procedure to gain a planning permission.
- Administrative procedure to gain a building permission.

A planning application concerning the siting of the building/structure, accompanied by a number of appendices (including expert opinions and certificate confirming ownership), must be

[7] Supplementary payments for small scale CHP plant up to 2 MW_e (this includes also units <50 kW_e) will only be made up to a total electricity export of 14 TWh from these plants.

[8] For a period of 10 years beginning from the start of continuous operation.

submitted to obtain a planning permission. Then a building application is to be submitted, again accompanied by a number of appendices, some of which may be the same as for the planning application.

After obtaining the building permission, building works may start. When this building work is completed, an application of approval for the new construction is to be submitted to the Building Authority. The approval application should usually be accompanied by the same documents as the application for building permission.

In most cases the decision for the planning application is made within 30 days or, for large or complex applications, within 60 days. For a CHP plant the 60-day time limit will apply, considering also the time needed to obtain relevant expert opinions, to carry out possible appeal procedures etc.

If a planning decision and all required documents are available, the building permission procedure may be completed within 7 days or, for obtaining a joint decision, within 15 days. For a CHP plant project the time limit may be extended by the Building Authority, considering the size and nature of the building/structure in question. The fastest procedure possible for a CHP plant therefore takes 60 *plus* 15 days.

5.4.2 Poland

Construction permit

The construction of a CHP plant in Poland is regulated by the following rules:

- Construction permit, which is universal for all constructions.
- Licensing (for facilities with capacity over 5 MW_e and over 1 MW_{th}).
- Contracting of power and heat sale in accordance with regulatory acts.

Before application of a construction permit the investor asks the local authority for issuing the general conditions for construction and land use. The local authority checks the application from the point of view of the local land use plan and energy plan (if there is no energy plan, the City Council takes the relevant decision) and gives detailed description of steps, which are necessary to fulfil the conditions.

For obtaining the construction permit the investor needs:

- Description of construction design.
- Obligatory environmental impact assessment for units with capacity over 300 MW_{th}.
- Facultative environmental impact assessment for units with capacity over 10 MW_{th}.
- Proposal how to cope with emissions of flue gases and dust to the air for units:
  - Fired by coal with capacity over 5 MW_{th}.
  - Fired by coke, wood, straw, liquid oil with capacity over 10 MW_{th}.
  - Fired by gaseous fuels for units with capacity over 15 MW_{th}.

The construction design should be prepared in accordance with Polish Construction Law e.g. it should contain all necessary opinions (for example about certification of construction parts by Polish certification bodies) and agreements with local administrations (water supply, power supply, sewage, hygienic inspection, road management etc.)

The procedure of construction design adjustment is time consuming, but when the construction design contains all necessary parts, the formal procedure of the construction permit takes no more than 1 month.

5.4.3 Germany

Related to the size of the planned CHP several different kinds of proposals, approvals and permits have to be completed. Basically the construction of CHP plants in Germany is regulated by four different categories of legislation:

1. Spatial legislation/planning (on state, municipal and county level).
2. If necessary, feed in conditions/regulations (with concerning electricity-/heat network provider).
3. Environmental legislation/permit (e.g. BImSchG, WHG etc.)
4. Building legislation/permit (e.g. BauGB, etc.)

For a fast and effective progress of CHP projects, all four categories should be take into account. The first step in constructing new CHP plants is to determine suitable locations. Therefore it is necessary to take account into the related state, county and municipal spatial plans. Those plans identify eligible sites for the construction of industrial facilities or CHP Plants.

In relation to the operation mode (feed in or in house) of the CHP plant it could be necessary to organise feed in contracts for electricity/heat in the local networks with the relevant network providers/energy suppliers. Principally the 'EEG-Energieeinspeisegesetz' offers the right to feed in electricity and heat into public networks for every supplier but practically there are lots of technical and further barriers.

In relation to the size of the CHP plant several environmental permits (BImSchG, WHG, Krw-/AbfG) need to be obtained. The exact thresholds are described in:

- BImSchV (Verordnung über genehmigungsbedürftige Anlagen) (*Enactment for permit indigently facilities*).
- VAwS (Anlagenverordnung) (*Enactment for facilities to handle water endangering substances*).
- Landesabfallgesetze (*Federal State Waste Laws*).
- Gefahrstoffverordnung (*Enactment to handle hazardous substances*).

Almost all sizes of CHP units need to have a building permission. Before starting a CHP construction, a building permission has to be obtained if there is a need to construct a new building for the CHP. The administration procedure will be done on municipal level, normally. The building permission will be a part of the environmental permission (if needed) to be obtained for the CHP unit. The need of an environmental permission depends on the size of the plant, the kind of fuel and the generation technology. The thresholds are in between 100 kW and 20 MW.

5.5 Conclusions

The analysis of EU and national energy policy framework leads to the following conclusions:

- In both EU and national policy plans CHP is recognised as an important option towards energy conservation and environmental protection. Difference exists between countries in the way CHP is promoted. Germany has adopted a relatively comprehensive set of policy instruments to promote CHP, but in the Czech Republic and Poland energy policy is weaker and based mainly on good intentions.
- Not even Germany has yet found the right balance between energy market liberalisation and promotion of both existing and new CHP installations, although with the introduction of the CHP-Upgrade Law; CHP should have a more beneficial position again.
- The EU presents a basic set of policy instruments that can be used by the Member States to promote CHP. Concrete implementation is, however, left to the Member States.
- The main problem for the Czech Republic and Poland is not the adoption of the EU legal requirements but the implementation of programmes promoting CHP.

- Implementation of CHP projects requires a comprehensive set of permissions and expert opinions. Procedures can be time-consuming as the permission and expert opinion of many institutions is required.

6. REGIONAL AND LOCAL ENERGY POLICY AND PLANNING

Recently, regional and local energy policy plans have gained importance in the ERN. To support CHP and energy efficiency through regional initiatives, the CHP Action Plan will take these initiatives into account. Furthermore, regional and local authorities in all three countries of the ERN have already several responsibilities regarding energy supply in their territories.

6.1 Czech Republic

The policy and objectives on the regional level can be analysed either in the documents of the ERN or in documents of the new Liberec county. Since January 2001 most of the territory of the Czech part of the ERN is identical with the territory of the new Liberec County.

6.1.1 Environment-energy concept of the Liberec County

There is no official energy policy available for the Czech part of the ERN. In 1997 an Energy Concept for the Czech part of the ERN was developed within the activities of the State Environmental Fund.[9] For the first time the study analysed energy supply and demand in the region with the stress on identification of potential measures that would reduce emission of pollutants in the air. The outcomes of the study were used for an investment strategy of the State Environmental Fund in emission mitigation measures but the regional strategy itself has not yet been developed.

Since January 2001, most of territory of the Czech part of the ERN is identical with the territory of the new Liberec County. The administrative authority of the region is the Regional office that will have to issue several binding documents for the Liberec County in the coming years. Of relevance for the CHP Action Plan can be the following:

- Regional development strategy (long-term strategy document).
- Regional development programme (medium-term document).
- Regional energy concept (medium-term document).
- Air protection concept taking into account the structure of energy resources.

The main regional competence of the Liberec County, relevant to the promotion of CHP, are as follows:

- Monitoring of the use of subsidies from the state budget and other Czech sources of financing.
- Development and implementation of own subsidy/support programmes (delegation of competence regarding national subsidy programmes).
- Support to municipalities in development of implementation of projects.
- Environment Impact Assessment.
- Building regulations and decisions in case of projects, which influence the territory of at least two districts.

Following the requirements of the Energy Management Act (see Chapter 5) the new Liberec County should develop its own energy concept (policy) within next 3 years (i.e. by end 2003). The concept should also deal with the future role of CHP on the territory of the Liberec County.

[9] Energetický koncept České části Euro-regionu Nisa. (Regional energy concept of the Czech part of the Nisa Euro-region), March Consulting, Prague, January 1998.

This document has not yet been developed and thus the CHP Action Plan can provide inputs to such a concept.[10]

The latest document, which sets the policy objectives and priorities for the Liberec County is the 'Development Strategy of the Liberec County' (August 2001). The most relevant to the Regional CHP Action Plan is the field of infrastructure (including energy matters). The schedule for regional planning is:

- Satisfying energy demand on the territory with goal-directed support to projects involving renewable energy sources (*deadline: 2012, monitoring: 2005)*.
- Optimisation and reduction of energy of energy supply, minimisation of energy use impact on the environment (*deadline: continuous, monitoring: 2015).*
- Development of the regional energy concept (*deadline: 2002)*.
- Support to programmes promoting wider use of renewable energy sources.

