A thesis submitted to the Department of Environmental Sciences and Policy of Central European University in partial fulfillment of the Degree of Master of Science

Opportunities and Barriers in the Introduction and Implementation of the Cleaner Production Concept in Georgia

Mikheil Tushishvili

July, 2008

Budapest

Notes on copyright and the ownership of intellectual property rights:

(3) For bibliographic and reference purposes this thesis should be referred to as:

Tushishvili, M. 2008. *Opportunities and Barriers in the Introduction and Implementation of the Cleaner Production Concept in Georgia.* Master of Science thesis, Department of Environmental Sciences and Policy, Central European University, Budapest.

Further information on the conditions under which disclosures and exploitation may take place is available from the Head of the Department of Environmental Sciences and Policy, Central European University.

Author's declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning

Mikheil Tushishvili

THE CENTRAL EUROPEAN UNIVERSITY

ABSTRACT OF THESIS submitted by:
Mikheil TUSHISHVILI
For the degree of Master of Science and entitled: Opportunities and Barriers in the Introduction and Implementation of the Cleaner Production Concept in Georgia

Month and Year of submission: July, 2008.

Cleaner Production (CP) is a concept which aims to encourage industries and consumers to adopt sustainable environmental practices. It has been demonstrated worldwide that CP projects are extremely successful in terms of the integration of economic, financial and environmental benefits. In Georgia, the industrial sector has a unique opportunity to gain large benefits from the implementation of CP because of the current transition of the country towards the market oriented economy. However, activities in the area of CP have not been very promising so far and, consequently, the aim of the present thesis is to evaluate current opportunities and barriers in the introduction and implementation of the CP concept and determine particular actions needed to overcome existing barriers. Moreover, the present thesis examines the legislative framework, policy options, the institutional structure as well as economic and financial instruments conforming to the market and informational/educational tools necessary for adoption of the CP concept at the national level.

The research is mainly based on the literature review and interviews with various stakeholders. The study reveals that the implementation of the CP concept requires building institutional capacity of the country to facilitate partnership between the government and the private sector. Regulatory and economic instruments which can help boosting the implementation of CP measures are identified. Furthermore, according to the research, demonstration projects are good tools if they have been scaled up. The research shows that opportunities to incorporate best practices of CP in the implementation of Multilateral Environmental Agreements (MEAs) should be certainly further studied. Also, the need for formation of appropriate professional capacity on CP through vocational schools, training centers, and universities is evaluated and outcomes are presented. The research reveals that it is also necessary to raise general awareness of consumers and the entire public in order to expand political support for the adoption and promotion of CP principles in Georgia. Findings of the present research will contribute to the advancement of industrial operations, decrease in environmental risks and development of the framework for introduction of new and clean technologies in Georgia.

Keywords: Cleaner Production, Georgia, environmental protection, industrial sector

Acknowledgments

First of all, I would like to thank my supervisor Dr. Tamara Steger for her continuous invaluable support and kindness. It was a great privilege to work with her for this master thesis.

Second, I am most grateful to interviewees for providing me with important data which has been a backbone for my thesis. In this regard, I wish to express my special sincere gratitude to the staff of the Ministry of Environment Protection and Natural Resources of Georgia for their great assistance particularly Ms. Nino Tkhilava, who was extremely helpful in guiding me during the research trip in Tbilisi.

I would also like to acknowledge the kind assistance of representatives of the non-governmental sector of Georgia for their extremely valuable ideas and comments. There were many experts who gave important advices and valuable suggestions, for which I sincerely thank them.

Third, I am grateful to the members of the Environmental Science and Policy Department for the friendly atmosphere particularly Ms. Irina Herczeg for her kind support and practical advices.

Finally, this thesis could not have been developed without assistance, understanding and encouragement of my family and friends. Thank you very much!

This thesis is dedicated to

MY MOTHER

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ADB -	Asian Development Bank
ANZECC -	Australia and New Zealand Environment and Conservation Council
BAT-	Best Available Techniques
CBA-	Cost Benefit Analysis
CDM-	Clean Development Mechanism
CP -	Cleaner Production
DEPA-	Danish Environmental Protection Agency
DFES-	Debt-For-Environment Swap
EE-	Energy Efficiency
EIA-	Environmental Impact Assessment
EMS-	Environmental Management Systems
EPR-	Extended Producer Responsibility
EU-	European Union
GEF-	Global Environmental Facility
GEGI-	Georgian Enterprise Growth Initiative
GEL-	Georgian Lari
GEPLAC-	Georgian-European Policy and Legal Advice Centre
GDP-	Gross Domestic Product
IIED-	International Institute for Environment and Development
IMF-	International Monetary Fund
IPPC-	Integrated Pollution Prevention and Control
ISO-	International Organization for Standardization
IUCN-	International Union for the Conservation of Nature and Natural Resources
JSC-	Joint Stock Company
LLC-	Limited Liability Company
LRTAP-	Convention on Long-range Transboundary Air Pollution
LTD-	Limited Company
MEA-	Multilateral Environmental Agreement
MENRP-	Ministry of Environmental Protection and Natural Resources
MOU-	Memorandum of Understanding
NCPC -	National Cleaner Production Center
NEAP-	National Environmental Action Plan
NGO-	Non Government Organization
NIS-	Newly Independent States
OAN-	Ozone Action Newsletter
OECD -	Organization for Economic Co-operation and Development
POPs-	Persistent Organic Pollutants
REC-	Regional Environmental Centre
PRTR-	Pollutant Release Transfer Register
SIDA-	Swedish International Development Cooperation Agency
SME-	Small and Medium Size Enterprises
TACIS-	Technical Assistance to the Commonwealth of Independent States
UK-	The United Kingdom of Great Britain and Northern Ireland
UN-	United Nations
UNCHS-	United Nations Centre for Human Settlements (Habitat)
UNCTAD-	United Nations Conference on Trade and Development
UNIDO -	United Nations Industrial Development Organization
UNECE-	United Nations Economic Commission for Europe

UNEP -	United Nations Environmental Programme
UNEP DTIE-	United Nations Environmental Programme Division on Technologies, Industry and Economy
USAID -	United States Agency for International Development
USEPA-	United States Environmental Protection Agency
USSR-	Union of Soviet Socialist Republics
VAT-	Value Added Tax
WWF-	World Wide Fund

1. Introduction

Cleaner Production (CP) has been recognized as one of the successful tools for improvement of the industrial sector's production efficiency and for considerable reduction of risks to the human and the environment. Moreover, CP approaches are acknowledged worldwide as essential instruments for the sustainable development of countries through maintaining high rates of economic growth, expanding environmental protection activities and, as a fundamental point, achieving social equity (Hicks and Dietmar 2007). The CP concept has been adopted by various industrial sectors in many countries and excellent results have been achieved so far through even minor improvements in the production processes (Sikdar and Diwekar 1999).

In Georgia, the industrial sector has a unique opportunity to gain large benefits from the implementation of CP because of the current transition of the country towards the market oriented economy. The initial investment cost can be relatively small in comparison with improved profitability of enterprises and their environmental performance. The industrial sector can achieve a substantial decrease in the operational cost because of the implementation of CP principles which resulted in reduced use of raw materials, energy efficiency, waste minimization and some other benefits (ADB 2002).

However, activities in the area of CP have not been very promising so far in Georgia and, consequently, the basic capacity level has not been yet established which is necessary for its successful implementation. Therefore, the present research will examine possibilities of the implementation of CP approaches in an attempt to reveal economic, financial and environmental benefits arising from application of the CP concept. Furthermore, a focus of the research is to examine the legislative framework, policy options, the institutional structure as well as economic/financial instruments conforming to the market and informational/educational tools for overcoming existing barriers in the adoption of CP. These findings will contribute to the advancement of industrial operations, decrease in environmental risks and development of the framework for introduction of new and clean technologies in the country.

1.1. Aims and Objectives

The aim of the present thesis is to investigate current opportunities and barriers in the introduction and implementation of the CP concept in Georgia and determine particular actions needed to overcome existing barriers at the national level.

The objectives are to:

- Identify policy options and regulatory, economic, financial, and informative/educational instruments for overcoming existing barriers in the introduction and implementation of CP in Georgia.
- Analyze current opportunities, existing motivations and major obstacles facing the industrial sector in promotion of new and clean technologies in Georgia.
- Evaluate the institutional capacity of the country in order to strengthen partnership between the government and private sector to implement the CP concept in Georgia.
- Analyze the role of demonstration projects in this field and identify potential positive benefits and/or shortcomings in further adoption of CP.
- Investigate what actions can be taken in order to introduce and promote the CP concept through various Multilateral Environment Agreements (MEAs) or international programmes in close cooperation and assistance of donor organizations.
- Conduct interviews with representatives of governmental authorities, private sector, scientific institutions, NGOs and independent experts to examine short and medium term factors which can have an influence on the success or failure in the adoption of CP.
- Produce a number of recommendations on the adoption of CP in Georgia considering specific conditions of the transition country.

1.2. Thesis structure

Following the introductory part, Chapter 2 describes the research design and methodology used for achieving the multiple objectives of the thesis. Qualitative study was used as the main method for the research. The data was collected through face-to-face semi-structured

interviews with a range of stakeholders as well as the literature review and evaluation of environmental legislation framework relating to the CP concept.

Chapter 3 provides analysis of the various existing literatures concerning the CP concept and benefits arising from its application. This section focuses on various policy instruments and opportunities to promote CP activities as well as categorizes existing barriers in the introduction and implementation of CP approaches. Furthermore, institutional mechanisms to facilitate rapid and efficient implementation of CP will be discussed and presented. The focus is then shifted towards evaluation of the role of demonstration projects in this field and possibilities to incorporate CP activities throughout implementation of Multilateral Environmental Agreements (MEAs).

Chapter 4 gives an outline of the industrial sector in Georgia starting from its roots of small scale manufacturing to giant soviet industrialization and, afterward, shifting towards market economy. This section will provide an overview of general economical trends and dynamics of the industrial sectors' operations in connection with large enterprises of Georgia. Moreover, the environmental performance of the industry will be analyzed pertaining to the release of pollutants into the atmospheric air and water. Additionally, the essential role of other key stakeholders in the introduction and implementation of CP policy and strategies is also briefly outlined. Lastly, first attempts to introduce CP approaches in Georgia through international organizations are presented and discussed.

Chapter 5 presents the research findings which are conceptualized and categorized consistently with the framework outlined in the literature review. Also, the discussion chapter has elaborated the current situation on CP policy practices in Georgia taking into account interviewees' views and perspectives.

The final chapters of the thesis present important recommendations and conclusions designed for various stakeholders in support of shifting to the better environmental performance of the industrial sector through the CP concept and approaches.

2. Methodology

This chapter describes the research design and methodology used for achieving the multiple objectives of the thesis. The main method used in this research is a form of the qualitative study and the tasks were accomplished through literature review and evaluation of legislation framework as well as face-to face interviews.

2.1. Data collection

2.1.1. Literature review

As it is known, the evaluation of the related literature builds a logical framework for the study (Marshall and Rossman 2006) and shows that the researcher is aware of how the issue has been studied before and he/she has views about known and even unknown problems of the study (Sandelowski and Barroso 2006). The review of the existing literature assists to collect the relevant information, opinions and findings of various authors about current opportunities and barriers in the introduction and implementation of the Cleaner Production (CP) concept in Georgia. Therefore, in this thesis, the literature review includes evaluation of various materials such as reports, books, journal articles, theoretical studies, case studies, strategies and action plans. On-line electronic resources also were used mainly from international organizations: UN, UNEP, UNIDO, World Bank etc. Furthermore, particular consideration was given to the literature in relation to the implementation of the CP approaches in the transitional countries. It is worth mentioning that the literature collected and analyzed was generally in English, though, some of materials especially in connection with the performance of the industrial sector were gathered in Georgian and later translated into English.

Moreover, the industrial sector was described on the bases of the data obtained from the materials and reports provided by the Integrated Environmental Management Department of the Ministry of Environment Protection and Natural Resources of Georgia (MEPNR). The Memorandums signed between the MEPNR and the concerned enterprises were also considered and analyzed. Additionally, the national legislation framework regarding the performance of the industrial sector and CP was also reviewed. A number of legislation acts, decrees, government and ministerial orders were reviewed in order to see how the various issues relating to CP implementation are integrated into the policy agenda of the state.

2.1.2. Interviews

One of the main methods used for the research was interviews. Cassell and Symon (2004) highlight four types of interviews in a qualitative research: depth, exploratory, semi-structured and un-structured. In this thesis, a semi-structured interview type was mainly carried out throughout the research activities in Georgia. In the semi-structured interviews, key questions are asked in the same way each time (Ritchie and Lewis 2003) and, accordingly, information collected is generally comprehensive and rich (Becker and Bryman 2004). The interviews were mainly conducted in the capital of Georgia - Tbilisi. A number of interviews especially with representatives of enterprises were also held by telephone.

The sampling for interviews was conducted purposefully taking into account the significance of selecting "information rich" cases from which we can learn regarding the issues of concern to the study (Taylor Powell 1998). It should be pointed out that 20 personal face-to-face semi-structured interviews were conducted with government officials, representatives of the industrial sector, scientists, and Non Governmental Organizations (NGOs) employees in order to have a multiple vision on the opportunities and barriers in the introduction and promotion of CP approaches in Georgia. Moreover, the goal was to acquire the latest information relating to possibilities for the establishment of national CP capacities in Georgia.

Taking into consideration the scope of the research, first, experts were selected from the Integrated Environmental Management Department of the MEPNR who are closely working with the industrial sector. Second, as the research covered only large enterprises, in view of the share of emissions within the sector, respondents were selected from this type of companies. Mostly interviewees from the industrial sector were the officers responsible for environmental performance of the company. Third, representatives from environmental NGOs were chosen for interviews taking into consideration the fundamental role of the organization in promotion of "cleaner" technologies within the industrial sector and active participation in the decision making process related to this field. Lastly, a number of interviewees were also selected from different institutions such as UNDP Georgia, Tbilisi Free University and various UN projects as well as several independent experts were interviewed taking into account their credibility, knowledge and experience. The full list of respondents is attached to this research (Annex 1).

Various semi-structured interview questions were prepared for different interviewees with the aim of the evaluation of current opportunities and challenges of the industrial sector in the introduction and promotion of the CP Concept in Georgia. The questions used in the semi-structured interviews are attached to the present work (Annex 2).

In most cases, a tape recorder was used to support later the data analysis. In other cases, field notes were taken in order to retain core findings and thoughts for the data analysis. It is important to emphasize that in some cases anonymity was a precondition in order to enable the open dialogue between the researcher and respondents.

2.2. Analysis methods

In a qualitative analysis, "data collection and analysis typically go hand in hand to build a coherent interpretation" (Marshall and Rossman). The analysis under this research was performed according to three steps of activities defined by Miles and Huberman (1994):

- Data reduction
- Data display
- Conclusion drawing/verification

Data reduction represents "the process of selecting, focusing, simplifying, abstracting, and transforming the data". At this stage, the decision was taken concerning the decrease of the chunk data and selection of the appropriate one for the present research (Silvermann 2000).
Data display is "an organized, compressed assembly of information that permits conclusion drawing and action" (Miles and Huberman 1994). At this step, the data is displayed in the forms of tables, networks, graphs, and charts etc. which help clarifying the main directions of analysis (Silvermann 2000).
Conclusion drawing/verification specifies "the beginning to decide what things mean" (Miles and Huberman 1994). Therefore, at this stage the data was interpreted and conclusions were drawn. The verification of data also was performed through re-evaluation of the field notes and presenting the data analysis to a number of stakeholders.

2.3. Problems and limitations

A number of limitations were encountered while conducting the present research. First, the important issue is that possibilities for the introduction and implementation of the CP have never been studied in Georgia. Therefore, the literature is extremely scarce and there are only a few experts directly working in this field.

Second, one of the shortcomings is that only large enterprises were selected for the current research. Representatives of small and medium size enterprises were not interviewed due to the lack of time and financial resources in gathering more data.

Third, the legislation framework was difficult to analyze in view of the fact that many of related legal acts were recently drafted and have not yet been approved. The legislation system in this field is under permanent changes and modifications.

Lastly, this research does not go into technical details concerning CP implementation in the particular industrial sector. More extensive research is needed to determine the full effects of the CP application on each specific industrial sector of Georgia.

3. Current status of Cleaner Production activities and recent trends in its development and application

The thorough literature review has been carried out taking into consideration the aim and objectives of the present research. The Cleaner Production (CP) concept has been outlined from various sides namely possible CP benefits, policy instruments to promote CP activities, existing barriers in the introduction and implementation of CP approaches, different stakeholders' involvement in the implementation of CP, the role of the National Cleaner Production Centers and demonstration projects, and opportunities to incorporate Cleaner Production activities through implementation of Multilateral Environmental Agreements (MEAs).