6.1.2 Communities and municipalities

The Community is the basic territorial self-administration commune of citizens, which creates the territorial area with delineated borders. The community has its own property and responsibility. Some communities have the right of public administration. In this case they can issue municipal ordinance. The most relevant rights in the public administration are the Physical Planning and Building Code. The Liberec region consists of 216 communities, of which 36 are municipalities.

6.2 Poland

The regional level authorities in Poland have a very direct responsibility in energy planning. The regional self-government checks whether the municipal energy plans cover needs of neighbourhood municipalities and the Governor checks whether the energy plans are in compliance with the State guidelines for energy policy.

According to the Energy Law, communities are solely responsible for preparation of energy concepts. This obligation is not limited by time. Indirectly the cost of investment in the energy sector can be accepted within the heat and power cost only when they are planned through an municipal energy concept, which should be accepted by municipal councils. From 50 communities associated in the ERN only 6 have prepared such energy concepts. In none of them the CHP option is analysed as an alternative or extension option to existing heat sources.

Since the reform of administration structure (1998) Jelenia Gora, the capital of the Euroregion, lost the competence of regional administration. This belongs to the city of Wroclaw, capital of Upper Silesia District. Therefore the Action Plan should be co-ordinated with aims and scope of the regional energy strategy, which is under preparation. The development of CHP in this region is mentioned in this strategy as one of most important points.

6.3 Germany

The planning on the energy sector in Germany is primarily performed from private and municipal energy suppliers based on the relevant market requirements. The role of municipalities and regions is restricted to energy providers who are owned by municipalities.

[10] The tender for Regional Energy Concept development was announced at the time of finalisation of this Action Plan.

Energy planning on regional level
The direct influence of the regions on energy planning is also very low in Germany since this planning is mainly based on the relevant market requirements on private economy level. These are, besides the eight public utilities, the two regional providers Envia and ESAG. In the ERN, some regional self-initiatives exist supporting the use of renewable energy carriers and CHP-equipment (e.g. within the scope of Inno-Lausitz).

Energy planning and investments on municipal level
In the German section of the ERN, municipalities own eight energy providers with different proprietary shares. The municipalities are responsible for the development and success of these energy providers. Normally, planning is based on municipal energy supply concepts. The CHP equipment is planned pursuant to the need of remote and local heat. In this planning process, the universities of the region, consultants and equipment manufacturers are involved. The representative of interests for municipal energy providers is the VKU (Verband Kommunaler Unternehmen).

6.4 Actions on regional policy and regulation

Based on the information from Chapter 5 on regional regulatory competence, several recommendations for regional actions promoting CHP could be developed.

Recommended actions on regional energy policy level:

1. *To fasten the procedures for planning, building and environmental permits for CHP installations, e.g. through a one-window approach.*[11] *This could mean the integration of the applications for planning, building and environmental permits at one agency, enabling investors to settle all permits at once.*
   - Who: municipalities, districts, regions.
2. *To include and assess the CHP option in regional and local energy concepts where possible.*
   - Who: Municipalities, districts, regions.
3. *To support regional/local self-initiatives in the field of CHP where possible through:*
   - Informing about technical options.
   - Informing regional stakeholders about new subsidy programmes.
   - Who: regional authorities.

In the next chapter the existing institutional capacity of the ERN will be analysed to see if this capacity is sufficient to start these proposed activities.

[11] We can not expect that regional authorities can change administrative procedures that are the same over the whole country, but they can work on quicker procedures in their own area.

7. IMPROVING INSTITUTIONAL CAPACITY; ESTABLISHING REGIONAL ENERGY AGENCIES

7.1 Existing institutional framework in the ERN

Czech Republic
On the national level the support to CHP implementation is promoted through the National programme for promotion of energy efficiency and renewable energy sources. This programme is administered by the Czech Energy Agency (CEA) and the State Environmental Fund (SEF). Both institutions are also present in the Czech part of the ERN: the CEA through its Energy Consulting and Information Centres (EKIS) and the SEF through the regional office. The Czech Cogen and the District Heating Association are interest group promoting both district heating and CHP on the national level. Nevertheless on the regional level no energy agency exists, which could promote energy efficiency and CHP.

Poland
In Poland no institution is officially responsible for promoting CHP technology. The governmental Energy Conservation Agency (KAPE) has organised each year since 1999 conferences within FEMOPET dealing with CHP. There is also a small Polish Cogen Club (member of Cogen Europe), which started activities in late 2000. The regional administration of Upper Silesia Woiwodship is going to launch an energy saving agency with support from EC.

Germany
The further intensified development of the CHP technology is a declared target of the federal government and it defines the related conditions by legal framework. The total process will then be supported accordingly by economic, environmental, and research institutions on all levels. On the regional level, interest groups exist consisting of energy consultants and equipment manufacturers. In other federal states, projects in the energy field are supported by local or regional energy agencies. In Saxony, such facilities do not exist yet.

Conclusion
We can conclude that the existing institutional capacity of the ERN is not sufficient to cover capacity needs in the field of energy efficiency / planning and promotion of CHP.

7.2 The need for institutional capacity building

It is important that an institutional framework will be built on the level of the ERN addressing energy conservation policy, including promotion of CHP and other energy efficient technologies. Establishing a strong institutional framework should include two elements:

- First, the establishment of regional energy agencies, advising different target groups in the region with information on energy conservation and CHP.
- Second, preparing existing (administrative) structures towards increasing involvement in energy issues. This will include capacity building on the municipal and provincial level.

The Action Plan mainly focuses on the establishment of regional energy agencies in the ERN. As regional authorities and their competence differ over each national part of the ERN, no general approach for the whole ERN can be chosen. It is viewed more suitable to start institution building with energy agencies that are independent and that can, in the long run, support local and regional authorities in the respective national parts of the ERN.

The foundation of a regional energy agency can be of assistance in implementing the national policy on the regional level and to distribute national funds for energy efficiency.

Important for a well-functioning energy conservation policy on the regional level will be the extension of the human capacity on regional administrative level. Then it will be important to facilitate easier handling of procedures related to installation of CHP and other energy efficient technologies. A so-called one-window approach for licensing can be a first step in that direction (enabling investors to gain a planning permission, building permission and environmental permission at the same address). The newly established energy agencies can co-operate with the regional authorities on these issues.

Other important issues such as investment information and energy efficiency advice should also be included in one organisation, preferably in the energy agency.

7.3 The establishment of regional energy agencies

As no regional energy agencies exist in the ERN, the plan is to establish three regional energy agencies, one for each national part of the ERN. The establishment of regional energy agencies can be supported by the EU SAVE II programme, but under the condition that at least two agencies in different countries are established. The establishment of these agencies in the ERN presents an ideal situation. SAVE II programme financed 40-50% of costs of establishment and running the agency for 3 years. The energy agencies should have a non-profit status, as this is the requirement from the EU SAVE II programme. As the SAVE II programme will be terminated in the year 2002 the new programme will be established as a successor of the SAVE programme. It is expected that the new programme will also promote the foundation of regional energy agencies.

The newly established energy agencies will have a role in disseminating information about CHP in specific and about energy efficiency in general. Target groups they should focus on are primarily municipalities, utilities and industries, possible investors in CHP. Later, possible extension of activities towards other target groups, such as households, could be possible.

Activities of the energy agencies should be the following:
- Informing local stakeholders about energy legislation (both national laws and regional regulations).
- Providing information about possibilities for energy conservation (CHP, building isolation etc.)
- Act as energy consultant for small-scale advises (against reduced tariffs).
- Give advise to potential investors about financing possibilities.
- Disseminate information about recent energy conservation projects (especially on CHP).

A large number of such energy agencies already exist in EU countries, some focus on households, others more on the commercial and public sector. Based on the personal occupation of the agency, it can act as information point or act more as an energy consultant.

In the ERN, the first focus of the energy agency should be municipal energy (management), and utilisation of CHP and local energy sources. The target groups are potential investors & decision-makers with limited expertise in CHP projects (or only technical or only economic expertise). The role of the agency will therefore be more of an energy consultant. The success of the energy agency will also depend on the competence of the staff and the amount of co-financing gained from the region. Municipalities, regional governments, local energy companies and engineering firms should be contacted to be possible partners in the establishment of the region. Both financial sources and expertise will be needed from local stakeholders.

Co-operation with regional universities and other institutes of higher education will also be of importance. First, there is technical (independent) knowledge/capacity available at these institutes that can be useful for the new energy agency and also students from these institutes can have an internship there and/or become employees at the agency. This will result in a new educated staff at the agencies and in the future it can promote an increase of employment in the region.

7.4 Actions to establish regional energy agencies

One of the major issues before starting the preparations for the establishment of an energy agency is the source of financing. Financial sources could be available from national sources (energy agencies) and /or EU sources. As finding the proper sources of financing will take a while, we expect that it will take until the beginning of 2003 before any financial sources will be available for the establishment of the agencies.

1. Preparatory work:
   - Search for possible partners for the establishment of the agency in all three parts of the ERN (regional authorities, energy utilities, commercial organisations).
   - Determining scope of work of the energy agency.
   - Writing business plan (see also point 2 and 3 below) and determining the budget needed.
   - Search for financial sources.
   - Applying for financing (both EU as national).

If planning to apply for financing under the successor of the SAVE II programme in 2003, this preparation should be ready by end 2002.

2. Establishment and staffing:
   - Search for suitable location of the agency, most practical will be to locate the agency in or close to the ERN's main cities.
   - Search for suitable staff, based on the scope of work of the agency.
   - Develop a strategy for promotion and awareness raising (see Chapter 9).

3. Marketing of the agency's activities. The success of the agencies' activities will to a great extent be influenced by the name and reputation of the agencies in their respective region. Marketing and dissemination of information to all possible target groups will be needed from the beginning:
   - Determine target groups of the agency and look for suitable ways to reach them when the actual work of the agency will start.
   - Search for sponsoring of the agency's activities.

8. FINANCING OF CHP PROJECTS

8.1 Introduction

The objective of this chapter is to provide the authorities and relevant recipients in the ERN with recommendations related to financing CHP projects. This would improve the access and availability of capital for investments, giving regional target groups the possibility to have more financial resources at their disposal and increase their capabilities to use these resources.

The Action Plan refers to two linked issues:
1. Improving cost-effectiveness of CHP projects through financial measures.
2. Increasing the availability of capital for CHP projects.

During the analytical phase potential funding programmes in the three countries were reviewed, their priorities for investments and eligible projects characteristics as well as available information on financing schemes used for running CHP units. Private financial sources were evaluated and sensitivity analysis was performed of factors influencing cost-effectiveness of CHP installations. Major barriers to financing were identified, within which *economic viability* of CHP schemes is the most important one, being also reflected in the difference between the technical and economic potentials identified.

The number of recently commissioned CHP units is small in all the three countries (in Germany no new CHP plants have been commissioned since 1995) mostly as an impact of the EU electricity market liberalisation on electricity prices and other less favourable conditions for CHP.

Newly developing or adopted legal and regulatory framework promoting renewable schemes generating electricity and heat based on CHP will affect also future CHP investments; current situation is characterised by a slow-down of investment activities.

Financing is only one of the issues in the complex of activities, the aim of which is the creation of a positive environment for investments into CHP for different groups of investors. The progress in other capabilities, e.g. in project identification and development, also determines the success of CHP projects. The recommendations for activities to be undertaken by regional and local authorities may support those recommended in other chapters thus underlying the need for a co-ordinated approach.

8.2 Country specific situation on project financing

Cost-effective installations of CHP have been described (see Chapter 4.4) including the potential for CHP as well as major factors, influencing cost-effectiveness of CHP projects. The following description involves the availability of financial resources in each of the countries and regions, their suitability for CHP investments and mechanisms they use for investment support. The following financial sources were reviewed:
- Availability of specialised funding programmes and schemes (Government/ EU/ Regional/ non-budgetary) to support CHP projects.
- Availability of in-house capital - own sources.
- Conditions of external private resources - mainly bank credits and third party financing.

8.2.1 Project financing in the Czech Republic

National funding programmes available for investment support for CHP units in the Czech Republic involve several programmes, in two of them CHP oriented sub-programmes are specified:

- State Environmental Fund (non-budgetary funds) and its Air Protection Programme with a sub- programme of support to CHP units based on renewables (combination of grants and soft loans). Lending and grant provision conditions have been significantly improved since 1 January 2002 (extension of loan duration, interest rate 0% for all applicants, increased grant share to 40% for municipalities, etc.)[12]
- Czech Energy Agency, managing the State Programme for Promotion of Energy Efficiency and Wider Use of Renewable Energy Sources (Government programme), part A - Sub-programme of CHP support and Sub-programme for increased use of renewables - direct investments support of 15% is provided for switch from individual boilers to DH for CHP units up to 5 MW with 30% energy savings, 5-50 MW for HOB reconstruction to CHP with 33% energy savings. Funds are very limited though.
- Programme of the Ministry of Industry and Trade - KREDIT - for small entrepreneurs, 6 years loan duration with 7% interest rate for *equipment purchase*.
- Phare Energy Saving Fund - Energy efficiency projects incl. CHP installations - the Fund provides soft loans (4-5%) to projects showing required energy savings and economic viability. The revolving annual budget is of about 60 mil. CZK.

The availability of in-house capital depends on the sector and is different for a hospital, a school, a municipality, a private owner of a swimming pool or an industrial enterprise. The public sector can be characterised by persisting deficits in municipal budgets and high need for social and environmental investments; state organisations by severe restrictions on expenditures due to other priorities and high state debt. In case of private investors, capital is always scarce and most recently the CHP alternative is losing due to low IRR and significantly higher investment cost of CHP options in comparison with heat-only alternative. In addition, especially in industry, sizing of CHP units has become difficult due to expectations of future lower electricity tariffs negotiated on the market. Also increasing gas prices prevent to achieve sufficient cost-effectiveness of the CHP option.

The banks provide credits at interest rates varying from 6.5 to 12%; with loan duration of up to 8-10 years. Experience of banks with smaller energy efficiency investments is still low because the administratively complex appraisal procedures concentrate on clients' creditworthiness as such and the impact of the project on clients' cash flow is being evaluated only in larger investments.

As to *Third Party Financing*, several types of services are provided by third parties: Energy Performance Contracting, ESCO services and outsourcing. Several companies have already established good track record in the energy service sector, some of them having access to capital resources from abroad: MVV EPS, KSÚE, Landis&Staeffa, HARPEN, TEDOM Energo, ESCO s.r.o., Motorgas. As to CHP units installed through TPF schemes, producers of CHP motors have been very active.[13]

[12] The reason is the low uptake of the funds for CHP in the past and the necessity to comply with the new EU Directive on electricity generation through renewables.

[13] E.g. TEDOM in municipal DH systems (Tedom installed CHP units in smaller DH systems for a 15 year contract), Motor gas in wastewater treatment plants and landfills. Motor gas is offering TPF for small CHP motors, but demand for that is low - of the overall figure of 38 installations of CHP units, 23 references of Motor gas relate to municipal wastewater treatment plants, and only in one case TPF has been used.

In the Czech Republic feed-in prices of electricity have been significantly increased since 1 January 2002 for electricity generated in CHP units based on renewable energy, e.g. biomass and biogas.

8.2.2 Project financing in Poland

Significant funds have been made available for environmental protection in Poland. A special programme targeted at CHP does not exist at the moment, but CHP projects can be financed from the non-budgetary programmes of environmental protection, in which they compete with other projects. Selection procedures evaluate the overall environmental productivity of the projects, the benefit-to-cost ratio. The following funds are available:

- Ecofund Foundation (debt-for-environment swaps) - soft loan scheme for private and public recipients. Advantageous environmental benefit-to-cost ratio is required.
- National Fund for Environmental Protection and Water Management (NFOŚiGW). Significant emission reductions are required by the combination of grants (for public recipients, 5-30% of the project costs) and soft loans (10,8 - 12,6% interest rate). Air protection has been second priority recently. Advantageous environmental benefit-to-cost ratio is required.
- Woivodship Funds for Environmental Protection and Water Management (VFOŚiGW - 40% of environmental fees and penalties collected on the Voivodship level). A high effectiveness rate is required, local projects have priority. All commercial and non-commercial entities eligible.
- Thermomodernisation Fund - grants - up to 50%, for 1 year. Loans - up to 50% of total investment costs (in case of renewable energy implementation - up to 70%). The Act on the support of Thermo-Modernisation Investment defines certain conditions before financing can be granted. Thermo-modernisation projects have to reach a minimum improvement of energy efficiency of 20-25% per year (depending on project type) and this has to be supported by an energy audit.

Bank credits - There has been a positive progress achieved in the assessment of energy projects by commercial banks. Nevertheless, enterprises prefer preferential loans offered by the National Environmental Protection and Water Management Fund and the Bank for Environmental Protection. As the investment needs of the sector exceed the capacities offered by the above institutions, it will be necessary for enterprises to use commercial loans offered by both Polish and foreign banks. E.g. district heating companies have been using primarily medium term loans (i.e. up to 5 years maturity). In this context, the system of guarantees provided by the State Treasury and other institutions is becoming important. The bank credit products may be described in the following detail: interest rates vary from 6.5 to 18% (range dependent on the type of the borrower and currency), maximum loan duration depends on the financial stability of the borrower and the track record and may be up to 20 years. Duration of a loan processing procedure can be from 2 to several months, depending on the bank, borrower and the project.