3.1. Cleaner Production Concept and benefits from its application

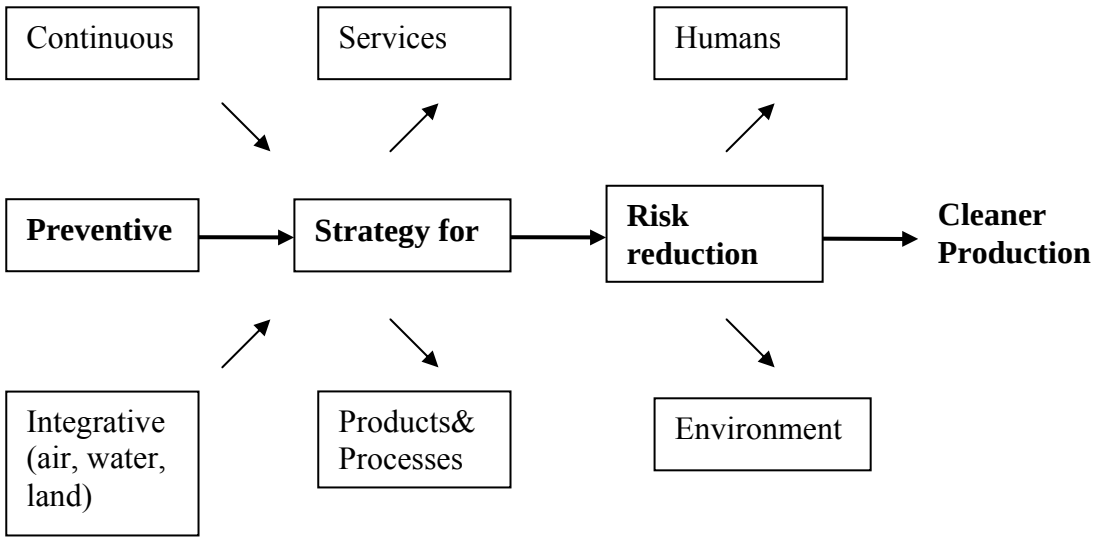
The term "Cleaner production" (CP) was introduced in the late 80th through initiatives of the Industry and Environmental Unit of United Nations Environmental Programme (UNEP) (Ayres and Ayres 2002). Professionals across the world use the most common definition of CP which is formulated by UNEP - "*Cleaner production is the continuous application of an integrated preventive environmental strategy applied to processes, products, and services to increase overall efficiency and reduce risks to humans and the environment*" (ADB 2002). The definition of CP is based on the theory that there are no production processes in practice without environmental impact and some forms of pollution (UNEP 1996). Therefore, the CP approach is to continuously diminish the generation of pollution and improve environmental performance of the industrial processes and product systems (Ayres and Ayres 2002).

The CP approach includes the following aspects:

- for production processes - conservation of raw materials and energy as well as abolition of raw toxic materials and reduction of quantity/toxicity of all emissions and wastes before they leave a process (OECD 1995);
- for products – reduction of impacts along the entire life cycle, from raw material extraction to its final disposal (UNEP 1996);
- for services - incorporation of environmental concerns into designing and delivering services (ADB 2002).

The crucial elements of CP approaches can be demonstrated through the following chart (Figure 1):

Figure 1. Definition of CP



Source: Jørgensen (1999)

Precautionary principle, preventive and integrated/holistic approaches are considered as key principles that provide the basis for CP (ANZECC 1998).

First, the primary importance of the precautionary principle is that there should be actions to mitigate possible causes of environmental pollution prior to the scientific evidence about actual effects (Ayres and Ayres 2002). Therefore, the precautionary principle has been applied to the system-wide transformation towards CP through streamlining the production methods to cover all phases of products' life cycle and averting the use of hazardous substances and generation of waste (Page and Proops 2003).

Second, the principle of prevention gives emphasis to the production process which should be driven by a focus on prevention rather than just on control and remediation (Stellman 1998). ANZECC (1998) highlights that it is much more economically feasible and extremely effective to prevent environmental damage then put efforts on management of generated pollution. The CP approach reduces emissions and waste while end-of-pipe technologies only control them (Van Dijken *et al.* 1998). End-of-pipe management which was used for many

years by enterprises to fix emissions was altered by preventive approaches considering minimization of emissions at the source.

Third, CP attempts to promote a holistic approach to environmental protection. Traditional end-of-pipe management individually addresses the specific environmental media problems of air, water and land (Ayres and Ayres 2002). Therefore, many countries accept a new holistic approach to the environmental resource use to address all media problems through an integrated approach (ANZECC 1998). For that reason, this approach creates conditions for regular avoidance of waste and pollutants, which considerably increases the production efficiency and improves product quality (Jørgensen 1999).

Incorporation of all these principles and the establishment of a National CP system is an important condition for successful implementation of CP approaches. The basic steps can be illustrated as follows (Figure 2):

Figure 2. Actions for the establishment of the National CP system

Formulation of National Policy → Development of CP programme → Strengthening of voluntary initiatives → Development of institutional capacity (CP centers) → Development of incentives → Creation of capabilities → Transferring of information concerning existing solutions → Development of regional capabilities within the country → Monitoring of the process Evaluation → Generalized dissemination of CP principles

Source: Adapted from Luken and Hesp (2004)

The national CP system is considered as the initial step for the establishment of fundamental mechanisms for CP processes at the national level (USEPA 1998). However, the most important question is why the industrial sector should introduce and invest in CP? The answer is that CP is considered to achieve both economic benefits for companies and improvements in environmental performance of enterprises (UNCHS 2001). A number of reasons to invest in CP are summarized in the table bellow:

Table 1. Benefits arising from CP application

Reasons	Actions
Economic benefits: reduction of operating costs	- Savings in raw materials and energy - Reduced costs of end-of-pipe solutions - Savings from waste minimization - Savings from the cost of environmental degradation by the enterprise - Increase in competitiveness and export opportunities - Efficiency actions: production scheduling and equipment maintenance - Improved competitiveness through the use of new and cleaner technologies
Reducing environmental degradation	- Improvements in air quality as a result of the reduction of pollutants emitted into the air - Improvements in water quality as a result of the reduction of pollutants discharged into the water - Conservation of land from the contamination which may potentially leak from waste generation, transportation, storage, and disposal activities - Conserving endangered species
Improving the quality of life	- Better health, safety and morale of employees - Improved safe and healthy conditions for communities and consumers
Other benefits	- Reduced liability connected with the treatment, storage and disposal of hazardous wastes - Reduced concerns over environmental legislation - Helping the industrial sector to comply with EMS and facilitates ISO 14000 certification

Source: USEPA 1998, Maheshwari 1997, Ashton et al. 2002, UNEP DTIE 2002, UNEP DTIE and DEPA 2000.

CP is understood as the approach requiring continuous improvement not only in efficiency and material substitution through technology innovations but also policies and managerial skills (ANZECC 1998). The successful introduction and implementation of CP can lead to economic, environmental and social benefits, if a good environmental management system exists (Agardy and Nemerow 2005). Many authors put emphasis on the importance of the introduction and implementation of Environmental Management Systems (EMS) and ISO standards in view of CP implementation.

In this regard, EMS can be described as the framework for enterprises to manage environmental impacts of their operations. Consequently, EMS allows a company to value and track its environmental performance (World Bank Group *et al.* 1999). Furthermore, EMS helps a company to establish new management structure and develop an action plan for

operational improvements. It also can bring CP approaches into the company's policy, management and day-to-day operations (UNEP DTIE and DEPA 2000).

It is also worth mentioning that a series of basic standards have been initiated by the International Organization for Standardization (ISO) in order to standardize the application of EMS. The best known are ISO 1400 series which represent series of voluntary standards for different components of environmental management. ISO standards are significant tools for providing a strategy and methodology for environmental improvements if they are correctly applied. The standards require that companies have environmental policy in place that includes commitments to cleaner production and compliance with relevant environmental regulations. The major impact of the implementation of EMS and ISO can be the identification of possibilities to implement waste minimization and a CP programme which have direct economic savings and environmental benefits (World Bank Group *et al.* 1999).

3.2. Policy instruments and opportunities to promote Cleaner Production activities at the national level

The establishment of an appropriate environmental policy framework provides a base for the introduction and implementation of CP program at the national level. There is a lot of literature produced with regard to the existing policy instruments.

UNEP DTIE (2000), Hillary (2000) and World Bank Group *et al.* (1999) emphasize that there are a range of policy tools such as regulatory and economic instruments as well as voluntary agreements and informational/educational tools which can be introduced and implemented by governments for the promotion of CP and catalyzing the industry commitment. Generally, two main approaches for the promotion of such instruments are distinguished. First, the "command-and-control" method toward environmental policy can be used which integrates efforts to introduce a legislation system with requirements to comply with specific standards. Second, market-based-approaches (taxes, fees, tradable permits etc) can also be applied through the economy rather than legislative measures (USEPA 1998).

The research reveals that both approaches are very promising in the adoption of clean technologies. The exclusive use of "command-and-control" approach is considered as

ineffective for achieving environmental performance improvements in the industrial sector since enterprises are not provided continuous incentives to make progress in their performance (IIED 1992). At the same time, market-based-incentives do not substitute the regulatory approach especially for "point" sources of pollution such as manufacturing facilities. Only within the regulatory setting can this approach expand cost effectiveness generated from CP approaches within the industrial sector (OECD 1995).

The various policy tools available for decision makers for the promotion of CP strategies are summarized in table 2.

Table 2. Policy instruments for promotion of CP approaches

Type of policy instruments	Examples of policy tools
1. Regulatory	- Air emission and water discharge standards - Ban of some substances, products and/or technologies - Special conditions for obtaining a license/permit - Environmental Impact Assessment (EIA) - Extended Producer Responsibility (EPR) - Negotiated compliance
2. Financial or Market-Based	- Taxes, duties, and fees (exemption or reduction) - Soft and revolving loans for the industrial sector - Subsidies (elimination of destructive financial backing) - Environmental charges/taxes - Marketable permits - Grant and some types of subsidies for CP implementation - Financial liability - Green public procurement programmes
3. Informational and Educational	- Eco-labeling - Demonstration projects - Dissemination of the best industry practices - Information clearinghouses and networks - Inclusion of CP in curricula of higher education system and professional schools - Establishment of training facilities - Public recognition and awards - System on Pollutant Release and Transfer Registries (PRTR) - Environmental reporting - Corporate environmental performance ratings
4. Voluntary programmes	- Voluntary agreements between government and enterprises - Industry codes of practice - Eco-audits - Public voluntary programs for acknowledgment - Environmental Management Systems (EMS) - Life-cycle assessment

Source: ADB 2002, ANZECC 1998, Lindhqvist 2001, Mickwitz et al. 2008, and UNEP 2008a

In many industrial countries, all four types of policy instruments have been applied to promote CP. First, countries have developed and introduced regulations to control air emissions and water and land discharges. The legislative framework is considered as a base for building environmental quality (ADB 2002). Second, economic instruments have been initiated in order to encourage the industrial sector to introduce new and cleaner technologies. Lastly, informational, educational and communicational assistance has been provided for a range of stakeholders for supporting CP activities (Jorgensen 1999).

It is important to mention that policy tools are not used in isolation. Regulatory instruments are often linked with penalties for non-compliance, economic instruments require a legal framework, and information, education and communication are considered as essential supportive tools for the implementation of CP (Lindhqvist 2001). Furthermore, it should be highlighted that not all policy instruments are suitable in all cultures and some of them can be inappropriate in a particular economy or at some point of time in the economic development of the state. Therefore, each tool should be carefully evaluated and selected before its application at the national level (ADB 2002). Lindhqvist (2001) emphasizes that there are still lots of opportunities for policy interventions in the field of implementation of CP approaches since this area in generally immature in many countries. In this regard, the present study will look at various policy tools which can be appropriately used for the promotion of CP methods in Georgia.

The above described policy instruments can also be grouped according to the nature of the interaction between government and industry taking into consideration the level of obligation of the policy instrument (ADB 2002):

- Specified compliance - the government requires the regulated party to implement specific and obligatory standards;
- Negotiated compliance - regulators (government authorities) and regulated parties cooperate to set standards;
- Co-regulation – high level of interaction and cooperation between regulators (government authorities) and regulated parties, but the agreed standards are not mandatory;
- Self-regulation – the industrial sector sets a number of standards that are not legally enforceable (Ashton et al. 2002 and ADB 2002).

In order to implement these measures, it is necessary to integrate CP policy into the wide policy agenda of the state through planning processes as well as to ensure mainstreaming of public policy for CP (ADB 2002).

In addition, one of the important issues for introduction and implementation of CP policy is the monitoring system and reporting format in place since any kind of improvement to any practice needs to have an established baseline and framework for monitoring and quality assurance. It is important to highlight that the application of policy tools would not be result oriented if there were no indicators for improvement or degradation (UNEP DTIE 2001). Therefore, the established monitoring system should be considered as the support format for the decision-making process regarding CP introduction and implementation (Sikdar *et al.* 2004).

3.3. Existing barriers in the introduction and implementation of Cleaner Production approaches

As it has been illustrated, the application of Cleaner Production (CP) approaches can bring to enterprises substantial economic benefits as well as significant improvements in environmental performance. However, there is a common view that the integration of CP activities into companies' day-to-day management is a very difficult task especially in developing countries and countries with economies in transition (ADB 2002). Therefore, it is essential to review a number of existing barriers which can hinder involvement of the industrial sector in more efficient practices.

The literature outlining existing barriers to implementation of CP is quite diverse and abundant. Authors distinguish different types of barriers for CP investments which can be grouped into five broad categories: regulatory, economic/financial, technological, institutional/organizational and informational/educational (USEPA 1998) and (Mitchell 2006).

Regulatory barriers

According to ANZECC (1998) assessment, regulations should be designed to provide incentives to enterprises for quick adoption of cleaner technologies. Lindhqvist (2001) suggests that the regulatory framework indicates what various stakeholders are permitted to do, or not to do and how certain activities should be carried out. In this regard, UNEP DTIE (2000) points out that CP is not economically attractive for the country if the national environmental regulations are weak and ineffective. Furthermore, Ashton *et al.* (2002) emphasize that sometimes regulations can be in place but lack of enforcement activities deterring the regulatory intentions. In many countries, weak enforcement can be explained because of the shortage of required resources for enforcement or unwillingness of government authorities to deal with powerful enterprises (ADB 2002).

One of the existing common barriers for CP implementation is legislative requirements which are usually media-specific rather than integrated covering the overall impact of the enterprise (ADB 2002). Therefore, the modification of legal requirements into an integrated method can be very helpful to shift from the end-of-pipe management to CP approaches. Moreover, ANZECC (1998) illustrate that CP can be encouraged through the special requirements set in the legislation when environmental impact reports and other forms of assessments to be performed before industrial development. These types of requirements give the industrial sector incentives to introduce new and clean technologies at an early stage of the development and operation.

There are a number of significant factors which should be considered at different stages in the establishment of a legislative framework for CP promotion, bearing in mind that the best systems merge both incentives and penalties to result in behavioral changes and overcoming barriers (ANZECC 1998):

- All CP related regulations should be introduced after consultations with private sectors;
- The regulatory framework should be oriented towards incentives for the private sector to adopt CP;
- The legislation should carry linkages and be a midpoint between economic incentives and environmental protection issues as a fundamental aspect of a clean revolution.

- Special attention must be given to more effective monitoring, compliance and enforcement activities of standards and regulations (Ashton *et al.* 2002).

The importance of self-regulation and other voluntary schemes which are considered as beneficial alternatives requiring fewer regulatory resources should be also emphasized (Lindhqvist 2001). The lack of self-regulation is also seen as the major barrier to quick adoption of CP in the developing world. Proven self-regulation examples are environmental auditing, environmental management systems, environmental reporting and voluntary agreements (Hillary and Thorsen 1999). However, the extensive adoption of self-regulatory measures by enterprises, which is socially desirable, depends on state policy to assist industrial sector efforts to self-regulate. Potential government actions can include the introduction of various sets of standards and/or reporting requirements (Brown and Woods 2007).

Economic and financial issues

There are various economic barriers to the rapid acceptance of CP. The most important general obstacles in countries with developing economies are highlighted. The first issue is that governments in these countries are mainly focused on economic growth while CP or related approaches are not seen as a state policy issue and are completely disregarded (Evans and Stevenson 2001). The second major problem is that the industrial sector is not transparent. There is a general practice of secrecy in industry and only a couple of enterprises provide openly detailed information on their operations, especially in connection with environmental performance (ADB 2002).

Other financial and economic obstacles can be summarized as follows:

- Funding mechanisms (loans, grants, credits, subsidies etc.) are not appropriate or do not exist at all for CP investments;
- Taxes, charges and tax deductions are all economic instruments that are not correctly applied or not used by governments to change industry and consumer behavior;
- Enterprises consider investments in CP as a high financial risk due to the apparently innovative nature of CP;

- The short term thinking and poor planning process of different stakeholders (decision-makers, owners of enterprises etc) involved in CP implementation is a common issue for developing economies;
- Absence of environmental funds which can potentially foster the promotion of CP approaches;
- Lack of advisory services and consultancies to back the industrial sector in preparing project proposals and loan applications (ADB 2002, ANZECC 1998, Luken and Van Rompaey 2008, UNEP 2000b).

There is a general view that new investments through CP approaches can double further economic development with a contribution to better environmental performance of enterprises and bring about general improvements in the health of the population.

Technological barriers

Zilahy (2004) emphasizes that one of the highly restrictive factors for prompt adoption of CP is the technical dependence of enterprises upon their infrastructural background. ANZECC (1998) asserts the same view, highlighting that companies are suspicious about investing in new and unproven technologies because of technological uncertainty regardless of the possible long-term benefits. Moreover, enterprises often are reluctant to invest in CP since they do not have appropriate technical capacity (the engineers and trained technicians to work with modern technologies) (Luken and Van Rompaey 2008). In addition, UNIDO and UNEP (2002) also clarify that investments in new technologies is an important decision for companies to undertake. Substantial cost, complexity of modern technologies, a fear of trusting new methods and techniques can discourage or hinder companies to invest in upgrading their existing equipment and plants.