ESCO companies are not yet fully established in Poland and the region. Main reason for the restricted extension of TPF services include: decreasing heat demand, limited number of professional energy service firms, low level of understanding the third party financing mechanism amongst energy receivers, and low level of understanding of ESCO investments by banks.

8.2.3 Project financing in Germany

There are several funding programmes for CHP projects available in Germany. Most of them are regular loans with reduced interest rates. At present the programmes offer loans of 4.7% to 6.05%. Some of the programmes take over the legal liability for a part or for the whole loan.

- Deutsche Ausgleichsbank (DtA) - Environmental program supporting projects aimed at preventive environment protection. It provides loans with reduced interest rates (up to 75% of the cost, 100% for SME's), 10-20 years repayment period, mainly for SMEs and free-lance entrepreneurs.
- Kreditanstalt fur Wiederaufbau (KfW) - Long-term investments in with a focus on environmental protection. It provides reduced interest rates for all kind of private and public enterprises, freelance entrepreneurs (for enterprises with an annual turnover up to 50 Mio € 75% of the cost, above 50 Mio € 66,66% of the cost, maximum amount usually 5 Mio €), project duration up to 20 years.
- ERP - Energy Saving Programme. Beneficiaries: SMEs up to 500 Mio annual turnover and freelance entrepreneurs. Project duration for construction projects up to 20 years, other projects up to 15 years (app. 5 years without repayment). Reduced interest rates (reduced interest rate up to 50%, maximum amount usually 1 Mio €).
- BMU - Demonstration Projects to Reduce Environmental Impacts. Project duration up to 30 years. Reduction of the interest rate for 70% of the investment costs.
- DBU - Environmental technology, demonstration actions and technologies (esp. reduction of emissions and renewable energy). Grants provided, the amount of grant depends on the project and the applicant.
- Most funds address as beneficiaries SMEs.

As to in-house capital, large enterprises have the human and financial potential to calculate the most efficient way to satisfy their needs of electrical energy and heat. For SMEs this is much more difficult to manage. In the *municipal sector* budgets have been in deficits or fairly limited and low revenues make investments into CHP projects very difficult. As a common feature in local authorities, investments are prioritised enforced by legislation (e.g. wastewater treatment plants) or by necessity (e.g. infrastructure).

In Germany TPF involvement in financing rehabilitation projects in municipal district heating systems increased rapidly during last ten years (ESCOs can be named: ABB Energie Service GmbH, Essen, STEAG Energie-Contracting GmbH, Heidelberg, HARPEN Energie Contracting GmbH, Dortmund, WECON Wärme und Energie Contracting GmbH, Hamburg). Despite the fact that no ESCO financed CHP plant could be identified in the ERN, there exist some TPF projects in the field of reconstruction of buildings.

8.3 Conclusions and recommendations

8.3.1 Conclusions on project financing

The contribution of the national funds played a very important role in the past. Most existing CHP installations in the ERN profited from direct investment support, soft loan mechanisms or fixed pay back tariffs in the past. Recently in all three countries the number of CHP installations installed has been almost zero, due to the fact that cost-effectiveness of CHP installations have decreased significantly after the electricity market opening.

Cost-effectiveness of CHP schemes

Disproportion between financial benefits of most CHP alternatives (with its extra-investment cost compared to heat-only solutions) and requirements of private financiers as to the project revenues need to be alleviated. This can be improved through:

- increased effectiveness of the investment (increased revenues),
- reduction of costs through financial measures (funding programmes).

To identify most effective measures to apply, sensitivity analyses have been carried out, giving the following results (see also Chapter 4):

- CHP projects are much more sensitive to changes in feed-in price of electricity and fuel price than to the level of investment costs and discount rate.
- Investment costs for CHP do not affect the viability of the project very significantly, the investment subsidies for CHP projects make sense only to CHP projects that are very close to breakpoint or in order to decrease investor's risk. Therefore, support of CHP projects by subsidising the feed-in price of electricity may prove to be more effective than support oriented in investment costs. Subsidising the feed-in price can also be attained by a remuneration of the externalities of CHP, such as environmental protection, climate change mitigation and security of supply. This can also exist in the form of a subsidisation of electricity per kWh.

Current status of revenues

Conditions in pay back tariffs for sales of electricity are expected to improve significantly for CHP installations based on renewables as a result of the new Decree on electricity production from renewables (as it happened already in the Czech Republic). Heat and electricity from gas fired CHP alternatives do not have this type of support.

Cost reduction measures

- Financial measures used to reduce capital costs of CHP projects are; subsidised interest rate, extended repayment period, provision of liabilities for collateral, direct investment subsidy. These measures are not sufficient recently to make CHP installations attractive.
- Significant improvement has been made for renewable schemes in the Czech Republic - from 1 April 2002 CHP units using biogas or CHP systems and schemes based on biomass can receive a loan with 12 year repayment period and zero interest rate.

Available capital overview

- With the exception for the Czech Republic, no specialised CHP funding programmes exist on national level, and regional funds have not yet been developed (with the exception for VFOŚiGW environmental fund in Poland).
- In Poland CHP projects are financed as a measure contributing to climate protection through energy savings. It means that CHP competes with other energy efficiency and environmental protection proposals and environmental benefit-to-cost ratio is carefully considered (e.g. through energy audits) before grant or interest rate support is provided.
- A specialised technology CHP sub-programme exists only in the Czech Republic, financed by the Czech Energy Agency from the Governmental programme for energy efficiency measures. According to available information the number of applications for CHP support is very low indeed (during last year there were 3 applications).
- No support has been provided to coal based CHP and units above 50 MW.

In-house resources

- The need for general investments in the whole ERN is very high with regard to modernisation and recovery of the private sector and the need for harmonisation of EU legislation for the public sector. Therefore, the high capital costs of new CHP installations, present a serious barrier when it has to compete with other necessary investments.
- Limited access to own sources and *bank credits* puts limitations also on using promotional funds.
- *Third party financing has been developed in Germany and the Czech Republic*, but low cost-effectiveness of CHP due to low pay back tariffs presents serious barrier to ESCOs.

TPF can be effective in case of Czech Republic for biogas fuelled CHP units in wastewater treatment plants and in some small-sized CHP installations in the buildings, swimming pools and other tertiary sector.

8.3.2 Recommendations to improve project financing

1. Increase and set up of fixed feed-in tariffs

This is the most effective instrument for increased cost-effectiveness of CHP. It has recently been used for renewable based CHP units as a result of the EU legislation aimed at increase of renewable-based generation of electricity and increased security of supply. In the Czech Republic increased fixed feed-in prices for electricity from renewables have had an immediate response from the potential project hosts. This instrument is transparent, easily understood and visible. It does not mean that it removes all barriers: technical requirements of transmission/distribution utilities on CHP installers can lift the investment cost significantly, mainly for small-scale CHP.

Subsidising the feed-in price can also be achieved by a remuneration of the externalities of CHP, such as environmental protection, climate change mitigation and security of supply. This can also exist in the form of a subsidisation of electricity per kWh. An additional element of remuneration of externalities is the possibility to link the performance of a CHP unit (e.g. energy efficiency or CO_2-indexation) directly to the level of support.

Fixed feed-in tariffs and/or remuneration of externalities cannot be influenced on regional level at present. Decision on possible negotiations with distribution utilities on distribution/connection tariffs can be made only on national level in the countries of the ERN.

2. Improved subsidy/soft loan conditions

The level of direct subsidy and conditions for loan repayment may improve cost-effectiveness of the CHP installation. Direct subsidy reduces the need for up-front capital, the minimised interest rate may significantly reduce the payback period and the need for guarantees. Provision of liability for the loan may overcome problems of lenders to secure the loan.

Yet, project financing depends on the approval of the public support providers. Mostly an energy audit or study is required and this presents a barrier to those investors, who have not yet become used to increased stringency for use of public funds and consider careful project development to costly.

3. Financial subsidy to project development phase /energy audit

Reduction of project development costs may have significant impact on the decision-makers, because otherwise the business plan development for DH projects is a costly activity as well as a detailed energy audit. This instrument may assist in generating a pipeline of projects. CHP option should be evaluated in all bigger projects for new or reconstructed public buildings and heat supply facilities and namely in all the specified successful pilot installations.

4. Inclusion of CHP into Emissions reduction /Air quality improvement/Climate protection plans /programmes

Regional priorities should be set up in regional air quality and climate protection programmes for the specific parts of the ERN. Regional authorities should have their say in the projects' selection procedures in case of national funding programme implementation.

5. Integration of ERN activities into NUTS[14] II programmes (creating conditions for projects development eligible for support through EU Structural Funds)

The promotion of sustainable regional development depends on an efficient, diversified and competitive energy sector in order to enhance the security, flexibility and quality of energy supply and reduce energy costs. In the less developed regions the SF will concentrate on Energy networks, energy efficiency and renewable energy sources.[15] CHP has been explicitly mentioned as a measure to be supported in industry coupled with voluntary agreements, energy audits, best practice initiatives. ERN representatives could advocate their interests through co-operation with responsible monitoring committees for pre-accession funds and SF on the NUTS II level. (National Development Plan and the 7 operational programmes should be paid attention to. The SF requires the implementation bodies and monitoring committees to work on the principle of partnership).

6. Capacity building of regional energy agencies/regional information points

Development of a centralised information source on: funding programmes for energy efficiency incl. CHP, their eligibility conditions, other funding institutions and their basic requirements, energy service and energy auditing companies, etc. on regional level is strongly recommended. These information points or agencies could also provide the investors with support on how to apply for certain funding, advise or help them with writing a firm business plan (see also Chapter 7.3 - The establishment of regional energy agencies).

8.3.3 List of priority actions in financing issues

1. Regional priorities should be set in climate protection and air quality protection programmes (EC Air Directives requirements already transposed into national laws). These priorities should be included in the Regional operational programmes or Environmental Operational programmes for financing through Structural funds. Within the programmes also pre-investment support should be provided to reduce the project development costs.
   - *Who: regional authorities.*

2. Support to CHP should be increased in national /regional funding programmes. Conditions of existing support programmes for renewable energy projects should be extended to cost-effective gas-based CHP installations. Currently, regional funds exist only in Poland.
   - *Who: regional energy agencies, national energy agencies, Ministries of environment.*

3. Promotion of TPF should be increased. Major barrier to TPF is a lack of trust to the external energy services ('it's too good to be true'), lack of awareness on TPF, complexity of procurement procedures, the attitude of technical personnel ('we can do it well enough').
   - *Who: national energy agencies, regional energy agencies.*

4. Capacity building - Education/training of potential investors in financing possibilities and project development.

   Increased responsibility for public expenditures is needed at the municipal level. Here financial management needs to be improved just as energy and environmental management. Banks require business plans of new investments before giving loans to large investments, in smaller investment they only evaluate the client's creditworthiness.
   - *Who: regional energy agencies, national energy agencies.*

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[14] Regional administrative levels created by the European Commission for the purpose of Community regional policies and support programmes, divided into NUTS I, II and II levels based on size and population. The ERN falls under the NUTS II level.

[15] The Structural Funds and their co-ordination with the Cohesion fund, Draft Guidance for programmes in the period 2000-06, Working paper for the Commission, 1999.

9. DISSEMINATION OF INFORMATION AND AWARENESS RAISING

9.1 The need for awareness raising on the regional level

Limited penetration of CHP in the ERN can partly be attributed to limited knowledge about the possibilities of CHP. E.g. in many cases, installing CHP units is not considered when heating plants and installations are reconstructed. Providing target groups with suitable information and promoting CHP through all kinds of actions (e.g. demonstrations, seminars) can raise awareness about CHP and energy conservation in general. Promotion and awareness raising in the field of energy conservation and promotion of CHP is usually the task of regional governments and/or energy agencies. The newly established energy agencies will have the task to cover a number of these activities.

The following key actions will be further elaborated:
1. Regional conferences on energy efficiency, renewable energy and CHP.
2. Regional information programmes (through regional energy agencies), including identification of pilot projects.
3. The dissemination of and training in existing guidelines, handbooks and Codes of Practices for CHP.
4. Improving statistics on energy supply and consumption in the region.
5. Energy auditing of public buildings.
6. Increasing cross-border co-operation between universities, research institutes and consultants.
7. Increasing the involvement of regional NGOs.

9.2 Regional conferences

The ERN's day-by-day activity is co-ordinated by working groups consisting of representatives of all three parts of the ERN. The working group related to energy conservation and CHP is the group 'Environment and Energy'. Till now the group focused on reduction of large-scale air pollution from the Turow power plant, municipal waste management and forest rehabilitation. The group has 4 to 6 meetings yearly, which are rather to inform about ongoing activities and to co-ordinate actions undertaken by each side of ERN. The working group has organised in 1997 a regional conference dedicated to ecological waste disposal and utilisation, which had wide impact on communities of the ERN. The topic being in concern of the Polish part of the working group nowadays is energy efficiency, therefore a next regional conference on energy efficiency is planned for autumn 2002.

Actions to be taken:
1. Organisation of regional conferences on energy efficiency in the Czech and German part of the ERN inviting all regional stakeholders involved in energy matters (spring 2003). Main topics:
   - Inform participants about local CHP initiatives.
   - Benefits and risks of CHP investments.
   - Who: energy agencies (in co-operation with energy utilities, CHP manufacturers, energy consultants and universities).

2. Co-ordination of regional conferences with other ways of awareness raising in the ERN, this can include specialised seminars and the publication of guidebooks and brochures.
   - Who: energy agencies.

9.3 Regional information programmes

One of the first (basic) ways of promoting CHP or other energy efficient technologies is providing information on CHP technology.

Several possibilities of spreading information and raising awareness have been identified:

- Through a web site informing about CHP and the Action Plan (*already worked on*).
- Brochures and other materials to selected target groups (municipalities, investors, heating plant owners), covering information on:
  - CHP technology.
  - Possible application of CHP on municipal level (e.g. swimming pools, hospitals).
  - CHP Action Plan of the ERN.
- Seminars for potential investors and other stakeholders, giving information about:
  - Project development cycle.
  - Possibilities of financing.
  - State and regional energy policy.
  - Regulations / permits needed for new installations.
- Pilot projects showing the possibilities to less convinced stakeholders:
  - Identification of pilot CHP projects**,** identifying new projects and use already implemented CHP projects as good examples for stakeholders.
  - Excursions to pilot project sites.
  - Publication of results of pilot projects (in the form of brochure or book).
- Close co-operation with ERN offices by disseminating information about CHP, energy efficiency, ongoing projects.

A mixture of theoretical and practical information combined with showing target groups the possibility for CHP on pilot sites will have to be chosen. This will show to be most effective as it combines information with practical implementation. The implementing agent of most of these activities will be the regional energy agency.

Actions to be taken:

Time schedule of activities:

- Development and publication of brochures.
- Development and publication of energy project guidebook (see 9.4).
- Organisation of seminars.
- Organise excursions to pilot projects.
- Who: regional energy agencies (in co-operation with energy experts from consultants and/or universities).

9.4 Dissemination of and training in CHP guidelines and handbooks

An item that is often underestimated in energy projects is project preparation, and especially economic analysis of energy supply and demand before a project is actually implemented. Experiences from project development in Central European countries learn that little project preparation leads to badly designed projects and difficulties to find financing. The main reason of this little attention is that preparation of projects through audits or feasibility studies is often underestimated. Technical knowledge of local stakeholders is usually sufficient but economic knowledge is lacking. Therefore, project preparation often starts with the search for technical solutions (contacting manufacturers of the needed technology) and attention for the economic details comes later (only when a bank loan or a state subsidy is needed).

Another important feature of project preparation and energy management in most Central and Eastern European countries is the focus on the supply side and neglecting the demand side. This

can result in energy projects that are technically in order, ensuring proper energy supply, but are not adapted to the actual demand for heat and power now and mainly in the future. This can result in district heating or CHP installations that are over-dimensioned, therefore operate energy inefficiently and operate with large financial losses. Connected to this problem are large installations build in the past based on larger heat and power demand than needed at present. After economic reconstruction, many industrial companies collapsed, leaving a heating company with excess heat and power supply. To increase energy efficiency in these plants and make them profitable again requires a combination of economic and technical expertise.

To show potential investors how CHP projects should be prepared, existing examples can be of help. Based on existing projects it could be possible to produce a standardised project development document (or guidebook). Through different activities, the target groups for CHP should be made aware of the necessity of project preparation before technically implementing a CHP project. The following steps should be analysed in the guide:

- Carrying out an energy audit, this audit should give a picture of the actual energy use, losses in the energy system and possible alternatives for improvement.
- Feasibility study, choosing one or two of the most promising alternatives given in the energy audit. This feasibility study gives a detailed analysis of the possible solution, both technically and economically (e.g. size of boiler related to actual and future demand, price and availability of fuels).
- Business plan needed for applying for loans at banks (often included in feasibility study).