There is also a common understanding that technology innovations in many developing economies are slowly adopted because of unpredictable policy and regulatory regimes which can result in unclear future market opportunities. Therefore, new and cleaner technologies ought to compete not only with old technologies existing in the company but also with the whole system in which it is placed (Foxon and Pearson 2008). Another important barrier which has been identified is the lack of a public pressure. The public attitude also plays an important role in leading to technological modification because of its significance in reaching

the environmental compliance as well as for improvements in overall environmental conditions of the state (Luken and Van Rompaey 2008).

Institutional/organizational obstacles

Inadequate institutional arrangements are considered important barriers in the quick adoption of CP. Strengthening of CP institutional structure is essential to encourage local businesses to adopt CP approaches taking into account the specific circumstances of states (OECD 1995). International organizations put emphasis on the following aspects of institutional constrains of developing countries and countries with economy in transition:

- Lack of appropriate CP institutional structures and human resources as well as of the general leadership in the environmental field;
- Nonexistence or weak role of National Cleaner Production Centers (NCPCs) as the crucial capacity building institution at the national level;
- Lack of coordination among different stakeholders to promote CP strategies and approaches;
- Lack of experiences in the environmental management functions at the company's level;
- Lack of communication within enterprises and exchanges of information on new and clean technologies and some others (UNEP 2000b, UNIDO and UNEP 2002, Foxon and Pearson 2008).

The literature shows that the local office for CP implementation can significantly increase chances for its successful application. Moreover, general acceptance of CP objectives can be extensively enhanced if the institutional partnership and good working relationship within local organizations are strengthened and developed (Gallup and Marcotte 2004). This issue will be discussed in more detail in the next sub-chapter of the present work.

Informational constrains

The implementation of CP program can be much more efficient through the development and implementation of CP awareness programme (USEPA 1998). The reason is that there is a

need to transfer the knowledge about CP at all levels: enterprises, governmental authorities, industry-support institutions and general public (UNIDO and UNEP 2002).

First, it is important to underline that most managers and professionals in private industrial sector do not have appropriate education and/or have little knowledge in the field of environmental protection. For that reason, the concepts of resource and waste minimization as well as energy efficiency would be very practical for them since these methods enable companies to benefit from savings and the introduction of better management options (Boyle 1999). ADB (2002) puts emphasis on the lack of information networks in many countries regarding clean technologies, environmental management practices, new products, trends in technology, markets etc.

Second, there is a lack of awareness among decision makers about potential benefits of CP application and there is a limited number of professionals have the knowledge regarding CP policies, practices as well as policy instruments to promote CP at the national level (USEPA 1998). Therefore, the intensive training programmes for decision makers are required to foster CP projects and activities in order to illustrate the existence of a win-win situation for economic development and environmental protection (UNIDO and UNEP 2002).

Third, the absence of CP related curricula in educational systems seems to be an important barrier (Boyle 1999). The linkage between CP and official educational institutions can be one of the most important tools for promotion of CP awareness (Ashton *et al.* 2002). There are a lot of opportunities in the different fields such as engineering, architecture, management, law and economics to include environmental and CP related issues as the part of the educational programme (Boyle 1999), (UNIDO and UNEP 2002).

Finally, Lindhqvist (2001) emphasizes that strategies promoting general public awareness and education are fundamentally important since they are cornerstone for all long-term transformations in the society. It is important to mention that public educational system and media in many countries failed to raise awareness and understanding of communities about problems associated with polluted production and CP possible benefits (ADB 2002).

3.4. Different stakeholders' involvement in the implementation of Cleaner Production

The introduction and implementation of the Cleaner production (CP) concept largely depends on the involvement and participation of wide range of stakeholders (ADB 2002). The industrial sector, government authorities, communities, research institutes and consumers all need to be involved in the adoption of CP approaches at the national level. Table 3 summarizes responsibilities of various stakeholders (large categories) based on the existing literature.

Table 3. Stakeholders involved in CP introduction and implementation

Stakeholders	Illustration of tasks to be accomplished
Environmental government authorities	- Establishment of the clear framework of long-term CP objectives and requirements - Development of CP Action Plan - Establishment of Inter-ministerial task force to coordinate CP activities - Development and enforcement of the CP related legislation
Economic and finance governmental authorities	- Incorporation of CP into finance policy, introduction of financing framework for CP investments, soft loans, tax exemptions and other incentives - Identification and promotion of appropriate CP technologies
Industrial sector	- Integration of CP into corporate philosophy and vision - Provide the support on management improvements - Establishment and integration of CP in on-going personnel development / training programmes
Local governments	- Negotiation of site-specific agreements that deal with environment, health, employment, and other local concerns
Trade Unions	- Organization of the training programme and workshops - Improvements in work-force skills
Sector Associations	- Development of Code of practices - Promotion of CP approaches and cooperation in identification of technologies that are locally applicable to the sector
Educational institutions	- Development of curriculum on industry-specific CP applications, technologies - Organization of trainings and workshops on CP related issues
NGOs	- Mobilization of general public to support improvements in the environmental performance of the industrial sector - Provide assistance in monitoring progresses

	- Encourage participation of companies and firms that are outside the structured industrial associations.

Source: ADB 2002, ANZECC 1998, World Bank Group et al. 1999, UNEP 2001a, UNEP 2001b, UNEP 2001c

The important issue is that inadequately informed stakeholders can bring about insufficient understanding of the negative impacts of industrial pollution as well as of benefits arising from CP applications. Therefore, it is crucial to engage stakeholders to the planning activities from the yearly stages and to include them at all levels of decision making process (ADB 2002). Additionally, the organization of CP related seminars, roundtable meetings as well as workshops and task forces with participation of all stakeholders can promote information exchange, build the consensus on CP activities and provide further opportunities to accelerate the application of CP approaches (Ashton *et al.* 2002).

3.5. The role of a National Cleaner Production Center in the introduction and promotion of clean technologies within the industrial sector

One of the significant aspects for promotion of the Cleaner Production (CP) concept is the strengthening of institutional mechanisms at the national level to facilitate its rapid and efficient implementation. The initiative to establish National Cleaner Production Centers (NCPCs) in developing countries and countries with economies in transition was jointly put forward by the United Nations Industrial Development Organization (UNIDO) and the United Nations Environmental Programme (UNEP) in 1995 (Luken and Navrat 2004). In total, 24 UNIDO/ UNEP NCPCs have been established in different regions through financial assistance of European countries (UNEP 2008b). Moreover, bilateral donors also provide assistance directly to the recipient countries for establishment of NCPCs (Zamparutti 1999) and, as a result, 50 NCPCs have been additionally established (UNEP 2008).

UNEP (2002) suggests that NCPC to be hosted by different institutions such as governmental authorities, industry unions, academic or technical organizations, non-profit associations etc. The agency proposes flexible approaches in setting up the institutional structure in view of a country's specific socio-economic context. Another option is the establishment of the CP centre which can be jointly owned by Public and Private sectors (Lopes 1996). Nevertheless, the important first step is to locate the centre in the appropriate institution which has the capacity to connect various stakeholders – industrial sector, government authorities, financial

institutions, consultants, etc. for mainstreaming CP into core activities of the interested parties. In this respect, the present research will examine opportunities and barriers in the establishment of the CP centre in Georgia.

The main purpose of such centers is to provide assistance to the industrial sector in the promotion and implementation of CP approaches. Moreover, the incorporation of CP into the national environmental policy agenda and the introduction of regulatory framework for its application are certainly considered as crucial activities for NCPCs (UNIDO and UNEP 2002). Gallup and Marcotte (2004) summarize three core areas for NCPCs activities under the Environmental Pollution Prevention Project of the United States Agency for International Development (USAID):

(1) Technical assistance to the industrial sector (technology transfer, demonstrations projects, mobilizing access to investment capital);

(2) Policy development and legislative framework (participation in design, promotion and establishment of national environmental management and CP policies, plans and strategies);

(3) Training and outreach (dissemination of the CP related information among various stakeholders, providing training and capacity building activities).

It is essential to mention that one of the major tasks for NCPCs is to develop and implement the national strategy for CP which is an indicator of the country's ability and willingness to promote CP approaches in the industrial sector (Staniskis and Stasiskiene 2003). The development of CP national strategy and its successful implementation can increase possibilities of external assistance as well as provide incentives to the industrial sector to further support the dissemination of CP approaches within the country. UNEP (2002) put emphasis on the importance of integration of the CP concept into the entire policy framework (economic, industrial, environmental, educational etc. policy areas) of the state. With this regard, it should be pointed out that there is the uncertainty of impacts of NCPCs on the formation of CP policies especially in post soviet countries. Moreover, Clarence-Smith (2001) raises the issue of weak contacts between the governmental institutions and most CP centers. He argues about the ability of NCPC to provide policy advises to government authorities and emphasizes that only mature centers have been able to bring policy changes for successful promotion of the CP at the national level.

Another important field of ambiguity regarding NCPCs is the ability to have a stable source of funding for operation. For the large majority of countries, the core funding for NCPCs comes from the Bilateral Projects or UNEP/UNIDO programmes with some topping up from governmental institutions (it generally includes in kind contribution). The experience of operation CP centers shows that UNIDO/UNEP or bilateral partners usually provide funding for 3-5 years. Therefore, OECD (1999) emphasizes that CP centers operation should be clearly defined whether they operate on a commercial basis or are public or even combination of both approaches. The long-term sustainability of NCPC, considering that the centre can survive and be successful in accomplishment of its tasks without relying on external (international) financial resources, require NCPC to be more proactive and work in closer cooperation with governmental institutions and the private sector. Moreover, environmental agencies of the countries with economies in transitions are actually weaker than the economic, finance and industry ministries. Therefore, linking more influential agencies and the private sector for the implementation of CP approaches can help raising the profile of NCPC and improve the chances for further success (OECD 2001).

One of the targets of the UNEP/UNIDO CP project was the creation of a Network of the NCPCs around the Globe (Sikdar *et al.* 2004). The current and future role of the regional or global networking activities can be summarised as follows:

- To enhance access to existing scientific, technical, and policy-related information required for CP implementation at the national level;
- To provide the base for exchange of information on know-how in “green” technologies as well as increase of experiences about "best practices" on CP;
- To provide consistent information to UNEP and UNIDO in order to facilitate feedback on progress made by NCPCs in the promotion of CP, difficulties encountered and the required future assistance;
- Possibilities for assessment of the progress on implementation of projects in the industrial sector and lessons learnt;
- Development of joint activities to promote CP implementation which can be more cost-effective (UNEP 1996, Sikdar *et al.* 2004, UNEP 2002, Van Ganeri *et al.* 2003).

There are different views regarding the level of success in the establishment and operation of the NCPCs Network. A number of authors emphasize that the UNIDO NCPCs Network has

been established and it facilitates the exchange of information, experiences and ideas among centers (Ashton *et al.* 2002). Furthermore, the Sustainable Consumption and CP: Global Status report of UNEP (2002) stresses that the established network of NCPCs has been demonstrating a good partnership and cooperation among different stakeholders. However, another author underscores that very little has been done to bring together these centres in a regional or global networks because of absence of available resources to implement an appropriately structured network of NCPCs (Clarence-Smith 2001). Therefore, the additional study is needed in order to collect and analyze the current information on the performance of UNIDO existing network and evaluate its contribution to transferring technologies and implementation of CP policies and strategies at the national level.

3.6. The role of demonstration projects in the field of Cleaner Production

Cleaner production (CP) demonstration projects help countries to introduce, assess and replicate new technologies in the specific industrial sector. According to the Asian Development Bank (2002) these programmes can show best techniques and cost-saving opportunities associated with CP. Moreover, there is a current need to deal with the introduction of new technologies that can be done through research and demonstration activities (Foxon and Pearson 2008). The industrial sector is more likely to implement new approaches and technologies if their effectiveness has been confirmed through practical demonstrations (ANZECC 1998). Therefore, demonstration projects have been very helpful in spreading the main message about CP as the existing alternative to the command-and-control model of pollution management (Evans and Hammer 2003). In addition, one of the greatest advantages of demonstration projects is their flexibility in serving multiple objectives and providing a wide range of information (technical and best practices manuals) on CP and promotional products (ANZECC 1998). UNEP (2002) indicates three significant steps in the successful implementation of demonstration projects: necessary actions *before, during* and *after* demonstrations. The Main components can be summarized as follows:

Before demonstration project:

- It is essential to develop explicit selection criteria for companies wishing to participate in the demonstration activities;
- Willingness to participate in demonstration activities should be considered as a matter of priority;

- The company' responsibilities should be clearly explained and defined.

During demonstration project:

- The implementation stage should not be delayed after completion of assessment;
- One of the important issues is the full involvement of financial managers of companies into project activities in order to demonstrate the cost saving opportunities;

After completion of the demonstration project

- It is necessary to ensure that results of demonstration projects were disseminated among representatives of the industrial sector and other stakeholders;
- Monitoring and evaluation activities: advantages and disadvantages of selected options should be defined.

A number of reports and papers have been produced by donor organizations (UNIDO, UNEP, USAID, KFW, World Bank etc) and various experts indicating that technology transfer process and demonstration activities in a range of industrial sectors have been effectively implemented:

- ✓ In Egypt, thirteen demonstration projects have been successfully implemented in 21 sites at the cost of UK£ 1.6 million in textile, food and oil and soap sectors (Hamed and Mahgary 2004).
- ✓ In Australia, CP demonstration projects implemented by the Commonwealth, Victorian and South Australian Governments have proved that CP has major benefits for individual companies and the whole community (ANZECC 1998).
- ✓ In India, demonstration project focused on three sectors: agro-based pulp and paper, textile dying and printing, and pesticides formulation… some new technologies were tested that improved the product and the operating environment… with a payback period of less than three months (World Bank group *et al.* 1999).
- ✓ In Vietnam, 15 demonstration projects were accomplished to demonstrate how CP can be effectively implemented (Staniskis and Stasiskiene 2003).

Despite the overall positive picture regarding the value of demonstration projects, the literature review reveals that there are some significant challenges and concerns.

First, Hillary (2000) stresses that the level of success of CP demonstration projects should be also measured following completion of activities through effects of such programmes on a wider audience of businesses. However, it is worth mentioning that demonstration projects have had limited achievements in encouraging non-involved enterprises to start CP activities at their own expenses (Clarence-Smith 2001). Therefore, it is crucial to ensure that demonstration projects with substantial results are replicated by other similar companies. The TACIS demonstration project was implemented several years ago in Georgia. The impact of this project on the overall performance of the industrial sector will be evaluated and presented.

Second, Evans and Hammer (2003) go further and call attention to national and international organizations on the fact that in some regions there is no need to prove CP benefits to any further extent. Although demonstration projects have a good intent, the multiplier outcomes of such programmes can be extremely modest (UNEP 2002a). The further assistance is needed for implementation of investment projects through innovative financial schemes (Evans and Hammer 2003). In this regards, it is interesting to see how Luken and Hesp (2004) summarize the objectives of the UNEP demonstration project "Strategies and Mechanisms for Promoting CP Investments in Developing countries":

- Improvement of general environment for attraction of investments in cleaner technologies;
- Stimulation of new initiatives such as new financial schemes, trust funds, policy transformations and training opportunities;
- Encouragement of national/international financial institutions to initiate credit schemes adapted to cleaner technologies investments.

In view of that, it can be concluded that donors start promoting the CP concept in a broader context ensuring also the adoption of appropriate policy measures for post demonstration implementation of CP approaches.

Lastly, the concern is raised that some companies are unwilling to share information with their competitors regarding production practices or CP innovations (ANZECC 1998). For that reason, a number of authors propose that demonstration projects should be complemented by the training and capacity building activities as well as by development of a CP action plan to ensure its further cost effective implementation at the national level (Ashton *et al.* 2002).

3.7. Opportunities to incorporate Cleaner Production activities through implementation of Multilateral Environmental Agreements (MEAs) at the national level

The aspect of access to the best available and clean technologies has become crucial for the last two decades for many developing countries as well as countries with economies in transition. The Rio Declaration on Environment and Development under principle 9 has proclaimed that "States should cooperate…and transfer…technologies, including new and

innovative technologies" (UN 1992). A number of Multilateral Environmental Agreements (MEAs) can encourage and promote the application of Cleaner Production (CP) approaches at the national levels. MEAs objectives can be achieved through technology transfers and providing the support to CP processes as well as managing natural resources in a more efficient and sustainable way (UNEP and UNCTAD 2007). The Kyoto Protocol, the Montreal Protocol, the Stockholm Convention, the Basel Convention and the LRTAP Convention are connected with the industrial sector operations and include special provisions for the transfer of best and clean technologies (Table 4):

Table 4. Provisions in some MEAs for transferring the best and clean technologies

Name of the Convention or Protocol	Content of the related provisions
1. Kyoto Protocol to the United Nations Framework Convention on Climate Change,	Article 10(c): "…take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries, including the formulation of policies and programmes for the effective transfer of environmentally sound technologies…and the creation of an enabling environment for the private sector, to promote and enhance the transfer of, and access to, environmentally sound technologies".
2. Montreal Protocol on Substances that Deplete the Ozone Layer	Article 10A: "Transfer of technology… that the best available, environmentally safe substitutes and related technologies are expeditiously transferred to Parties operating under paragraph 1 of Article 5".
3. Stockholm Convention on Persistent Organic Pollutants	Article 12(4): "The Parties shall establish, as appropriate, arrangements for the purpose of providing technical assistance and promoting the transfer of technology …" Annex C, Part 5 A: Useful measures could include: (a) The use of low-waste technology; (b) The use of less hazardous substances; (c) The promotion of the recovery and recycling of waste and of substances generated and used in a processes...(e) Good housekeeping and preventive maintenance programmes, (f) Improvements in waste management...".
4. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	Article 10(2)c: „Co-operate... in the development and implementation of new environmentally sound low-waste technologies and the improvement of existing technologies with a view to eliminating, as far as practicable, the generation of hazardous wastes and other wastes and achieving more effective and efficient methods of ensuring their management in an environmentally sound manner...".
5. Convention on Long-range Transboundary Air Pollution (LRTAP)	Article 6: "Contracting Party undertakes to develop the best policies and strategies...in particular by using the best available technology which is economically feasible and low- and non-waste technology..."