Actions to be taken:

- Publication of book/brochure on economic issues of energy projects.
- Seminars for stakeholders (e.g. investors, decision-makers), one-day seminars held in every national part of the ERN (repeated every year 2003-2005).
- Who: Regional energy agencies (guidebook in co-operation with regional experts, and/or universities).

9.5 Improving statistics on regional energy supply and energy use

A first step towards energy conservation begins with the awareness that energy consumption can be decreased. An energy audit can be a proper way to do so, but can also be an expensive measure, especially when the given stakeholder is not planning any reconstruction or other energy conservation measures following after the energy audit (for energy audits, see next paragraph). As there are a lot of public organisations not aware of their energy consumption, simple ways of measuring energy use and keeping an 'energy account' can raise the awareness towards energy consumption. The energy use of single buildings can be known, but calculating the energy consumption of all public buildings owned by a municipality is another thing.

Actions to be taken:

1. Identifying public buildings with yearly energy consumption above a certain threshold (e.g. > 1,000 GJ/year).
2. Regular measurements / calculations of energy consumption (e.g. every month).
3. Developing a central database of energy statistics, kept at the municipal office.
4. Together with energy use, calculate and publish monthly / annual energy costs per site and for whole municipality.
5. Implement energy monitoring, targeting and energy management information system.
    - Who: municipalities (> 5,000 inhabitants) in co-operation with energy utilities and energy agencies.

9.6 Energy auditing of public buildings

In connection with CHP promotion, monitoring of energy consumption is only a first step. When really implementing energy conservation measures, more extensive studies (such as an energy audit) will have to be carried out.

An energy audit (or pre-feasibility study) is a study that evaluates the most appropriate ways to reduce a facility's energy cost. The auditor must begin by developing a clear understanding of how the facility is used by its occupant. Also, an evaluation of the historical energy usage pattern of the facility and its current utility rate(s) must be completed. It is important to verify the facility is on the correct rate(s) before proceeding with the audit.

The energy audit evaluates factors that effect energy usage including all fields of energy use (space and water heating, cooling, electrical appliances etc.) and include impact of various factors (building use, material used etc.) The energy audit report should provide the facility operator with a menu of energy saving options that detail:

- Estimated Annual Savings.
- Estimated Implementation Cost.
- Simple Payback.
- Rate of Return.

In addition, the energy audit report must include the energy calculations made to estimate annual savings and implementation cost. In the Czech Republic the energy audit is mandatory for larger public buildings and also district heating systems including heating plants and CHP plants.

Actions to be taken:

Short term (2002 / 2003):

- Carrying out energy audits in public facilities already identified as most suitable for CHP installation (swimming pools, hospitals, sewage treatment plants).
- Feasibility studies of sites with the highest energy saving potential.
- Search for suitable ways of financing by involving ESCOs and financial institutions in project implementation.

Long term (2004/2005):

- Project implementation at sites identified as economically feasible.
- Analysing sites with less favourable economic parameters on the possibility of installing CHP.
- Monitoring cost-effectiveness of existing projects and of possible future projects.
- Who: Responsibility for the actions lies with municipalities as the owner of the buildings. Work carried out by energy consultants in co-operation with energy agencies.

9.7 Cross-border co-operation between universities and research institutes

The evident lack of knowledge in technical and economical potentials of CHP-plants and in setting up CHP-projects are identified as two of the major barriers for the further extension of CHP-technology in the region. Therefore it will be useful to involve regional institutions of higher education with experience in those fields into CHP promotion. Currently there are institutions of higher education in all three parts of the Euro region working in the field of energy studies and technology and regional economy for decades:

- Wroclaw University of Economics with the branch in Jelenia Gora, the Faculty of Regional Economy and Tourism.
- Technical University of Liberec with the Energy Technology Department.
- University of Applied Sciences Zittau/Görlitz.

Actions to be taken:
All three institutions could support regional energy efficiency through promotion of CHP technology in the region and provide other technical expertise. Major activities could be:

- Devote part of general scientific research to improvement of energy efficiency in the ERN.
- Develop case studies for concretely planned projects.
- Involve students and graduate student through writing their thesis about CHP projects.
- Demonstrate to students pilot CHP installations in the ERN.
- Take part in the dissemination activities through dissemination of knowledge to planning engineers, financing institutions and potential users.
- Exchange of full-time students and graduates among universities and their involvement in common projects.

An additional advantage to involve regional universities is the unbiased position of those institutions concerning all other commercial and administrational participants. In any case that could be a very important precondition to determine the most suitable of all available solutions.

9.8 Increasing the involvement of regional NGOs

Where the self-government is not able to undertake innovative and wider actions because of lack of budget or lack of experience, there is a possibility to engage non-government organisations. Therefore the authorities and members of the Association of Communities of the ERN in Poland decided to create the Foundation of Ecological Culture in Jelenia Gora in 1990. This foundation focused on actions dedicated to dissemination of ecological ways of development in the region. The Foundation took part in a number of activities launched on the level of the Euroregion and financed by both Euroregion and EU funds. The Foundation has initiated the establishment of a regional ecological centre based in the Castle of Czarna nearby Jelenia Gora. Currently the castle of Czarna is almost ready to start permanent activity in order to implement projects prepared in the last years. However, the Foundation has to little capacity to launch an energy saving agency with EU support. Therefore and because of the adoption of a regional energy strategy of Upper Silesia there is a necessity to assist the Foundation by institutions and NGOs acting on regional level. One of them, which took part in preparation of the regional strategy is the Upper Silesia Ecological Development Foundation (Dolnoslaska Fundajca Ekorozwoju), founded 1991, which acts as initiator of regional-wide actions for promotion of environment protection. The orientation of the Foundation towards energy savings became stronger after the introduction of the Thermo-modernisation Law in Poland.

10. CROSS-BORDER CO-OPERATION IN EURO-REGION AND EUROPEAN UNION

Euro-regions are important intergovernmental partnerships in two respects:
1. They provide a framework for cross-border co-operation between border regions increasing both efficiency and effectiveness of national actions.
2. The Euro-regions can co-operate directly with the European Union and can profit from the EU support.

This chapter focuses on the enhancement of cross-border co-operation between the three parts of the ERN, regarding energy planning in general and CHP in particular, and the possible role for the EU in supporting the ERN.

10.1 Improving cross-border co-operation

The ERN has been able to develop several sorts of cross-border co-operation activities during the past decade. Nevertheless, several barriers limit the scope of co-operation that should be overcome to improve this co-operation and actively work together between regions in the field of energy and infrastructure.

The most important barriers to further co-operation, perceived by the stakeholders themselves, are the following:[16]
- Language barriers between national regions.
- Different legislation.
- Incongruity of the three national parts of the ERN, especially regarding the administrative structure and differences in regional competencies.
- Different priorities and degree of interest in cross-border co-operation.

The institutional barriers related directly to the ERN are the following:
- Different structures of regional authorities in all three parts of the ERN.
- Weak position of ERN Working Groups (although in some cases they can be effective lobby groups).
- Weak information management within the ERN.
- No sustainable and systematic co-operation with external actors.

In the past, unfavourable institutional conditions existed in the Czech Republic, due to the fragmentation of local authorities and the non-existence of a second tier of local self-government. Since the reorganisation of state authorities in 2001, this unfavourable situation was changed when the Czech part of the ERN became almost one region (Liberec county) with a regional administration that gained extensive competence in the field of energy and spatial planning.

Due to a different administrative reorganisation, the area of the ERN on the Polish side does not fit into the regional administration area, which was till 1998 the Woivodship Jelenia Gora. The authority of the Association of Communities Members of the ERN is much lower, because they are in competition with remaining communities assembled in the new Woivodship Dolnoslaskie with the capital Wroclaw. The communities in the ERN only form 25% of the communities within the new Woivodship, having limited access to regional funds. Opportunities for them to

[16] See publication 'Administrative Co-operation in the Euro-region Neisse-Nisa-Nysa' (OECD, 1999).

receive additional funding for energy related projects are application to central government or EU funds.

In the German part of the ERN, several administrative districts exist within the ERN. This forms again another administrative level than on the other sides of the border.

To fill in these institutional gaps, the ERN Working Groups exist. The working groups have to be understood as a kind of auxiliary structure, which are supposed to compensate for missing administrative levels and ensure smoother cross-border co-operation.