Source: UN 1998, UNEP 2000a, UN 2001, UN 2005, UNECE 1979

The above listed agreements comprise provisions to provide access to clean technologies to all Parties, in particular developing and transition countries. Consequently, technical assistance

projects which are implemented under these MEAs often include a technology component with the aim of know-how transfers (UNEP and UNCTAD 2007). Georgia is a party of the above stated agreements and this research will examine existing opportunities and barriers to implement CP approaches under MEAs in Georgia.

Furthermore, the large funding possibilities for promotion of CP through these conventions are now available throughout the Globe. The Global Environment Facility (GEF) was established in 1991 to assist developing countries to protect the global environment and implement a number of MEAs. The total funds approved from 1991 to 2005 have been more than 5 billion dollars (GEF 2005). Also, a Multilateral Fund was launched under the Montreal Protocol to assist developing countries in phasing out of Ozone Depleting Substances and introducing new and clean technologies. It has provided up to two billion dollars to developing countries from the time of its establishment (OAN 2007). Therefore, there are a number of opportunities to introduce new and clean technologies through international assistance in many countries with transitional economies.

However, the literature on linkages between MEAs and CP is not rich. There are a few articles and reports released only recently concerning the introduction of new technologies under MEAs. Bakken (2001) raises the issue of MEAs implementation in a traditional way with end-of-pipe solutions. He argues that most early MEAs contained this requirement and were implemented accordingly. UNEP and SIDA joint report (2006) also highlights that the implementation of various MEAs relies mainly on end-of-pipe solutions which are associated with high cost of abatement technologies and can lead to halting economic development. Therefore, it can be assumed that CP can lead to greater implementation of MEAs, using for example economic instruments and preventive strategies. The significance of economic instruments has placed an essential focus on the costs of reductions which can allow the industrial sector to meet objectives more flexibly (Bakken 2001).

In this regard, it is important to mention the role of CP for compliance activities under MEAs. Zhao and Ortolano (1999) describe how cleaner technologies facilitate the introduction of alternatives to chlorofluorocarbons in China. They present the view that most companies in the refrigeration sector had incentives (mainly market demand, technology transfer and availability of the information) and abilities to adopt cleaner technologies, which is a good sign for the compliance with the Protocol. UNEP and SIDA (2006) in their joint report

analyze linkages between the Kyoto Protocol, the Stockholm Convention and the Basel convention with CP approaches. The key findings can be summarized as follows:

- CP has demonstrated that energy efficiency is a successful concept for the industrial sector and can facilitate its application under the Kyoto Protocol;
- CP has demonstrated that that 'pollution prevention' and/or 'waste minimization' can be implemented with a great level of success, particularly in outdated industries of transitional and developing countries. These activities can result in reduction of the volume of toxicity of hazardous waste streams (Basel Convention);
- The CP approach can be used to minimize the release of POPs via implementation of process-integrated measures (Stockholm Convention);
- Institutional linkages between MEAs and NCPCs are particularly highlighted;
- The special role of CP demonstration projects in the implementation of MEAs is underlined;
- Duplication of efforts should be avoided through incorporation of the CP concept into core areas of MEAs (cost effectiveness).

Furthermore, Kolominskas and Sullivan (2004) discuss the linkages between the CP programmes and Pollutant Release Transfer Register (PRTR) data. They assume that PRTR unified reporting (mainly used by OECD countries at the moment) can help identifying CP opportunities since PRTR requires enterprises to report their release of emissions into the environment. The authors present information categories to be provided by PRTR:

- Raw material use, water and energy consumption by a process unit;
- Release of pollutants by a process unit;
- Enhancement of the knowledge about causes of emissions at the facility; and
- Access to data enabling an initial comparison of different technological options.

They argue that enterprises are encouraged to have a clear picture with regards to their processes in terms of emissions and the use of raw materials. Therefore, CP activities can benefit through using PRTR reporting process through identifying potential emissions of concern and provide various options for solving identified problems and improving operation. Additionally, one of incentives under PRTR is the obligation to report publicly on emissions. This incentive is considered as a supplemental for companies to reduce their emissions.

The overview of the literature demonstrates that CP is recognised as an important tool for the implementation of MEAs. However, there is a lack of profound evaluation of effects of the CP concept, approaches and programmes in supporting and facilitating the implementation of particular MEAs at the national level.

4. Case study: the industrial sector and efforts to introduce and implement Cleaner Production approaches in Georgia

In Georgia, the industrial sector has an interesting history that dates back to 200 years ago. This chapter focuses on the industrial sector profile starting from its roots of small scale manufacturing to giant soviet industrialization and, afterward, shifting towards market economy. Furthermore, the current status of this sector is outlined from two main sides. First, general economical trends and dynamics of the industrial sectors' operations are presented. Second, the environmental performance of the industry is analyzed in connection with the release of pollutants into the atmospheric air and water.

Moreover, the essential role of other key actors (governmental institutions, professional associations, non-governmental organizations, mass media and others) in the introduction and implementation of CP policy and strategies is also briefly outlined. Finally, attempts to introduce CP approaches in Georgia through international assistance are presented and discussed.

4.1. Industrial sector profile

4.1.1 Brief historical overview

Beginning of the industrial sector in Georgia

In Georgia, the history of the industrial sector began at the end of the 18th century and it is mostly connected with the expansion of manufacturing processes. The term *manufacturing* originates from the Latin and consists of two words - *manu* and *factus* which means "made by hand" (Creese 1999). The manufacturing processes can be defined as the transformation of raw materials into usable products by the use of manual labor or machineries (Kennedy and Frontini 2003). In the beginning of the 19th century, the small-scale manufacturing business began extensively developing in Georgia with the main focus on goods required for the local market such as silk, woolen and cotton clothes, footwear, headgear, construction materials, earthenware crockery, wine containers, furniture, soap and others. In Tbilisi province, there were 450 manufacture units with a total of 5000 workplaces (Kacharava *et al.* 1977).

The first substitution of manual operations with machines took place in the middle of the 19th century (Bakradze 1958). The first enterprises introducing machinery were mechanical plant (1851), iron foundry (1851) and tobacco factory (1858). It is interesting to mention that all factories were built by foreign investors. Later, the large glass company was constructed by the baron Kuchenbaur (German citizen) and he invested into the enterprise so called "European modern technologies" with the intention of increasing productivity and decreasing production costs. The company annually produced about 300 thousand wine bottles, 200 thousand of lamp glasses, 100 thousand water bottles etc (Kacharava *et al.* 1977).

At that time, there were two significant developments in the mineral industry of Georgia which have played an essential role in the development of the entire industrial sector throughout two centuries. First, manganese was found in the vicinity of Chiatura (West Georgia) and the country became a major producer of this mineral. In 1900, the country produced 45.4% of the total world manganese production and the export was more than 53.8% of the world total export. Second, the production of coal was initiated in Tkibuli (West Georgia) which was the major deposit in the South Caucasus (Kacharava *et al.* 1977). Moreover, the following industrial sectors were developed: brickworks, saw-mills, plants for production of oil containers, and textile companies (Bakradze 1958).

In addition, one of the significant steps was the establishment of the first sector professional association. The industrial companies working for the production of manganese were united in the organization "Black stone" (the local name of the manganese) with the objective of helping local companies to access world markets and further stimulate production activities (Kacharava *et al.* 1977).

Industrialization in the Soviet time (before the Second World War)

After the collapse of independence in 1920, Georgia's industrial production sector was harshly disrupted by the political instability and war. Approximately 95% of Georgian enterprises were nationalized by the new government. In 1928, the new socialist rulers set the primary tasks of the industrialization of the country. The Soviet industrialization was a state-led process and the ultimate goal was to catch up and overtake western countries (Fitzpatrick and Viola 1990). The Soviet industrialization was mostly performed through the construction of gigantic state enterprises. In Georgia, there were built the oil-processing plant in Batumi,

the cement plant in Kaspi, the Zestafoni ferroalloys plant, several large steelworks and many others. Soviet industrialization proceeded very rapidly and the industrial growth rate was unprecedented in history. The western economists emphasize that the rate of growth was annually about 9-14% (Hunt 2003).

However, according to Kenez (2006) the soviet industrialization was not designed to bring about balanced growth. The reason is that the state demand to build the heavy industry was high and all scarce resources were spent on its development. As a consequence, the light industry was considerably declining especially in small republics like Georgia. Moreover, the fundamental features of the Soviet economy in connection with the industrial sector were generated throughout the industrialization period. The extremely centralized and hierarchically organized economy required a huge bureaucracy which attempted to manage, supervise and distribute resources. Therefore, the bureaucracy totally controlled enterprises and the system placed little consideration on the quality of performance because the output was only measured in the quantity of produced goods.

The industrialization process was interrupted by World War II during which the Soviet Union experienced huge and diverse losses.

The industrial sector of Georgia after the Second World War

After the Second World War, a large share of investments was put in the rehabilitation of the industrial sector. According to the Soviet Statistics, the industrial growth was very encouraging (Table 5):

Table 5. The increase of the industrial output in 1940-1980

Years	1940	1960	1965	1970	1975	1980
The industrial sector in %	100	387	547	836	1158	1627

Source: Centre of Statistics 1981

However, the growth of industry was accompanied with huge environmental impacts and the total ignorance of challenges existing in this sector. The following features of the operation of the production sector should be especially highlighted:

- Poor planning and coordination of the work because of the central distribution system;
- Central planning system resulted in the formation of production monopolies;
- Poor quality of produced goods and tools needed for the industrial, commercial and individual consumers (the rejection rate was very high) because of obsolete enterprises and machinery as well as of inadequate incentives for workers;
- Mismatch of supply and demand as well as high level of stocks because of the manufacturing of goods without consideration for the requirements of the existing market;
- Profit and revenue rise were not a primary motivation for the operation of the industrial sector;
- Lack of training and knowledge development opportunities resulting in insufficient level of professional skills;
- The excess of employment in the industrial sector which is a consequence of the requirement to provide jobs for the majority of population (IMF *et al.* 1991).

Moreover, the domination roles of the central government in the planning processes, the use of only the "command-and-control" method, the flawed remuneration system, establishment and development of industries with high material and energy consumption without consideration of environmental and geographical factors all contributed to the economic deterioration. Georgia's industrial sector became dependent on external providers of primary sources of energy, raw materials, spare parts and other supplies (Lagidze 1995). As an example, the heavy industry (Metallurgical Plant, Kutaisi Automotive Factory and others) greatly depended on commercial agreements on supplies with other republics of USSR and approximately 90% of the raw materials for the light industry came from outside of Georgia (Curtis 2004).

In the late 80s of 20th century, the main industrial products produced by Georgia were machine tools, steel pipes, cast iron, cement, synthetic ammonia and prefabricated building structures. Gasoline and diesel fuel were also processed by Georgian refineries from imported crude oil. However, the level of obsolescence of Georgia's industrial sector by 1985 was 30-50% and the proportion of manual labor in the industrial sector was about 40% (Lagidze

1995). The obsolete enterprises and equipment were kept in service by extending the lifetime through frequent major repairs (IMF *et al.* 1991).

4.1.2 The first decade of independence

Georgia restored its independence in 1991 and the country recognized the critical need to make a quick transition into the market economy. However, the way towards democratic reforms was delayed because of civil war and ethnic conflicts. As a result, thousands of people were killed, 300,000 refugees and displaced persons were internally moved from two of the Georgian regions: Abkhazia and South Ossetia.

It should be mentioned that the collapse of Georgia's economy was unprecedented across former USSR republics. Two major sectors of Georgian economy, heavy industry and tourism, were totally ruined. The situation in the industrial sector was aggravated by energy crisis, the deficiency of raw materials and supplies (Lagidze 1995). The disintegration of the close ties with other economic sectors of Soviet republics brought about the "death" of the industry in Georgia and, consequently, about 60% of employees from the sector lost their jobs. The total decline of GDP was more than 70% from 1989 to 1994 in Georgia (Koehler and Zurcher 2003).

The stability started returning in 1995 despite the major political and social problems related to the unresolved conflicts. The country received substantial foreign assistance to carry out reforms in different sectors including industry. The government started the mass privatization project following the Russian experience of voucher programme. The main goals of the privatization activities can be summarized as follows:

- To form a private sector through quick and extensive privatization process in order to shift to a market economy;
- To promote conditions for equal sharing of assets by allocating shares to citizens;
- To engage and commit the entire Georgian population to the process of privatization (Lieberman *et al.* 1997).

Regrettably, the privatization programme through distribution of vouchers completely failed because of several reasons. Most citizens received their vouchers and sold them on the market

for cash due to the poor economic conditions, lack of information and understanding about benefits rising from privatization, and over complicated procedures. As a result, more than 90% of all shares were purchased by 500 persons and the result of privatization was very far from the original main objective – to ensure equal sharing of assets (Lieberman *et al.* 1997).

The industrial sector could not revive after years of deep failure. Some relative growth was recorded in the production of construction materials, oil products, chemicals, wood processing and light industry through performance of Small and Medium Size Enterprises (SME) (Lagidze T. 1995). These types of companies were generally privatized and they were able to continue operation in view of the fact that businesses were in private hands.

It should be further mentioned that the governmental financial assistance of the industrial sector has been ceased and, consequently, most large enterprises faced problems to continue operations. The main question that can be raised is why these companies were not attractive for investors. First, most of large companies had accumulated significant debts. Second, the equipment and technologies are archaic and there is a need for huge investments for rehabilitation. Third, the tender process itself was not transparent involving the conflict of interests and excluding some investors who were not favored by the lobby groups. One such example can be the privatization process of JSC "Chiatura manganese". According to the GEPLAC (1999) the government announced the tender of this company three times in two years and the agreement has not been reached with potential investors.

4.2. Current trends in the operation of the industrial sector in Georgia

4.2.1. General trends and dynamics of the industrial sector's operation

In November of 2003, the non-violent change of government took place in Georgia after mass demonstrations known as the Rose Revolution. The government started the implementation of new reforms towards the market economy of the state. Main objectives of reforms in connection with the industrial sector can be summarized as follows:

- Development of positive business climate with the aim of attracting foreign investors;
- Improvement of governance institutional system through its high transparency and efficiency;

- Promotion of private investments through the execution of liberal economic reforms in order to boost the economic growth;
- Implementation of anticorruption reforms and legalization of shadow economy which was substantial part of the economic system of Georgia;
- Establishment of competent, efficient, respectable and transparent civil sector which will help promoting market economy principles (World Bank Group *et al.* 2007).

Table 6 shows the GDP trend from 2000 to 2006 and the industrial sector performance in the total GDP structure.

Table 6. Georgia - GDP data

Years	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Real GDP growth, % over previous year (Total)	1.8	4.8	5.5	11.1	5.9	9.6	9.4
By sector:							
Industry	**3.2**	**-2.5**	**8.4**	**7.7**	**4.1**	**11.5**	**15.9**
Agriculture	-12.0	8.2	-1.4	10.3	-7.9	12.0	-9.6
Construction	4.0	10.3	43.1	46.6	35.9	14.1	9.8

Source: GEPLAC 2007

According to GEPLAC (2007), the manufacturing industry had the highest share (57.7%) in the GDP structure of the industrial sector in 2006 (Table 7).

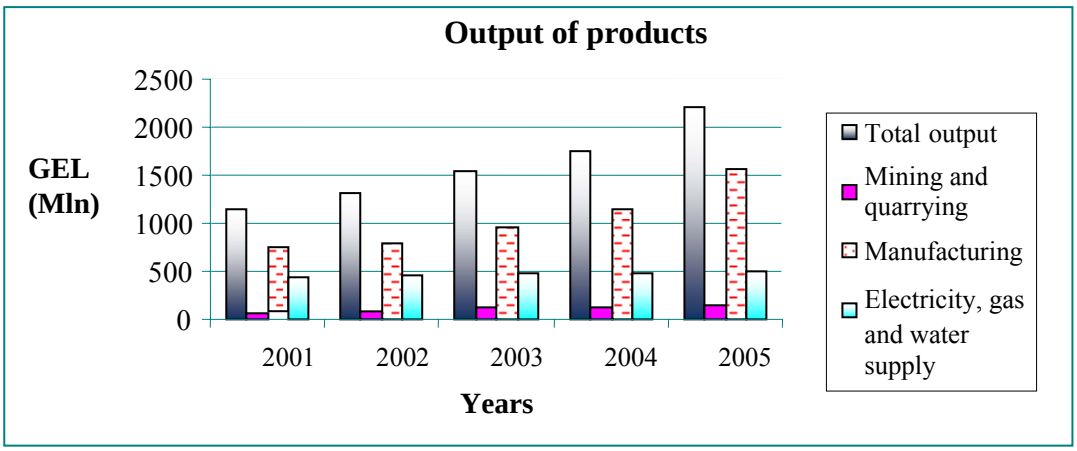
Table 7. The industrial sector's indicators

Year	**Value added in the industry at current basic prices (mln GEL)**	**Index of the industry (1996=100%)**	**Real value added in industry at basic prices (% changes over the same period of previous year)**	**Share of value added in industry at current basic prices (%)**			
				Mining	**Manufacturing**	**Energy production and distribution**	**Other**
2000	1044.2	108.2	3.4	3.9	49.5	25.2	21.4
2001	1111.0	105.0	-2.9	3.4	46.4	23.1	27.1
2002	1313.8	114.0	8.6	3.8	47.5	23.7	25.0
2003	1515.3	122.9	7.8	5.0	49.2	21.4	24.4
2004	1581.9	127.1	3.4	4.9	50.8	19.2	25.1
2005	1823.0	140.9	10.9	5.0	54.8	17.9	22.3
2006	2053.6	163.8	16.2	7.0	57.7	18.3	17.0

Source: GEPLAC 2007

The data from the Statistical Department of Georgia shows that total output of products has been considerably increased in the entire industrial sector. The largest increase has been again recorded in the manufacturing sector from 657,2 million GEL in 2001 to 1552,7 in 2005 (Figure 3).