10.2 Cross-border activities

To improve the cross-border co-operation in the promotion of energy efficiency and CHP, the following activities are proposed:

1. Exchanging information/experiences when establishing regional energy agencies, ensuring co-operation between the new agencies in the future. The regional energy agencies are supposed to be established in the framework of the EU SAVE II successor programme. This will be ongoing in the three regions simultaneously, presenting plenty of possibility for co-operation.
   - *Who: newly established energy agencies.*
2. Determining common priorities and actions achievable in all three parts of the ERN. Seminars or regional conferences will be the ideal place for determining common priorities.
   - *Who: ERN Working Groups.*
3. Analyse possibility of common cross-border energy (efficiency) projects.
   - *Who: newly established energy agencies.*
4. Analyse the possibility of funding of common projects or activities through regional, national or EU programmes.
   - *Who: newly established energy agencies, ERN Working Groups, private investors.*
5. Capacity building aimed at local / regional energy policy development, including:
   - Orientation of the general scientific research, and also diploma papers and thesis for concretely planed energy efficiency and CHP projects in the ERN.
   - Knowledge-transfer (dissemination) for planing engineers, financing institutions and potential users.
   - Exchange of full-time students and graduates among universities and their involvement in common projects.
     - *Who: newly established energy agencies, universities in ERN.*

10.3 Co-operation with the EU in energy planning and promoting CHP

10.3.1 Regional implementation of EU policy

From EU energy policy and regulation and specific CHP policy the following possible actions can be derived that could be undertaken at the regional level. Some of these actions, that can be handled better on national /regional level, have already been analysed in previous chapters, namely:

- Local and regional energy planning.
- The development of standard contracts.
- Simplified procedures for building permits and CHP authorisations.
- The application of financial instruments (e.g. soft loans), when available at the administrative level.
- Dissemination of information regarding CHP possibilities, advantages and technological options.

Other activities could have added value when carried out in co-operation between the three national parts of the ERN. These activities are:

- Monitor development of CHP, including the impact of liberalisation and the removal of barriers.
- Encourage negotiated agreements with industry and services (promote EMAS).
- Give priority to CHP based solutions, whenever feasible in public procurement.
- Capacity building in public sector and for relevant private actors.
  - *Implementing organisation: Newly established energy agencies, ERN working groups.*

10.3.2 The impact of EU accession

It is expected that the Czech Republic and Poland will accede to the EU within the period for which the Action Plan is drafted (in the year 2004) and thus a potential impact on the actions proposed must be considered. Differences in the pre- and post-accession period can be in the following fields:

- Regional authority and regulations, e.g. in the CR restructuring of regional authorities is not yet completed.
- Financial instruments, differences in pre- and post-accession funds.
- Institutional framework, some regional institutions can come under the competence of other administrative levels.
- Higher interest for making business in the ERN which will not be the border region for the EU any more.
- Easier access to the information from the EU through becoming eligible for many new programmes of the Commission of the EU.

10.3.3 Recommendations for future co-operation with EU

The access of the Czech Republic and Poland to the EU will open many opportunities for cross-border co-operation within the ERN. But already now several options for cross-border co-operation in the framework of EU programmes are possible:

1. Involvement of regional actors in successor programmes to SAVE/Altener programmes of the Commission of the EU; such projects could be related to:
   - Identification of CHP projects in the region (CHP projects in general or biomass related).
   - Monitoring the impact of liberalisation and/or regional policy on CHP development in the ERN.
2. Setting the presence of the ERN in Brussels through either own representative or through representatives of association of municipalities/regions or association of SAVE Energy Agencies.
3. Involvement in the 6th Framework Programme through projects proposed by universities located in the ERN.

11. BENEFITS OF REGIONAL ENERGY ACTION PLANS

11.1 Environmental impact

Improving energy efficiency by increasing the share of combined heat and power production will substantially contribute to the abatement of several environmental problems related to energy production and supply. Particularly environmental emissions to air will be reduced caused by fossil fuel based energy supply, in particular CO_2, SO_2, NO_x and particulates. The decrease in energy demand will lead to a decrease in emissions. Particularly, in the ERN where energy supply is mainly based on lignite or hard coal, the impact of energy conservation on emissions reduction is high. Emission reduction studies in all three countries have identified energy conservation as one of the main cost-effective options with a large potential. The reduction of these emissions will abate global, regional and local environmental burdens. The environmental impacts of utilisation of the estimated technical CHP potential have been analysed. The results are shown in Table 11.1 and are based on current heat demand, not taking into account future energy demand trends. Given the uncertain economic situation of many industries and other large heat and power consumers, it would be very difficult to give a good estimation of this trend.

Table 11.1 *Estimate of emission reduction potential resulting from realisation of technical CHP potential in the ERN [1000 tons]*

Part of Euro-region	CO_2 [1000 tons]	SO_2 [tons]	NO_x [tons]
Germany	289 - 368	480 - 2 400	248 - 427
Poland	111 - 133	1 080 - 1 600	270 - 319
Czech Republic	380 - 442	1 170 - 2 690	684 - 825

11.2 Economic impact

A number of economic benefits can be identified. First, inefficiency in energy supply and demand leads to high expenditures for domestic energy production and imports. In the future, imports in the Czech Republic, Poland and Germany will increase. Increasing energy efficiency will decrease the expenditures for energy imports and decrease import dependency. Secondly, in industry, the penetration of energy efficient technology is often coupled with production increase. Therefore, energy efficiency and production efficiency will go hand in hand. Increasing energy efficiency in energy-intensive industries will improve competitiveness.

Table 11.2 *Estimate of investment necessary for realisation of technical CHP potentials in the ERN [million EUR]*

Part of Euro-region	Investment [million EUR]
Germany	175 - 558
Poland	19 - 53
Czech Republic	85 - 335

11.3 Social impacts

Energy price

Energy efficiency improvement and the related energy savings have social benefits. First, the share of energy expenditures in household budget in the Czech Republic & Poland is relatively high compared to the EU. Improvement of energy efficiency of power and heat production could reduce the end-consumer prices and thus energy expenditures of households. However,

for every case it should be assessed if new investments in energy infrastructure do not mean additional heat price increase for consumers.

Currently, the cost of heat supplied by district heating systems where the main source is operated in CHP mode reaches in Poland 0.8 Euro/m^2 or 65 Euro per one typical household monthly. These costs make up 13% of the average disposable income of families in Poland. The average price of heat in such systems amounts to 8.5 Euro/GJ. This level of prices is relatively high but still acceptable for inhabitants. Where the heat price and the heat costs are higher, there is need to consider alternatives to the existing heat sources and/or undertaking thermal renovation measures in buildings. From another side the value of 8.5 Euro/GJ should be the target figure for planning CHP plants within existing district heating systems.

Employment

The manufacturing and installation of new efficient technologies will require an extension of existing industry and services in the field of CHP technology and thus tend to creation of new jobs in manufacturing industry and building industry. In addition, when the CHP technology will use local biomass as a source of energy, new jobs will be created in fuel preparation and handling.

12. SUMMARY OF ACTIONS

The table below gives a short, clear overview of the proposed actions for the short- and middle-term (2002 - 2005).

Table 12.1 *Overview of proposed actions*

Category	Action	Stakeholders involved	Term
Financing	1. Establishment of regional EE Funding programme.	Financial Institutions (FI), investors, regional funds.	2002-2003
	2. Preparation for the use of EU funds.	Regional development agencies, FI, public organisations, investors.	2003-2005
	3. Education / training in the field of financial proposals.	Regional development agencies, FI, investors, public organisations.	2002-2003
	4. Promotion of third party financing.	Regional and national energy agencies.	2002-2004
Institutions	1. Establishment of regional energy agencies.	Regional development agencies, Regional administrations, national energy agencies, regional experts, NGO's.	2002-2003
	2. Quicken administrative procedures (building and planning permissions).	Municipal offices, energy agencies.	2002-2003
	3. Include and assess the CHP option in regional and local energy concepts.	Municipalities, districts, regions, regional energy agencies.	2002-2005
Promotion & awareness	1. Organisation of regional CHP conferences.	Regional Development Agencies, Energy Agencies, Universities, Energy consultants, utilities.	2002-2004
	2. Seminars on energy project development and CHP.	Energy Agencies, Universities.	2002-2004
	3. Publication of energy policy guidebook.	Energy Agencies, energy consultants.	2003
	4. Development of system of energy statistics.	Municipalities, energy consultants, utilities.	2003-2005
	5. Energy auditing of public buildings and DH systems.	Municipalities, energy auditors, utilities.	2003-2005
	6. Wider involvement of regional universities in project development and training of experts.	Universities in all 3 parts of ERN.	2002-2005
	7. Involvement of regional NGO's	NGO's, energy agencies.	2002-2005
EU and cross-border actions	1. Co-operation between universities and research institutes.	Universities, ERN office.	2003-2005
	2. Co-operation between regional energy agencies.	Energy Agencies, ERN offices.	2002-2005
	3. Analyse possibility of cross-border energy projects.	Energy Agencies, ERN offices, energy consultants.	2004-2005
	4. Common involvement in EU energy programmes.	Energy Agencies, ERN offices, universities.	2003-2005