Figure 3. Output of products (at current prices, million GEL)



Source: Department of Statistics 2006

A number of reasons for progress in the industrial sector developments should be especially highlighted. First, the new Tax Code reduces tax rates and it introduces 7 taxes instead of 21. These taxes are social, income, property, profit, VAT, excise, and gambling tax. Some more innovations are listed below:

- New instrument for dispute resolution which is tax arbitration;
- Opportunities for extension of payment of tax for 3 or 6 months;
- Taxpayer's right to offset overpaid sum to the budget against other tax liabilities (GEGI 2005).

Second, the licensing and permitting system has been modified including the following key components:

- The considerable reduction of number of licenses required for business activities by almost 84%;
- Instead of licenses and permits, the private sector in many cases is only obliged to inform authorities about the intent to operate;
- The issuance of licenses and permits is simplified using a one-stop shop, "silence-is-consent" rules and statutory time limits (World Bank Group *et al.* 2007).

The environmental legislation system in connection with ongoing reforms and CP introduction and implementation will be analyzed in details in the next chapter of the present thesis.

Third, the largest part of SMEs (more than 90%) has already been privatized and the privatization process of several large enterprises has recently been successfully accomplished by the new government:

- ✓ Heidelberg Cement which is a large German company has recently entered into the Georgian market. The corporation controls two large cement companies: Kaspi and Rustavi cement plants. These two companies produce about 1,600,000 metric tons of cement per year;
- ✓ The company from the Kazakhstan "KazMunaiGas Exploration and Production" JSC has acquired the Batumi Oil Terminal which presently receives exports of oil from Azerbaijan. The company can handle annually up to 240,000 b/d of crude oil and refined products;
- ✓ The company "Stanton Equities Corporation" acquired JSC "Madneuli" (production of manganese) and its associated companies;
- ✓ The Georgian – Russian business-group's joint stock company "Energy Invest" has acquired the chemical enterprise "Azot" and it constructed a gas-turbine power station in Gardabani;
- ✓ The British company "Stankor" has become the owner of JSC "Zestaponi Ferrous", JSC "Chiatura Manganese" and "Vartsikhe 2005" LLC. The holding became known as "Georgian Manganese Holding Limited" LLC (Ministry of Economic Development of Georgia 2008a).

Moreover, the total number of enterprises in the manufacturing sector has been significantly increased from 2969 units in 2001 to 4306 units in 2005 (Table 8).

Table 8. The number of enterprises in the industrial sector of Georgia in 2001-2005 (units)

Years	2001	2002	2003	2004	2005
Mining and quarrying	89	91	99	117	148
Manufacturing	**2969**	**2935**	**2775**	**3137**	**4306**
Electricity, gas and water supply	175	172	175	179	178
Total number of enterprises	**3233**	**3198**	**3049**	**3433**	**4632**

Source: Department of Statistics 2006

However, despite such positive trends in the industrial sector's development some major challenges in connection with environmental protection issues have remained unresolved. The governmental present policy mostly ignores environmental protection as a priority requirement for the industrial sector's operation. The obsolete technologies and equipment lead to the poor environmental performance of the entire manufacturing sector including all types such as SMEs and large enterprises. In many cases environmental standards are not met and the industrial sector has large environmental and public health impacts. The next sub-

chapter intends to illustrate trends in the pollution of the environment (atmospheric air and water).

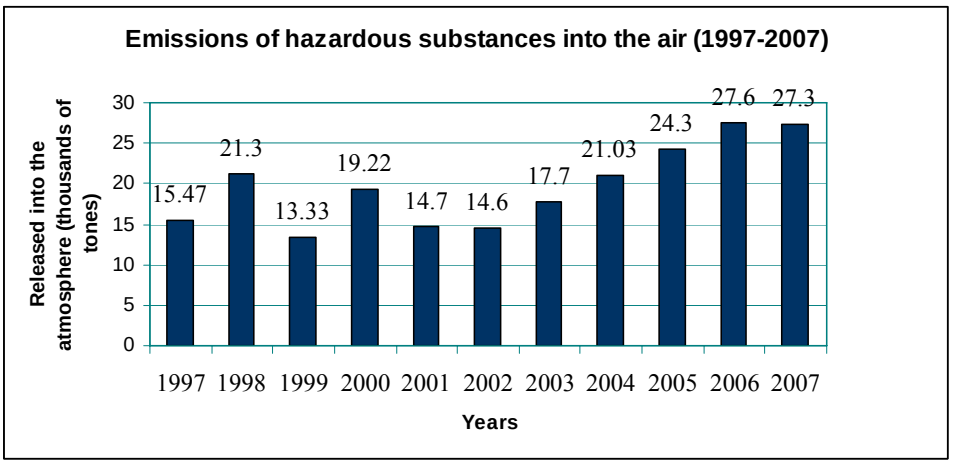
4.2.2. Recent trends in the environmental performance of the industrial sector

The economic results of the government's reforms are very encouraging especially in the manufacturing sector but the growth of the industrial activities in the country requires much more of energy and natural resources as well as higher utilization of the transportation, which leads to the generation and release of more pollutants into the atmospheric air and water.

Pollution of the atmospheric air

In Georgia, one of the challenging environmental areas is emissions of hazardous substances into the atmospheric air. The main sources for air pollution are traffic (mobile sources), industrial and energy sectors (stationary sources). Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Oxides (NO_x), Dust, and Volatile Organic Compounds (VOCs) are major air pollutants from the stationary sources in Georgia (Air Protection Division 2007). Figure 4 below illustrates the trend in the total emissions of hazardous substances into the air from stationary sources.

Figure 4. The total emissions of air pollutants from stationary sources in Georgia (1997-2007)



Source: Air Protection Division 2007

In accordance with the information from the Air Protection Division of the Ministry of Environment Protection and Natural Resources of Georgia (2008), the major enterprises contributing to the atmospheric air pollution are incorporated into table 9.

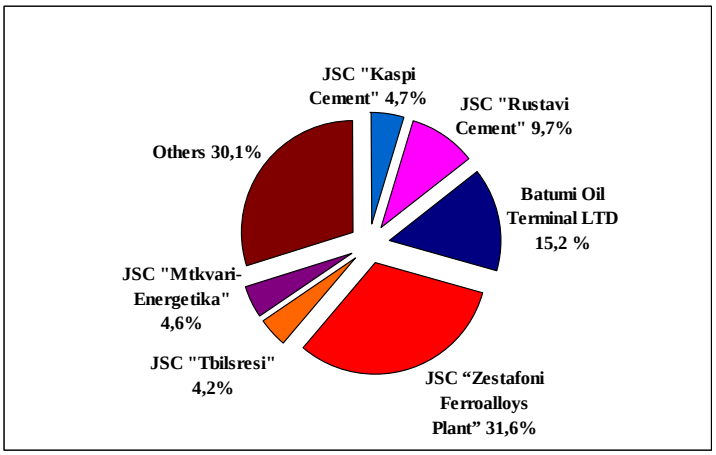
Table 9. The large enterprises and their share in the atmospheric pollution

The name of the enterprise	The amount of released substances in thousand tones			The share of enterprises, %		
	Formed	Among those		In the pollution of cities	In the pollution of regions	In the pollution of the country
		Cached	Released into atmosphere			
JSC "Tbilsresi"	1,154	-	1,154	43,9	17,8	4,2
Batumi Oil Terminal LTD	4,144	-	4,144	91,7	88,6	15,2
JSC "Rustavi Cement"	4,487	1,841	2,646	80,5	40,8	9,7
The Plant "Azot" of JSC "Energyinvest"	5,823	5,305	0,518	15,7	8,0	1,9
JSC "Energyinvest"	0,229	-	0,229	8,7	3,5	0,8
JSC "Zestaponi Ferroalloys Plant"	14,289	5,671	8,618	98,6	77,7	31,6
JSC "Mtkvari-Energetika"	1,243	-	1,243	47,3	19,2	4,6
JSC "Kaspi Cement"	3,711	2,426	1,285	87,2	70	4,7
Poti Sea Port LTD	0,335	-	0,335	87,7	20,4	1,2
JSC "Mina"	5,836	5,090	0,745	-	76,7	2,7
Total	**41,251**	**20,333**	**20,918**	**-**	**-**	**76,6**

Source: Air Protection Division 2007

As the table shows, these 10 large enterprises represent 76,6% of the total atmospheric air pollution in Georgia. It is important to highlight that the share of five companies in the pollution of individual cities more is than 50%. The highest contribution to the pollution of the respective city is 98,6% and the accountable enterprise is JSC "Zestafoni Ferroalloys Plant". Moreover, JSC "Tbilsresi", Batumi Oil Terminal LTD, JSC "Rustavi Cement", JSC "Zestafoni Ferroalloys Plant", JSC "Mtkvari-Energetika" and JSC "Kaspi Cement" represent 70% share of the total air emissions from stationary sources within the country (Figure 5).

Figure 5. The major enterprises contributing to the air pollution in Georgia (2007)



Source: Air Protection Division 2007

Therefore, it is vital for the decision makers to focus on the air quality management in order to attract new and clean technologies into the sector. In case of Georgia, the end-of-pipe solutions still can be effective in reduction of pollution levels due to the specific conditions (outdated technologies and equipment) of the large and some SMEs industrial companies. However, the cost of the end-of-pipe solutions is extremely high and not affordable by the largest part of Georgian enterprises. In this regard, the CP approach can bring about economic and environmental benefits through reduction of operational cost, increase of profitability, improvement of worker safety and decrease of environmental impacts.

Pollution of the water resources

In Georgia, the water quality is threatened by the municipal wastewater, the industrial and mining discharges as well as urban and agricultural runoff. The major industries responsible for pollution of surface waters are mining, chemical production, oil exploration and exploitation, and thermo-power stations. The large polluters of the water are almost the same enterprises which have been mentioned above. The information below relating to the large enterprises has been obtained from the Water Resources Management Division of the Ministry of Environmental Protection and Natural Resources of Georgia (2008):

- The Plant "Azot" of JSC "Energyinvest" produces liquid ammonia, nitrogen fertilizers and synthetic fibers, nitric acid etc. In 2006, the company discharged 1,978,600 m^3 of wastewater. The main pollutant is ammonia and the company discharges the wastewater into Tbilisi-Rustavi Wastewater Treatment Plant, where it is mechanically

treated together with municipal sewage coming from two cities - Tbilisi and Rustavi. Additionally, the company does not have a local wastewater treatment plant and, consequently, the concentration of ammonia regularly exceeds allowable limits. In addition, there is also the danger of emergency releases of ammonia into the water.

- JSC "Mtkvari-Energetika" is a thermal power plant with two units which are operating on gas. In 2006, the company discharged into the river Mtkvari 309,000 m^3 of the industrial and household wastewater without any treatment. The discharged water consisted of 0,8 tone of organic substances, 0,04 tone of oil products and 15 tones of suspended particulates.
- JSC "Tbilsresi" is also a thermal power plant. In 2006, the company discharged 273,573 m^3 of the industrial and household wastewater without treatment. The discharged water consisted of 208 tones of organic substances, 3 tones of oil products and 5 tones of suspended particulates.
- One of the hot spots in terms of water pollution is Joint-Stock Company "Madneuli" which is located in the Bolnisi district. JSC "Madneuli" is the leading mining enterprise in the region. The operation includes ore mining and processing of copper-gold-bearing ore. Main pollutants are cooper and zinc which go into the river system Machaver-Chrami. The environmental audit is currently being performed and the report will be released shortly.
- Batumi Oil Terminal LTD is an oil port which works in the area of transshipping crude oil from the oil fields of Azerbaijan. In 2006, the company discharged into the rivers Korolistskali, Kubistskali and Bartskana - 2,758,000 m^3 of wastewater. The discharged water consisted of 39 tones of organic substances, 14,6 tones of oil products and 37 tones of suspended particulates.
- JSC "Tbilaviamsheni" is the largest engineering enterprise in the region. The main activity is the production of aircrafts. Furthermore, the enterprise has also started the production of various types of electric equipment. In 2006, the company discharged into the river Mtkvari 534,000 m^3 of wastewater. The discharged water consisted of one tone of organic substances and 6,4 tones of suspended particulates.
- The Batumi Sea Port Limited is one of the important transport junctions connecting Europe with Asia. It operates five terminals: the oil terminal, the multi-purpose container terminal, the railway ferry terminal, the dry cargo terminal and the passenger terminal. The main problem is that the landing pier has the water drainage pipes and

water goes directly to the sea without any treatment. In case of emergencies, the present system can not secure from the pollution of the coastal zone.

- JSC Rustavi Metallurgical Plant mainly produces steel tubes and pipes. In 2005, the company discharged 184,300 m^3 of wastewater. The company discharges the wastewater into Tbilisi-Rustavi Wastewater Treatment Plant, where it is mechanically treated. There is no information concerning the composition of the wastewater. According to the independent expert's evaluation, the wastewater should contain high concentrations of suspended particulates, iron ions and phenols.

It is important to underline that having safe and high quality water resources is a key condition for good heath of the population. The CP approach can bring about technological options for each enterprise to reduce significantly the amount of generated wastewater and to improve extensively the quality of discharged water.

Finally, the past few years has shown the emergence of the introduction and implementation of CP measures in the industrial sector taking into consideration its continued growth. In Georgia, the liberalization of the economy also leads to the growth of new industries and demand for the CP must be prominent because of possibilities to decrease cost of the production through resource and energy efficiency as well as to reduce the generation of hazardous liquid, gaseous and solid wastes.

4.3. Other key actors in the introduction and implementation of the CP policy

4.3.1 The role of governmental institutions in the application of the CP concept

The Ministry of Environmental Protection and Natural Resources of Georgia

The main governmental authority responsible for the environmental protection is the Ministry of Environmental Protection and Natural Resources of Georgia (MENRP). The competences of the MENRP are defined by the Law of Georgia on the Protection of the Environment (1996) and the order of the Government of Georgia on the "Status of the Ministry of Environmental Protection and Natural Resources" (2004a). The MENRP's responsibilities among others include sustainable and integrated use of natural resources, organization of environmental monitoring system, regulation and supervision of integrated environmental

pollution control system, preparation of national reports on the state of environment, and development of National Environmental Action Plan (NEAP). The work of two departments is linked with the industrial sector operations:

- The Integrated Environmental Management Department is the key unit within the MEPNR which comprises four sub-divisions: Air Protection, Water Resources Management, Waste and Chemical Management and Biodiversity Conservation. The department is responsible for the preparation of State policies and strategies as well as priority activities and drafts of legal acts and subordinate legislative regulations in the respected fields.
- The Department on Sustainable Development consists of four sub-divisions: International Relations, Strategic Planning, Hydro-meteorological and Climate Change, and Projects Coordination. The Division on Strategic Planning is responsible for coordination of the preparation of national reports on the state of the environment and National Environmental Action Plan (NEAP). The Hydro-meteorological and Climate Change Division works for the implementation of the Kyoto Protocol and coordinates the preparation of CDM projects together with the industrial sector.

The scope of the work of two MENRP's agencies is very interesting. First, the Environmental Inspectorate was established in 2005 with the mandate to ensure the compliance with environmental regulations. The inspectorate is the only governmental body which has the responsibility to check the compliance status of the industrial enterprises with regard to environmental protection. Second, the Centre of Monitoring and Forecasting under MENRP is the responsible Agency for the management and development of the information on the weather and climate. The Agency is responsible for performing the quality analysis of the atmospheric air, water and soil. It also creates and maintains databases and carries out scientific and other research activities.

The MENRP has the legal competency to promote in cooperation with other stakeholders the CP concept and approaches. Environmental officers of the MENRP made some attempts to introduce the CP concept in the middle of nineties. All related opportunities and challenges will be discussed in detail in the next chapters of the thesis.

The Ministry of Economic Development of Georgia

The role of the Ministry of Economic Development of Georgia in the introduction of the CP approaches is extremely important in view of the fact that the Ministry is a key responsible authority for the development and implementation of governmental economic policy relating to the industrial sector. At present, the development of five year action plans has been suspended and the Ministry now is responsible for the preparation of 3-year indicative plans which specify projections of the revenues, expenditures and basic elements of economic parameters of the budget of Georgia. Furthermore, the Ministry is also responsible for the coordination of the work of sectoral ministries (Ministry of Economic Development of Georgia 2008b).

Within the Ministry, the work of several departments should be especially highlighted. First, the Department of Economic Policy is the unit which provides analysis of the macro-economic policy of the country. The department is in charge of development of licensing and technical regulatory policy with respect to the business sector and legislative initiatives to support the entrepreneurship in Georgia. Second, the Department of Mineral Resources Licensing has been recently shifted from the MEPNR. The main responsibility is to issue licenses on the use of natural resources according to the exhaustive list of licensed activities under the law of Georgia on Licenses and Permits (2005). Third, the Department for Foreign Trade and international Economic Relations is the responsible branch for cooperation with international organizations, donors, secretariats of multilateral agreements etc. The department works in the field of evaluation of international projects/programmes and development of proposals related to the economic policy of the country corresponding to EU requirements (Government of Georgia 2004b).

Moreover, the Ministry consists of ten public law legal entities from which two (the Enterprises Management Agency and Georgian National Investment Agency) work in the area of industrial businesses:

- The Enterprises Management Agency is the responsible authority for backing the state interests in the enterprises where the state has its share. The Agency prepares the necessary information and documents concerning the privatization of state enterprises. It also makes evaluation of investment projects and develops re-investment schemes and supports their implementation;

- The Georgian National Investment Agency is responsible for promotion of investments at the national and international levels. It supports foreign investments and increases awareness of potential investors about existing opportunities in Georgia. Furthermore, the Agency organizes business forums, conferences and workshops to promote investments into the Georgian economy (Ministry of Economic Development of Georgia 2008b).

In addition, it should be noted that there is no an environmental unit within the Ministry. Consequently, it is not surprising that the minimization of the environmental impacts from industrial activities, transferring of new and clean technologies, the use of renewable energies, energy efficiency, waste-free technologies and other key environmental concepts are not integrated into the economic policy of the country.

The Ministry of Labor, Health and Social Affairs

In the health sector of Georgia, one of the goals of the Ministry of Labor, Health and Social Affairs is to protect the community from dangerous environmental factors. The short term activities, among others, include the improvement of the system of public health's monitoring from environmental hazards. According to the Action Plan "Main Direction in the Health Sector (2006-2007)" (Ministry of Labor, Health and Social Affairs 2006), the protection of the public from dangerous environment factors (such as accident prevention, water and food security, health and safety at the work place etc.) are included into the public health activities of the State.

Therefore, the Ministry has incorporated health, safety and some environmental aspects into the action plan. However, there are no concrete actions on the improvements of the unsustainable practices in the sector, which can considerably threaten the health and safety of the Georgian population.

The Ministry of Education and Science of Georgia

The Ministry of Education and Science of Georgia works towards the development of an innovative educational system through the advocacy of fair competition, equal opportunities, and civil integrity. The Ministry is the responsible authority for the development of

knowledge and skills which are considered as the precondition for social success and self-realization (Ministry of Education and Science of Georgia 2007).

In fact, the Ministry supports various projects and programmes in connection with different forms of teaching and education. At present, the Professional Education Supporting Program has been implemented with the primary goals to support the secondary professional institutions and provide access to professional education for a large fraction of the society (Ministry of Education and Science of Georgia 2007). Regrettably, there are no indications that the environmental issues including the CP concept will be included in the curricula of educational institutions.

4.3.2. The role of other stakeholders in the promotion of CP related activities at the national level

NGOs sector

In Georgia, there are two types of non-governmental organizations: foundations and member-based associations. This sector has rapidly grown after the collapse of the Soviet Union. There are about 3,000 registered NGOs in Georgia and more than 50% of them focus on environmental protection, conservation and sustainable development issues (Price 2000). However, most Georgian NGOs have very small groups of activists and they are not able to mobilize the general public to support improvements (Karatnycky *et al.* 2001). It can be stated that NGOs' work is scattered in the different fields and there is a lack of experts to do and implement long term activities.

The financial constrains are also a main challenge in view of the fact that almost 99% of the environmental groups heavily depend on financial support from donor organizations. However, "donors rarely provide Georgian NGOs with multi-year funding that would permit them to build organizational capacity… and, as a result, the internal structure of many NGOs, though strong on paper, is generally weak" (USAID 2007).

Although, it is important to point out that the non-governmental sector has been strengthened in the field of the biodiversity protection because of the availability of resources from GEF, TACIS, USAID, SIDA, WWF, IUCN and others. Regrettably, there are only a few NGOs

(e.g. “Energy Efficiency Centre” or “Green Alternative”) working with the industrial sector particularly in the field of energy efficiency and waste management. The fundraising activity in these areas is extremely complex due to the necessity to work with the private sector which is still closed in most cases for external “interests”. Therefore, these NGOs are very small and do not have institutional capacity to implement long term objectives on a large scale.

Professional associations

In the industrial sector, professional associations are generally not very active in Georgia. There are only a few professional unions working in this field (e.g. Association of Business Consulting Organizations – Georgia, Association “Women and Business”, and the Georgian Association of Refrigeration, Cryogenics and Air Conditioning Engineers). The challenges in the operation of professional industrial groups in Georgia based on the information collected from the MENRP and independent experts can be summarized as follows:

- The poor understanding and knowledge of key players in the field about advantages of professional associations;
- The lack of short and medium term objectives and the poor planning process within the groups;
- The lack of expertise and resources to provide technical consultancy, legal consultancy, and training.

The involvement of professional associations in the implementation of the CP is an essential step because of the need for matching businesses and the qualified technical expertise of experts. Furthermore, the decision-making process itself can be considerably improved through the establishment of extensive dialogue between the private sector and governmental institutions.

Environmental consultancy groups

A functional and well developed environmental consulting sector is particularly important for adoption of CP practices at the national level. In Georgia, the market demand for the local environmental consultancy is extremely low since environmental protection itself is not considered as an essential component of the industrial sector performance. Moreover, there

are only two or three companies which implement about 99% of the work in this field. Georgian environmental consultant companies mostly perform the following duties:

- Development of pollutant emission inventory reports
- Preparation of EIS mostly for SMEs
- Preparation of Environmental audit reports mostly for SMEs
- Development of energy audit reports and waste management schemes for SME

The large manufacture enterprises normally utilize the experience of European or American environmental consulting companies because of the trust in overseas expertise and/or requirements of companies' foreign shareholders.

Additionally, the low level of the environmental consultancy sector at the local level is also connected to some extent with the absence of traditions to work with environmental consultants (impacts of the soviet management) and lack of experts having the capacity to perform required duties at high professional level.

Local communities

The strong ties with the local communities can bring about fast and effective adoption of the CP. In this respect, Georgia does not have a clear strategy or action plan for the development of manufacturing businesses especially in the field of small and medium-sized industries at the local levels.

Moreover, local environmental groups are usually not active in mobilizing local communities to participate in the decision-making process on the subject of the environmental protection. In Georgia, environmental conflicts with the large enterprises have accounted for very small numbers of social protests and lawsuits.

Mass media

The mass media (TV, newspapers, internet etc) can be considered as an important player to set a national agenda of the state towards environmental protection. In Georgia, the mass media has not shown particular interests in highlighting hot spots in the environmental field. The

reason is that Georgia still faces various political and social problems such as unresolved conflicts, refugees, migration, unemployment etc. and the informational streams mainly cover these fields corresponding to the demand of the public.

However, relative progress has been made in covering information on illegal logging, hunting and fishing because of the active position of the environmental inspectorate in these fields. All these illegal activities have significant social, ecological and economic implications and the mass media frequently focuses on these issues. In this respect, it seems to be extremely important to raise awareness of journalists, government officers, and the general public about consequences of industrial pollution and the vital role of clean technologies for society.

4.4. Attempts to introduce CP and TACIS Cleaner Production demonstration project in Georgia

The first CP related legislative provisions

In Georgia, the starting point in the introduction of the CP concept was 1996 when the new law of Georgia on the Protection of the Environment (1996) was adopted. The law provides main directions for development and adoption of subordinated regulations in the environmental field. Table 10 summarizes key terms and principles with regard to the CP concept which have been incorporated into the law.

Table 10. Terms and principles relating to the CP concept in Georgian legislation

Terms (Article 4)	Definition
Cleaner Production	Industrial processes, where integrated environmental protection policy is continuously applied.
Best Available Technologies	Best in terms of environmental protection, usable and economically available technologies deemed to be the most effective from the point of view of the prevention, minimization or transformation of harmful effect on the environment, may not be widely used, but it can technically be possible to adopt, implement and use. Although not being economically reasonable due to significantly higher costs for achieving costly environmental benefits, it is still available for subjects of activity.
Best Techniques	Best technology as well as the methods of its management, organization, supervision, control, and means of implementation.
Environment Management Systems (EMS)	Part of the entity's management system and business strategy, which covers all operating aspects directly or indirectly related to the issues of environmental impact (including environmental management plan, environmental policy, human resources, and register of environmental standards).

Environmentally Clean Products	Products manufactured from environmentally safe raw materials through using best available technologies and practices.
System of Integrated Control of Environmental Pollution"	Environmental pollution regulatory system which is based on integrated control of pollution of main components of the environment capable to accumulate pollution, in particular: water, land and ambient air.
Principles (Article 5)	**Definition**
Principle of Risk Reduction	When planning and caring out the activity an entity is obliged to take appropriate measures for preventing or reducing all adverse effects on human health and environment.
Priority Principle	An activity, which may cause adverse effects on the environment and human health, can be altered to another activity involving a lower risk (even if more expensive). The priority shall be granted for the change if its cost does not exceed costs for compensation of the ecological damage caused by the less costly activity
Polluter Pays Principle	The obligation of an entity along with other physical or legal entities to provide compensation for damages caused to the environment.
Principle of Chargeable Use of Nature	The obligation of an entity to pay for use of land, water, forest, flora, fauna and mineral resources.
Waste Minimization Principle	When carrying out an activity, the priority shall be given to waste minimization technologies
Principle of Recycling	When carrying out an activity, the priority shall be given to re-usable or recyclable, biodegradable or safely decomposable materials, substances and chemicals.
Principle of Restitution	The degraded environment as a result of the specific activity shall be restored to the state close to initial conditions (restitution in integrum).
Environmental Impact Assessment Principle	During planning and design activities, the entity shall consider and assess possible environmental impact of the activity according to the requirements of the legislation

Source: The law of Georgia on the Protection of the Environment 1996

All these terms and principles were later incorporated in the different legislation acts such as Law on Environmental Permits (1996), Law on State Ecological Examination (1996), Law on Water Resources Management (1997), Law on Hazardous Chemicals (1998), Air Protection Law (1999) and others. In fact, CP related terms and principles were declared in all media specific laws, which created an encouraging frame for the implementation of various activities in this field.

Norwegian capacity building project

In 2003, the Norwegian Ministry of Foreign Affairs started Cleaner Production and Energy Efficiency (CP&EE) Capacity Building Programmes in Georgia. The general objective of the project was to improve environmental performances in the industrial sector of Georgia. The project had to be implemented in five main directions:

- To establish an Energy Efficiency and CP Centre

- To implement combined training and project development activities
- To implement demonstration and investment projects
- To carry out various awareness raising activities and informational campaigns (EECP 2003).

First, the CP Centre was established under the NGO "Energy Efficiency and CP Centre (EECP)". Second, the new Centre performed a number of training workshops for providing general information about energy efficiency and CP and basic knowledge for performing CP measures. There were 16 participants in total from 7 small industrial companies from Tbilisi: "the Bread Factory № 1", "the Bread Factory № 4", the mill factory "Progress", the milk factory "Sante Walsh Products", the non-alcoholic drinks factory "Oasis", TbilWino, Electroautomat (EECP 2003). Third, a Revolving Fund was established within the centre with the maximum limit for loans of 7,000 USD per company.

The Revolving Fund provided resources for companies operating only in the cities of Tbilisi and Rustavi. The total amount available for companies from Tbilisi was 29,350 USD and for enterprises from Rustavi was 28,500 USD. In the activities of the project, only 6 small industrial companies participated from Rustavi namely the bread factories "Beta +", "Burji" and "Krtsanisi", the printing house "Polygraph", the beer factory "Rustavi XXI", the sausage factory "Georgia - 2". Implemented activities were mostly related to the energy efficiency measures with short-time paybacks (EECP 2004).

In 2005, the Norwegian project was completed and the centre was restructured and incorporated into the existing Energy Efficiency Centre (EEC) which had been established under the EU TACIS Project "Creation of an Energy Efficiency Centre and Development Natural Energy Study in Georgia" in 1998.

TACIS project "Cleaner Production in the selected countries of the NIS: Moldova, Georgia and Kazakhstan"

In 2003, at the same time when the Norwegian project was being implemented, the TACIS launched the implementation of its project "Cleaner Production in the selected countries of the NIS: Moldova, Georgia and Kazakhstan". The objectives of the project can be summarized as follows:

- Establishment and support of framework conditions for introduction and promotion of cleaner production strategy in industrial sectors in three NIS countries: Moldova, Georgia and Kazakhstan;
- Capacity building of cleaner production centers in respective countries with the aim of achieving "Basic Capacity Level" in the field of cleaner production through training activities and implementation of CP demonstration projects;
- Building and raising the awareness of decision makers and representatives of the industrial sector from NIS regarding the economic and environmental benefits of CP approaches (TACIS project 2004).

In case of Georgia, there was made a decision to establish the CP centre and locate the team of the project under the Regional Environmental Centre for Caucasus (REC Caucasus).

The TACIS programme provided financial assistance for the implementation of demonstration projects in two companies in the city of Tbilisi: the wood processing company LTD "Wood Service" and the paper producer JSC "Tbilisi Paper Factory". The first company received assistance for modification of the processing cycle with focusing on efficient use of raw materials at each stage of production, reduction of consumption of energy, improvements in the quality of products, and recycling of generated waste. The second company was provided with support to implement low cost measures relating to the effective management of resource use and losses to wastewater, closure of water cycles, energy efficiency, optimal usage of equipment, and upgrading methods of the process (TACIS project 2005).

Besides, the TACIS programme covered some awareness raising activities through publication of technical literature and organization of training workshops regarding the CP concept and approaches. In addition, a study-tour was organized to Poland and Ireland for representatives of governmental authorities from Moldova, Georgia and Kazakhstan with the objectives to share experiences of building environmental policy in connection with CP related measures (TACIS project 2004).

Project activities were completed in 2006 and the CP centre under the REC Caucasus also discontinued its functioning.

The next sections of the thesis will provide detailed analysis of current opportunities and barriers and will present various recommendations for the implementation of CP measures in Georgia taking into account existing experience and knowledge outlined in the literature review chapter.

5. The findings from the research: identified opportunities and barriers for the introduction and implementation of CP policy in Georgia

5.1. Importance of the strengthening of the institutional capacity to implement the CP concept in Georgia

The analysis of the existing documents and materials as well as various interviews with different stakeholders reveals that the implementation of the CP concept and approaches requires building institutional capacity of the country to facilitate partnership between the government and private enterprises. Hillary (2000) emphasizes that "the core element of any country's cleaner production programme will be the establishment of the Cleaner Production Capacity Building Centre – National Cleaner Production Centers (NCPCs)". Moreover, OECD (2006) recommended to Georgia to launch a National Integrated Pollution Prevention and Control Centre which would cope with CP approaches and environmental management issues.

As it was illustrated in the previous chapter, two such centers have been established in Georgia under the financial assistance of donor organizations. Both centers were operating more or less at the same time but they closed down once the funding of projects came to an end. The research revealed that major challenges for self-sustainability of the centers were the lack of political support, a full reliance on international donor organizations, the absence of long-term strategy and low awareness of the private sector regarding CP benefits. It is important to compare views of different stakeholders regarding activities of above mentioned centers and to review institutional barriers hindering wider adoption of CP in Georgia.

Generally, majority interviewees especially from large enterprises emphasize that the establishment of the CP centre is a very significant step because it can incorporate clearinghouse functions attracting various stakeholders. Some interviewees shared views concerning potential activities of the CP centre in Georgia which can be summarized as follows:

- To organize and coordinate CP related activities within the country;
- To participate in formulating CP national policies and strategies;
- To assist governmental institutions in preparation of respective legal acts for adoption of CP approaches;

- To assist enterprises in preparation of demonstration projects in various industrial fields;
- To work with international organizations for fundraising activities with the aim of development sectoral investment projects;
- To participate in the development of sectoral and cross-sectoral Codes of Practices;
- To organize training programme for different stakeholders (environmental officers from industrial sectors, environmental inspectors, governmental officers etc);
- To organize extensive awareness raising campaigns in order to draw attention of the public on the importance of new and clean technologies in improvements of the public health and environment;
- To organize monitoring and evaluation procedures of carried out activities in order to make quick adjustments in the work programme.

In this regard, it is important to mention that both CP centers focused only on some specific activities such as demonstration projects and training/workshops which were dictated by the respective programmes. Several interviewees stressed that these centers were not prepared to bring about policy changes or establish a new enabling environment because of the nature of approved projects, narrow scope of terms of references and limited resources.

Therefore, it seems that the effective implementation of CP approaches requires a more holistic approach (Gujaraidze pers.comm.) which can be explained as immediate and integrated actions across different areas. These activities should be implemented as the package of measures namely strengthening of the institutional capacity, establishment of the necessary regulatory framework, development of economic incentives for introduction of cleaner technologies, implementation of demonstration projects leading to their wide replication, intensive training programmes and awareness raising campaigns. These measures can result in quick, efficient and cost-effective adoption of the CP concept at the national level (Gujaraidze pers.comm.).

Quite a few interviewees from the MEPNR raised the issue of the development of National Action Plan for CP implementation in Georgia which can be the course of actions to support and encourage enterprises to adopt CP. The Action Plan may cover various CP related activities such as general waste minimization, energy efficiency, materials recovery and recycling, water consumption minimization, resource use efficiency and many others

(Tkhilava pers.comm.). Furthermore, Gombault and Versteege (1999) state that the strategy for CP should be incorporated into the overall objectives of environmental policy through the National Environmental Action Plan (NEAP). In the case of Georgia, the first NEAP was approved in 2000 and it did not mainstream CP related issues into national planning process activities. The second NEAP has been developed through assistance of the UNDP but it is still in the drafting process. In this regard, the CP centre can be the driving force in the incorporation of CP approaches into the environmental policy and/or governmental action plans and into respective legal acts.