APPENDIX A LIST OF INFORMATION SOURCES

Table A.2 *CHP related web sites*

EU web pages:	
http://europa.eu.int/comm/dgs/energy_transport/index.html	Directorate General for energy and Transport (DG TREN).
http://europa.eu.int/comm/energy/en/fa_2_en.html	DG TREN - Energy Demand Management.
http://europa.eu.int/comm/energy_transport/en/public.html	DG TREN publications.
http://tecs.energyprojects.net/	The page informing about findings of the future Cogen project finished within SAVE programme 2000.
http://www.bkwk.de/ - in German	Bundesverband Kraft-Warme Kopplung e.V. (B. KWK).
http://www.caddet-ee.org	Global information site on energy saving technologies.
http://www.cogen.org/ and http://www.cogen.org/projects/educogen.htm	The European trade organisation for the promotion of cogeneration. The website includes latest news, publications (some free of charge) on cogeneration in Europe.
http://www.energy-efficiency.gov.uk/	Link to CHP Good Practise Case studies
http://www.euroheat.org/ and http://www.chp-info.org/	The international organisation for district heating, district cooling and combined heat and power generation.
http://www.euro-region-nisa.cz/en/main.html	The official ERN website.
http://www.gmp.uk.com/wipoverview.htm	World-wide Independent Power - Promoting on-site power and cogeneration.
http://www.iea.org	The International Energy Agency.
http://www.jxj.com/magsandj/cospp/index.html	COSSP - Cogeneration and online power production - Online magazine.
http://www.localpower.org/	World Alliance for Decentralised Energy.
http://www.srci.cz/nisa/nisa_en.html in Czech and English	Official Euroregion project web-site.
Other CHP web sites (English language):	
Other CHP web sites (non-English):	

Table A.3 *Overview of SAVE II projects in the field of CHP promotion and development*

Year (Contract N°)	PROPOSERS	Country (of Co-ordinator)	TITLE	SECTOR
2000 (2)	Hellenic Industrial Development Bank S.A./ Slovak Energy Agency.	Greece	'Penetrating the small scale CHP market using alternative financing mechanisms' and 'Promoting CHP in the framework of East-West Energy Partnership (PROCHP)'.	CHP, TPF
2000 (8)	MARCH Consulting Group.	United Kingdom	Extension of ESCOs TPF involvement in Public Sector CHP and in DH schemes in the Czech and Slovak Republics.	TPF, CHP
2000 (23)	ECD Energy and Environment.	United Kingdom	MICRO MAP Mini and Micro CHP - Market Assessment and development plan.	CHP
2000 (27)	CEREN/ ECN.	The Netherlands	CHP statistics and impacts of the Gas Directive on the future development in Europe.	CHP
1999 (115)	INESTENE.	France	The promotion of small scale cogeneration in rural areas.	CHP
1999 (159)	Cogen Europe - European Association for the Promotion of Cogeneration.	Belgium	Educogen.	CHP
1999 (085NL)	ECN.	The Netherlands	Analysis of obstacles to CHP implementation in the Czech and Slovak Republics.	CHP
1999 (169UK)	ESD.	United Kingdom	The future of the CHP in the European market.	CHP
1999 (Z-021)	CRES - Centre for Renewable Energy Sources.	Greece	Guide for the training of engineers in the combined heat and power related issues.	CHP
1999 (Z-063)	AI- Ambiente Italia srl, instito di Ricerche.	Italy	Micro-cogen-risks and chances for small scale CHP in the liberalized energy market.	CHP
1999 (Z-092)	Finnish District Heating Association.	Finland	CHP - Web site - promotion of combined heat and power and district heating and cooling by making and disseminating a CHP Web site.	CHP

A.1 Other literature

- Cogen Europe, *European Cogeneration review 1999*, Cogen Europe, Brussels, July 1999.
- Educogen - An educational tool for cogeneration, second edition (2001), the key document of the Educogen project. (*Comprehensive explanation of cogeneration principles, technologies, applications, economies etc. - 176 p.)* - downloadable from www.cogen.org.
- A Guide to Cogeneration (2001) - This guide is designed to explain the principles and applications of cogeneration and to help policymakers and other professionals understand this technology - downloadable from www.cogen.org.
- Risks and Chances for small-scale heat and power in the liberalised power market (downloadable from http://www.ambienteitalia.it/Cogen%20eng.htm).
- The Future of CHP in the European Market - The European Cogeneration Study (2001) - downloadable from www.cogen.org. (This study describes the current status, future markets, conditions and scenarios for cogeneration in 28 European Countries).
- Barriers to Combined heat and power production in the Czech and Slovak Republics, ECN November 2000 (downloadable from http://www.ecn.nl/library/reports/2000/c00042.html) Publication includes two Action Plans (Czech Republic & Slovak Republic up to 2010).

APPENDIX B OVERVIEW OF ENERGY SUPPLY SITUATION IN THE ERN

The overview below gives a schematic overview of the energy supply situation in general and the role of CHP in specific. Furthermore, it provides a schematic summary of existing CHP and energy policies and recommendations for improvement from the CHP Action Plan for the ERN.

Topic	Germany	Poland	Czech Republic
Energy supply national/regional situation.	Sufficient local sources, competition, 8 municipal distributors.	No competition yet, net export of energy, ongoing gasification.	No competition yet, 2 partly privatised distributors, net import of energy, ongoing gasification.
Role of DH.	Extensive DH networks.	Extensive DH networks in cities.	Extensive DH networks in cities.
Role of CHP.	Past growth, mostly small CHP plants, currently no new projects.	High in large DH systems, not very developed in medium in microscale.	1 large and 1 medium sized public CHP, many small and medium (industry) CHP.
Future plans.	Rehabilitation, growth of small-scale CHP (< 2 MW).	Rehabilitation of DH, new CHP.	No plans, some ideas.
CHP policy.	Exists, driven by GHG emission reduction.	Long-term option.	No clear targets.
Legal framework.	CHP upgrade law, certificates, energy market.	Some privileges for power purchase from CHP.	No specific CHP legislation, some privileges for power purchase from CHP.
Energy market.	1998 Energy Law.	1997 Energy Act.	2001 Energy Act.
Energy efficiency.	Energy tax, RES priority law, CHP Modernisation Law.	Act on Thermo-modernisation.	Energy Management Act and Decrees.
Environment protection.	Emission Act, TA luft.	Environment Protection Act.	Clean Air Act.
Regulatory framework.	Avoided cost formula.	Justified cost formula.	Avoided cost formula.
Institutional Framework.	Federal level.	National Energy Regulatory Authority.	National Energy Regulatory Office.
Role of regions/municipalities.	Energy planning of municipal distributors.	Energy Planning and Investment programme - municipal level.	Obligatory regional energy planning, tentative municipal energy planning.
Barriers.	Many.	Many.	Many.

Topic	Germany	Poland	Czech Republic
Policy framework.	Support to only existing and small-sized CHP installations.	CHP is long-term option.	Missing, CHP is a long-term option.
Regulatory framework.	Only for existing CHP and new CHP < 2 MW.	Only for large CHP.	2 licences, authorisation.
Institutional framework.	Regional Energy Agency is missing.	Regional Energy Agency is missing.	Regional Energy Agency is missing.
Pricing, tariffs, taxation.	Improved recently through CHP Modernisation Law.	Not clear yet, new ordinance expected.	Minimal feed-in tariff set since 2002, but low tariffs.
Financing.	Missing financing of CHP.	Limited support to some projects (Environmental fund, GEF).	Limited support to some projects - grant, soft loans (CEA, SEF).
Market conditions.	Need for reduction CHP technology price to be competitive.	Low pay-back tariffs, no clear future, temporary power system overcapacity.	Low feed-in tariffs, no clear future, long-term power system overcapacity.
Knowledge, awareness.	Knowledge missing in public and service sector.	Knowledge missing in public and service sector.	Knowledge missing in public and service sector.
Conclusions.	Support to CHP is necessary.	Support to CHP is necessary.	The role of CHP is underestimated.
Recommendations.	Information, promotion, pricing and tariffs, investment subsidies, regional energy policy development.	Organisation of seminars, fairs, site visits in existing facilities, energy plans, pricing and tariffs.	Analyse the role of CHP and DH in regional plans, pre-feasibility and feasibility studies, awareness campaign.