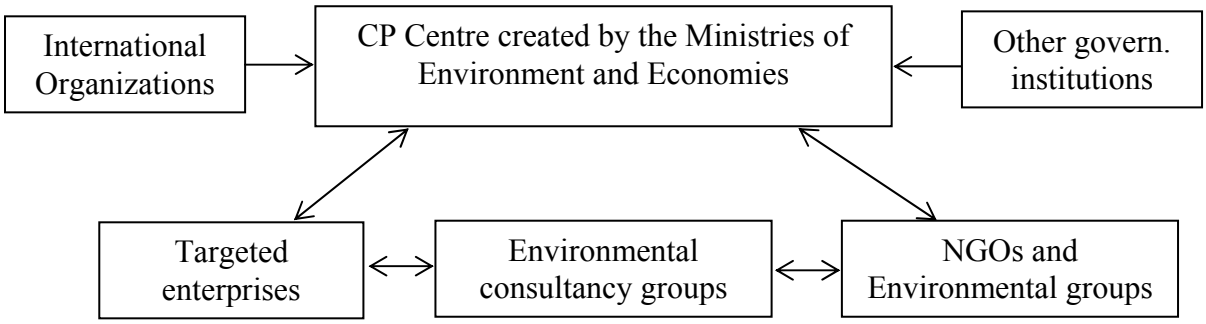
One of the significant aspects relating to the operation of the CP centre in Georgia is the issue of sustainability once projects are completed. Long-term sustainability of the CP centre in connection with the possibilities to carry on the work without relying on external funding requires initially clarifying the legal status of the centre and its location within the environmental governance system of Georgia. One of the interviewees stated that "it is better to spend more time on the establishment and planning of the CP centre rather than to discredit this idea afterwards" (Gujaraidze pers.comm.). There are quite a few different thoughts how to organize the CP centre but the common understanding is that the CP centre should not be an isolated and narrow specialized agency and it should have good linkages with various stakeholders.

Interviewees mainly proposed three options regarding the possible legal status of the CP centre in Georgia.

Option 1

The CP centre can be established as a public law legal entity jointly by the Ministries of Environmental Protection and Natural Resources (MEPNR) and Economic Development of Georgia (Shotadze pers.comm. and Gujaraidze pers.comm.). The potential structure is illustrated in figure 6.

Figure 6. The CP centre created as a public law legal entity



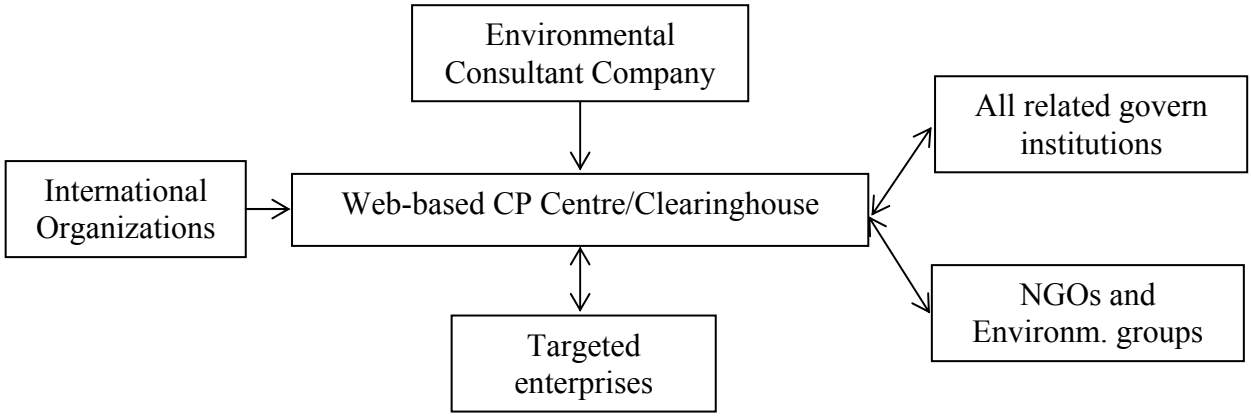
The advantage of this option is that "the CP centre might have own revenues and it can be funded by budgetary allocations at the same time" (Shotadze pers.comm.). Consequently, the CP Centre would not entirely rely upon international financial support and its sustainability is guaranteed. Furthermore, it should be pointed out that "at the initial stage the governmental involvement is needed to boost the idea" (Lomtadze pers.comm.) and "the only possibility for the future CP centre is the strong support of government institutions as well as private sector" (Girgvliani pers.comm.). Another positive side of this option is that the government will definitely take commitments and efforts more seriously when it makes some financial contribution to proposed activities.

However, there are also a number of weaknesses which have been highlighted. First, several interviewees asserted that it would be very difficult to establish strong links with industrial enterprises especially SMEs in view of the fact that governmental initiatives are generally met very cautiously by the private sector. Second, the promotion of the CP might be seen by enterprises as the governmental interference to businesses of the private sector. Lastly, one of the interviewees raised the issue of the cost and benefits since "new institutions can eat a lot of money" and "become just a bureaucratic machine" (Todua pers.commm.).

The same interviewee stated that "the location of the CP is a key issue…and let's think about a web-based CP centre through facilitation of an environmental consulting company". The idea seems to be extremely attractive and this option is demonstrated in figure 7.

Option 2

Figure 7. The web-based centre on the CP through facilitation of the consulting company



It is worth mentioning that interviewees from private companies mostly highlighted the importance to have access to the information regarding new technologies through the CP center. Therefore, the industrial sector is lacking of technical knowledge which can be enhanced through "the establishment of a so called Technology Transfer Centre" (Todua pers.comm.). This CP centre can have the clearinghouse functions providing the information about all kind of technologies: cement, asphalt, wood, textile, food production, chemicals, construction, mining etc.

Moreover, an important component of successful technological transfer programmes is the trust between the service suppliers and beneficiaries (Atkinson 1994). Accordingly, if the private sector trusts the CP centre it will definitely work (Todua pers.comm.). The encouraging side of this option is that the CP centre will be unquestionably interested in being widely known as the consulting centre and it will select technologies which are appropriate for companies. Besides, some information can be free of charge and some cost money (Todua pers.comm.). Jorgensen (1999) states that the CP programmes mainly assist to disseminate the technical information through development of databases, publications and technical query consultancy responses. Additionally, the consulting company can deliver training to personnel and even bring and install such technologies given that they are interested in providing high quality services.

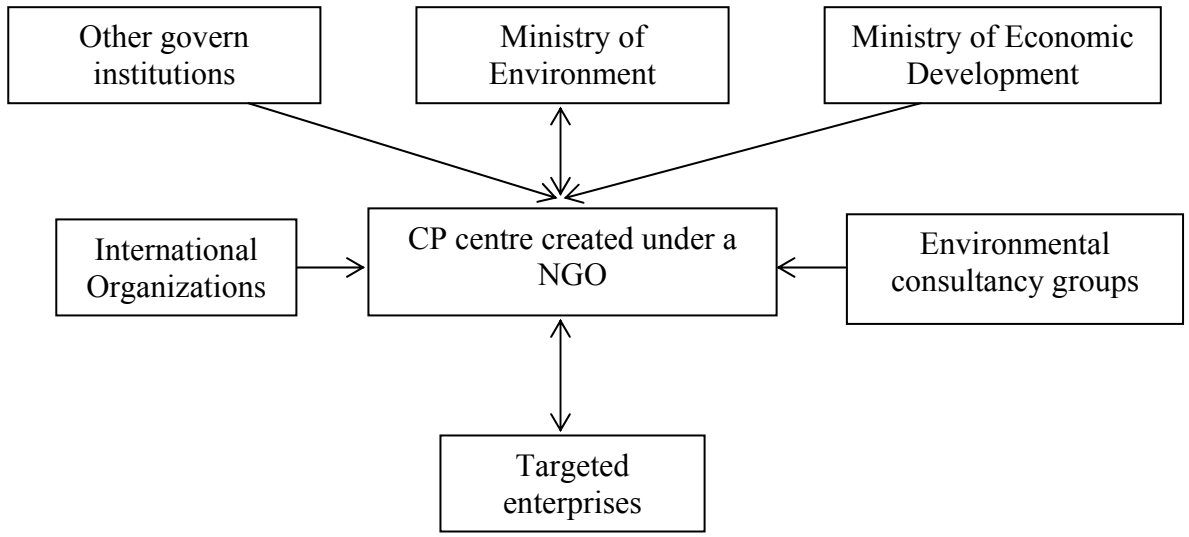
At the same time, several interviewees pointed out shortcomings of this approach. One of the general remarks was that the CP Centre would have limited access to the decision process in

the country. Consequently, the Centre would not play an active role in establishment of a policy framework leading to the widespread adoption of CP polices and strategies. Furthermore, it is foreseen that this type of organization will focus its work predominantly upon the industrial sector and the awareness and understanding of governmental, regional and local authorities as well as general consumers would not be enhanced or improved.

In this regard, a third option was proposed by a number of interviewees to locate the CP centre under a strong and influential NGO which has well-built links with other stakeholders (Figure 8).

Option 3

Figure 8. The CP centre created under a NGO



Actually, this option was partially applied by international organizations when CP centers were established under the "EE and CP" NGO and REC Caucasus. It is interesting to study how interviewees see the application of this option following experiences with previous centers. "Certainly, the CP centre can be created by one the NGO with the strong involvement of governmental authorities" (Girgvliani pers.comm.). "CP centre can be established by the NGO sector but it should be very closely affiliated to the Government and, consequently, Memorandum of Understanding (MOU) should be signed for enhancement of the cooperation" (Shotadze pers.comm.). "The CP centre should have solid backing of governmental authorities especially from the MEPNR of Georgia" (Suladze pers.comm.).

The majority of the interviewees expressed the need for the establishment of the Steering Committee which can facilitate the engagement of various stakeholders in CP related activities. The establishment of the Steering Committee also helps to promote awareness among the key players and allows for a straightforward resolution of the issues facing the CP centre.

Finally, the importance of the introduction of permanent monitoring and evaluation programmes regardless of the legal status of the CP Centre is a significant component of CP related activities. It is essential to permanently evaluate short and long-term impacts of the CP center's activities in connection with improvements of environmental performances of the industrial sector through results-oriented indicators. In addition, the ability of the CP centre to create partnership with decision makers and international organizations in setting the CP policy framework should be closely monitored.

5.2. CP related regulatory aspects: analysis of environmental legislation system in connection with the industrial sector of Georgia

Analysis of recent regulatory changes in field of the environmental protection

In Georgia, the legislation system in the field of environmental protection has been repeatedly modified and changed. One of the interviewees asserted that "the government considers strong environmental legislation as the barrier to the transition towards market economy and the decision makers extensively diminish environmental obligations of enterprises" and "the current policy is that Georgia has to initially develop its economy and, later, the country can care about the environment". Furthermore, another interviewee continues the same idea that "the strong environmental legislation is considered as the obstacle for the economic development of the country and the government tries to make it simple as much as possible". On the other hand, a number of interviewees spoke about positive features of ongoing legislative reforms which "lead to simplification procedures, less corrupted environment, well-organized environmental management as well as business and private sector developments in Georgia".

It is interesting to look at the main directions of reforms in this field. First, the introduction of new Law of Georgia on Licenses and Permits (adopted June 24, 2005) is to be highlighted since it has significant impacts on the operation of the entire industrial sector and permitting system in Georgia. In the previous law on Environmental Permits (1996), all activities were divided into four categories and all of them were subject to an environmental permit. Furthermore, activities in the first category were required to obtain environmental permit and develop EIA as well. In the new law, there are only two categories: the list of broad-spectrum activities incorporated in the first category is only subject to a permit and the second category includes all other activities which do not require a permit any more and they are not regulated by this law. As a result, the number of activities requiring the permit has been considerably decreased. A few interviewees fully support reforms because "it is an excellent way to give a fresh breath for the private sector and decrease the bureaucracy procedures" but other experts raised the concern about "companies especially SMEs which can do whatever they want" and "the delay in the introduction of new and clean technologies by SMEs because of the absence of any requirements to do so". It also should be mentioned that the new law on the environmental impact permit was adopted in 2007 which defines all specific activities subject to environmental impact permit and EIA.

Second, several large industrial enterprises still operate without environmental permits because of the loophole in the previous law (OECD 2006). The new Law of Georgia on Licenses and Permits contains the new provision requiring old enterprises to obtain the environmental impact permit and prepare EIA before 1st January of 2009. Together with EIA, the set of documents is to include: volume and types of expected emissions (stationary sources of emission and emission inventory report, maximum allowable emission/discharge reports), and executive summary with description of the planned developments. Several interviewees highlight that this requirement definitely is a good initiative to back up the introduction of new and cleaner technologies in the old large industrial enterprises.

Third, the most controversial are decisions regarding activities of enterprises (covering about 95% of SMEs) which are not subject to an environmental impact permit. The licenses for water withdrawal and discharge are abolished for such enterprises. Furthermore, these companies are not required any more to prepare the report on maximum allowable emissions into the atmospheric air. Instead of all these legal requirements and licenses, enterprises have to comply with technological regulations which are a set of requirements for each pollutant

(one for all types of industries) to be followed by enterprises. This new legislation act has been prepared but not approved yet. As one interviewee said "it is not understandable whose experiences the administration follows and how the self-regulation especially for withdrawal of water can be followed if once most of enterprises could wish to take water from the same river". Actually, representatives of enterprises also stressed the importance to have clear requirements since such initiatives could "generate confusion" and establish "unhealthy competition between enterprises" leading to the deterioration of natural resources. In this regard, ANZECC (1998) asserted that the pollution licensing system also has benefits for the industrial sector because it provides certainty to the private sector by setting clear guidelines and objectives for emission levels, and clear penalties for non-compliance. One of the interviewees stated "when government talks about the simplification of administrative procedures for licensing and permitting systems, the environmental legislation is mostly suffering. Certainly, simplification is needed for other procedures but not for the environmental. Everybody understands that environmental procedures are safeguards for the population and these legal requirements should be in place to protect us and future generations".

Lastly, quite a few interviewees stated that Georgian regulations do not encourage any kind of specific improvements in the environmental performance of enterprises or wise management. However, two possibilities were emphasized when businesses can introduce new technologies without internal legal requirements. One of the conditions is the orientation of enterprises towards export to countries which have stricter environmental regulations like EU. One expert highlighted "If there are requirements for imported goods to be met by ISO 9000 or 14000 standards, these requirements can be taken into consideration in Georgia. Otherwise, it is a very minor chance that the management of companies themselves will introduce something new in their respective enterprises". The second possibility is if the company is overtaken by a foreign partner and "the investor considers it as a matter of priority to improve the image of the owned enterprise" (Chkobadze pers.comm.). Actually, this has happened a couple of times especially in the sectors of chemical and cement production which are the major polluters at this moment.

Voluntary agreements to promote new and clean technologies in Georgia

Krarup (2001) clarifies that voluntary agreements are generally made between the governmental authorities and enterprises. In Georgia, four large companies namely Heidelberg Cement Georgia – Saqtsementi, Batumi Oil Terminal Limited, Batumi Sea Port Limited, and JSC Madneuli have signed the Memorandum with MEPNR of Georgia for environmental programmes in their respective companies prior to obtaining the environmental impact permit. It is worth mentioning that all companies have been recently privatized by foreign investors. In this regard, one of the interviewees stated that "the large companies do care to protect the environment because of foreign investments" (Todua pers.comm.). Another interviewee from MEPNR highlighted that "opportunities to introduce CP related activities are higher if a company is overtaken by a foreign partner since a new owner considers as an important issue to protect its own business image and the company definitely alters outdated technologies". In fact, voluntary agreements with these companies can bring about significant improvements in the field of environmental protection since the enterprises participating in the exercise are quite large polluters at this moment.

Lindhqvist (2001) stresses that voluntary agreements "have been used to address a range of policy issues, including product related concerns, pollution and energy efficiency targets, and reporting requirements". Table 11 illustrates the details of each company's environmental action plan approved under the agreements.

Table 11. Environmental programmes introduced by companies through voluntary agreements with the MEPNR of Georgia

The name of enterprise	Date of signature	The list of some environmental activities agreed by the parties
JSC "Madneuli"	10 February of 2007	- Carrying out the Environmental Audit work in Madneuli according to the International Standards. (2007 January-March); - Rehabilitation of the pumping equipment (pumps, pipes) (2007 February- April); - Choosing new places for the new waste/low grade dumps and create new project designs (2007- 2008 years); - Reconstruction of the collector buildings of the waste water from the dumps (2007 February-August); - Widening of the roads for transportation of ore and place new the road signs (2007 February-April); - Waste dump and tailings dams re-cultivation operations of (2007 April- November, 2008 April- November); - Repairing of pipes towards the tailings dumps (2006

		November – 2007 April); - Re-equipment activities of pit water cleaning building technical facilities (2006 December, 2007 October) - Create a technical report about pollution in stationary water on the pollution of the atmosphere air by contaminants (2007 June-July); - Rehabilitation of atmosphere air contaminants stationary water suction (aspirator) systems (2007 December); - Obtain the water parameters on locations for water extraction and water usage (2007 October).
Batumi Oil Terminal Limited	20 August of 2007	- Implement ISO 14001 Environmental Management Standard (2007-2008); - Implement technical and managerial procedures for improvement of water consumption records (November 2007); - Carry out stepwise reconstruction and upgrading of waste water cleaning facilities (2007-2008); - Carry out stepwise renewal and upgrading of aspirating system (2007-2008); - Improve waste management system (2007-2008); - Conduct PSB containing transformer oil survey (Sep. of 2007); - Conduct asbestos containing materials survey (Aug. of 2007)' - Conduct the independent environmental audit and draw up the Environmental Impact Assessment Report (01/08/08 – 30/09/08).
Batumi Sea Port Limited	20 August of 2007	- Drawing up an environmental protection management plan (November 2007); - Working up a rehabilitation of drinking household water-supply systems (April 2008); - Working up a stepwise plan of rehabilitation and reconstruction work of drainage-household sewerage systems (April 2008); - Acquisition of the modern type new skimmer for cleanup of oil-spill and its remains from sea surface (December 2007); - Testing transformers oils on PCB-content and implementation of a corresponding arrangements (November 2008); - Elaboration and implementation of environmental monitoring plan (November 2007); - Carrying out the independent ecological audit and preparing the environment affect assessment report (August 1-September 30, 2008).
Heidelberg Cement Georgia – Saqtsementi	28 November of 2007	- Schedule and implement air pollution preventive complex actions. Namely, carry out renewal and upgrading of systems of air pollution stationary sources aiming achievement of permissible limit values for air pollution (2008); - Conduct the independent environmental audit and draw up the Environmental Impact Assessment Report (30/09/08).

Source: MEPNR of Georgia and JSC "Madneuli" 2007, MEPNR of Georgia and Batumi Oil Terminal Limited 2007, MEPNR of Georgia and Batumi Sea Port Limited 2007, MEPNR of Georgia and Heidelberg Cement Georgia – Saqtsementi 2007

The analysis of the agreements reveals that JSC "Madneuli" has more concrete and detailed action plan for environmental programme than other companies. In case of Heidelberg Cement Georgia – Saqtsementi, the agreement typically comprises general statements and

obligations. Only one company - Batumi Sea Port Limited works for implementation of ISO 14001 Environmental Management Standard. In addition, the administration of enterprises mostly focuses on "end-of-pipe" emission management rather than on the study of the production processes and CP approaches which will be much more cost-effective at this stage. The interviewees from enterprises stated that these are first attempts to improve environmental performance and CP measures are considered as the next step for further development of companies. Finally, it is important to mention that interviewees from MEPNR of Georgia confirmed that all four companies are implementing voluntary actions in due time.

It seems also relevant to highlight that there are no proposals from locally owned companies to take voluntary commitments. One of the interviewees said "If there are no requirements in the law, no one from the local companies will do voluntarily actions". Another interviewee raised the extremely interesting point that "CP is the tool for better management and it is not a tool for pure environmental protection. It is also not necessary to have very stringent environmental regulations. The work of governmental authorities is to make the profit oriented private companies aware of the CP benefits since CP can help provide savings and increase profitability which is considered by SMEs as the driving force".

In addition, many interviewees raised problems in connection with operations of local SMEs because "there is no tracking of environmental performance of these companies" (Chkhobadze pers.comm.) and "lack of capacities to enforce regulations to protect the environment especially in SMEs" (Todua pers.comm.). Therefore, a special study is needed to assess needs and challenges facing SMEs regarding introduction and promotion of new and clean technologies in Georgia.

Enforcement of environmental legislation

The enforcement of environmental legislation is an extremely important issue since the infringement of laws can lead to the deterioration of public health and the environment itself. Actually, environmental legislation generally is weakly enforced because of absence of the political will and insufficient resources given to enforcement agencies (Redclift and Woodgate 1997). The verification of enforcement of environmental legislation in Georgia is under the responsibility of the State Inspectorate for Environmental Protection and its regional

bodies. The inspectorate has the power to impose sanctions if enterprises are in non-compliance, including fines and requests to the court for suspension of activities.

Most interviewees emphasized that the State Inspectorate for Environmental Protection mainly concentrates its work on checking compliance in the field of natural resources or checking sites for logging. The Inspectorate does not focus on the pollution control and pollution prevention issues since "it is not considered as their priority activities" (Gujaraidze pers.comm.). The World Bank Group *et al.* (1999) emphasized that "enforcement needs not only a clear legal basis and technical expertise but also broad political support". Furthermore, one interviewee said that "large enterprises have environmental permit but nobody is to check whether they meet requirements of the legislation". Another expert also stressed that "the inventory of emissions is made by companies themselves and this information has never been checked by the inspectorate. Consequently, enterprises can generate a high level of pollutants without any control and there are obviously no incentives to introduce cleaner technologies".

In fact, the Inspectorate was established in 2005 and a lot of efforts were made by the administration to build the capacity of new agency for performing the required tasks. The Inspectorate made an excellent progress in some above mentioned fields but the pollution control currently is the weakest side of the Agency. One expert said that "in the Agency, the most challenging issue is the lack of trained personnel and appropriate knowledge to implement policy and legal objectives". OECD (2006) emphasizes that the Inspectorate's institutional capacity in Georgia should be definitely strengthened and "inspectors would have to be well informed on applicable BATs and… respective permit conditions". Finally, many experts underlined about the necessity to equip the inspectorate with appropriate tools which should definitely help performing required tasks.

5.3. Economic instruments to achieve implementation of CP measures in Georgia

As it was described in the case study, Georgia has experienced a rapid growth of its economy in recent years. It is obvious that economic development should be considered as the matter of priority for the government in order to improve the overall welfare of the population. Moreover, improvements in the operation of the industrial sector are the key factors for success of ongoing reforms in an attempt to build the competitive economy. At the same time, the public health and environmental protection issues are to be also emphasized and integrated

into the policy agenda of the state. Therefore, the clash between the immediate urgent needs for economic development and environmental protection is an ongoing challenge for Georgia.

It has been proved in many countries that CP creates economic benefits and saves money to enterprises as well as results in significant improvements in environmental performance of companies. Therefore, it is interesting to study the main economic factors, which put obstacles to the successful implementation of CP principles by the industrial sector of Georgia. The research demonstrated that modifications of legislation for the period of the last two years resulted in a cease of existing economic instruments which could potentially promote clean technologies in Georgia. In this regard, one of the great challenges is that fees on the pollution of the environment with harmful substances are currently abandoned. As one interviewee highlighted "Georgia canceled environmental fees despite the recognition of the Pollutant Pays Principle in the environmental laws".

In fact, environmental fees are unquestionably useful economic instruments which can create incentives for improvement of technological cycles and, accordingly, enterprises can reduce emissions with the intention of avoiding high taxes. However, the government tries to reduce and cancel any taxes which it considers an obstacle for economic development. In this regard, one interviewee stated that "decision-makers do not consider that the utilization of environmental taxes can bring about long term economic, social and environmental benefits as well as raise incentives for enterprises to adopt CP related measures".

Moreover, many interviewees talked about the lack of incentives and support measures to enterprises which want to introduce new and cleaner technologies. First, there is a lack of credit schemes for enterprises especially SMEs to update the technological process and introduce cleaner technologies. At present, banks have extremely high interest rates because of the absence of the state policy in this field. It is very important to promote special credit schemes for CP investments which can encourage investments in new technologies. Second, a few interviewees from the industrial sector talked about the need to introduce tax deductions on new and cleaner equipment which can help boosting the application of better practices in Georgia. One of the experts asserted "taxes levied on the purchase of new equipment are extremely high and there are no any incentives for companies to set up cleaner technological cycles". Lastly, one interviewee proposed to "reduce general (income/profit) taxes for one or

two years in order to leave more money for the development of business if an enterprise agrees to introduce new technologies".

In addition, one interviewee talked about "instability of rules of the game at the market and frequent changes of governmental requirements". The same expert proposed the way forward which is particularly valid for transitional countries including Georgia: "Actions of the government should be predictable to the industrial sector and, as a consequence, enterprises should have a clear picture about priorities and strategies of the country for the next 5 years at least. Furthermore, the planning system should be improved and the country should clearly declare goals and objectives for short and medium period of time." In this regard, the research also shows that the lack of communication between the industrial sector and government is one of the major challenges for adoption of CP measures. One expert highlighted "the government should have permanent contacts with the industry in order to make a right choice regarding proper policy and economic instruments which they are going to apply and find correct ways to achieve objectives".

Lastly, one important point was raised by several interviewees regarding the absence of the Environmental Fund in Georgia. The World Bank Group *et al.* (1999) highlight that Environmental Funds are considered as extremely useful financial mechanisms established to resolve inadequate funding level for environmental projects. The establishment of such a Fund in Georgia will be definitely an important step in dealing with a wide range of environmental challenges and it can provide a great support for implementation of CP investment measures in the industrial sector of Georgia.

5.4. Demonstration projects as tools for quick and efficient adoption of CP principles in Georgia

Demonstration projects are considered as extremely useful tools for the introduction of CP principles at the national level (ADB 2002). A number of important issues have to be raised in connection with demonstration activities in Georgia. First, the selection process of demonstration companies is extremely important because "demonstration projects can be useful only for sectors where there are many companies. Moreover, a company should be interested in the CP and has to contribute some funds as well as it should make some noise

after the implementation in order to force others to be interested in the CP" (Todua pers.comm.). In fact, one of the limitations of the TACIS demonstration project was that the pilot projects were implemented in sectors where currently there are not many players.

Second, the research revealed that demonstration projects are good tools if they have been scaled up. One of the interviewees emphasized that "when the demo projects are implemented the sustainability plan and replication strategy are to be developed and the work should be concentrated on the establishment of the enabling environment and advocacy activities" (Shotadze pers.comm.). Another interviewee also stressed that "in Georgia, the only thing which works is that people look at each other and copy from each other since companies especially SMEs perfectly know who does what and they look carefully at the market" (Todua pers.comm.).

Certainly, the logic of the demonstration activities indicates that successful technologies tested during the pilot phase should be replicated by other companies operating in the field. Regrettably, EE and CP demo projects and TACIS pilot activities do little to bring about policy changes and to reach wide scale replications because of the absence of clear strategies, availability of resources, and political support. Furthermore, one of the interviewees emphasizes that a smooth and successful transition between demonstration activities and the wide scale replication has not been possible since "even support to pilot projects (equipment, training, procurement etc) was extremely slow because of TACIS bureaucratic rules and procedures and this process was very long and the companies were exhausted with such actions".

Third, it is interesting that most interviewees from large industries highlighting industrial activities such as cement and asphalt production as well as oil refinery processes and mining activities where demonstration projects can be unquestionably useful to implement. In case of SMEs, mostly they pointed out agricultural and food production sectors such as dairy products, wine production, food processing, flour mills and bakeries. The main areas for improvements in the production processes were typically mentioned energy and water efficiency measures. Actually, energy and water consumption represent a major operational cost for many enterprises and their savings can bring about a significant increase in the profitability of companies.

Fourth, the information dissemination about demo projects is a crucial aspect for further adoption of CP principles. The interviewees from the industrial sector said that the information on EE and CP centre and TACIS pilot projects has not been disseminated properly. There are a number of issues to be addressed such as the stakeholders' participation in the preparation of pilot projects as well as transparent procedures in the selection and testing of technologies. Moreover, the important issue is the availability of the information concerning the economic feasibility of new technologies, technical sustainability, institutional aspects, regulations and other governmental activities in the field which should be shared with representatives of enterprises. One of the interviewees from the private sector expressed the essential role of the CP centre "in dissemination of the information on results and experiences gained from various activities". Therefore, it is important that "the intensive informational support is organized and initial training and awareness workshops are launched before the implementation of CP measures" (Girgvliani pers.comm.).

Finally, one of the interviewees raised an important issue about CP demonstration projects which "should be cost neutral projects". He emphasized that the TACIS project had some extra money which went to the companies and there were produced some bias overall results. Another expert said that "maybe technologies were too expensive and could not fit Georgian conditions for that reason the replication has not happened". Moreover, she highlights that "there was no maybe a market demand on such improvements". The important point is that there has not been done any post monitoring study about projects which were implemented in Georgia through assistance of the international organizations. It becomes clear that without the thorough evaluation of previous activities as well as results generated from executed projects, the implementation of new demonstration projects or other actions in the field presumably would not result in widespread adoption of cleaner technologies in Georgia.

5.5. Possibilities to integrate the CP concept and approaches in the implementation of Multilateral Environmental Agreements (MEAs) in Georgia

The CP concept and approaches can be utilized by various Multilateral Environmental Agreements (MEAs) in an attempt to facilitate and expand effectiveness of their implementation at the national level. CP can be considered a method and effective tool for achieving some targets which are quantified and set by MEAs. Majority of the interviewees

highlighted the Kyoto Protocol of the United Nations Framework Convention on Climate Change and the Montreal Protocol on Substances that Deplete the Ozone Layer are two MEAs where CP can have the great impacts on the compliance and enforcement issues.

First, the integration of CP approaches seems to be important for the implementation of projects under the Clean Development Mechanism (CDM). One interviewee stressed the importance of using "best practices of CP in different fields (e.g. oil refineries, cement and asphalt production, dairy products, processing industry such as canning, drying, freezing, and preparation of juices, jams, and jellies, textile production etc) which can be definitely practical to apply in the industrial sector of Georgia" (Verulava pers.comm.). It is important to bring up one issue which has been highlighted many times by various interviewees. The CDM mechanism similar to the CP concept is still not seriously considered as the tool which can bring about technological improvements which result in increased profitability and better environmental performances. At the moment, only one project "Landfill Gas Capture and Power Generation Project in Tbilisi" under the sectoral scope of energy industries (renewable-/nonrenewable sources) and waste handling and disposal is registered.

There are a few project proposals mostly in the energy sector and only one project from the industrial sector - "Nitrous Oxide Emission Reduction at Rustavi Enterprise "Azoti" is under negotiation. Based on the research, a number of challenges were identified and analyzed. First, the industrial sector does not possess appropriate knowledge about benefits of CDM and funds available for mitigation activities under the Kyoto Protocol. Furthermore, the industry does not have access to the information and related procedures and "there is a general fear of the unknown actions linked with CP or CDM" (Shvangiradze pers.comm.). It is interesting to quote one interviewee: "Can you imagine procedures that the company should go through? Certainly, large companies heard about the Kyoto Protocol and CDM mechanism but they do not know what kind of projects can fit them. They do not have any idea what is GEF, MLF, UNDP, project cycle, CP measures etc and they are afraid of possible administrative problems connected with these mechanisms." (Todua pers.comm.). As a result, no one from the representatives of the industrial sector expressed an interest in CDM participation.

Second, decision makers are not aware of opportunities existing under MEAs. "They are not fully aware of existing obligations as well as opportunities and there is no support from high level governmental officials to promote such mechanisms" (Gujaraidze pers.comm.). Also,

the problem is that procedures of the international organization are very difficult, slow and complicated. It happens very often that strategies of the Government do not fit strategies of donor organizations and vice versa. At present, the Second National Communication under the Kyoto Protocol is ongoing and one of the objectives is "to involve all stakeholders and raise the awareness of the decision makers about CDM and potential benefits" (Shvangiradze pers.comm).

Lastly, CDM projects need serious support from the consulting sector in Georgia. "The present capacity is extremely low and the industrial sector itself can not prepare such complicated studies and documents. The CP centre can take care of all these issues." (Girgvliani pers.comm.). This is an important point in view of the fact that the majority of large projects and studies are done by international consultancy groups due to the absence of the local expertise in the field.

In Georgia, the positive example when CP measures have been incorporated into the actions under MEAs is the Montreal Protocol. There has been implemented one small scale project "Incentive Programme for the End–Users in the Commercial/Industrial Refrigeration and Refrigeration Transport Sub-Sector" where energy efficiency and CP measures were linked and successfully implemented. The project required each enterprise to contribute about 50% from the necessary total investment. It is interesting to mention that 15 enterprises have participated in the project's activities because of "economic feasibility of proposed measures and short payback period" (Suladze pers.comm.).

Results of the research show the importance of implementation "Debt-For-Environment Swap" (DFES) which can provide "a unique opportunity to link debt reduction with global environmental benefits and poverty alleviation" (OECD 2006a). OECD (2006b) proposes five areas for consideration: biodiversity protection, small and mini hydropower generation, biogas production, municipal waste management, and wastewater management. Regrettably, currently the industrial sector of Georgia is not in the list of potential beneficiaries. However, a few interviewees emphasize "the importance of development of projects in the field and their submission to potential donors for further consideration" and "it will definitely receive support of investors because of the significance of the industrial sector for the economic development of the State".

5.6. Importance of the education in promotion of CP principles in Georgia

The long-term success of the implementation of CP principles will require the formation of adequate professional capacity which can be provided through vocational schools, training centers, and universities. However, it is important to realize that the educational system for CP can be definitely better organized in the course of the governmental efforts to develop and approve the strategy on the broader environmental education of the entire society. There is an urgent need to work out a State Program on Environmental Education and Awareness which can incorporate the CP concept and principles.

Based on the research, it is getting obvious that the professional school system, which has recently received support of the Government through the State programme "Professional Education Supporting Programme", is the best opportunity to introduce CP principles into the educational system of Georgia. According to the State Programme, the Government will provide "public financing of 38 professional training centers and 19 secondary professional educational institutions" (Ministry of Education and Science of Georgia 2007). It is important to develop "the sustainability plan which helps building the long term capacity of vocational schools since they are lacking professionals and requiring investments in the equipment and tools" (Suladze pers.comm.).

One of the objectives of the State Programme is to develop new curricula for professional schools and preparation of competent certified experts. It is the right time to initiate the development of the CP related materials in order to ensure that scholars are trained in "good practices", which can help raising their qualifications and can greatly assist in the future professional career. There is a huge room for improvements since "the environment is still considered separately from a good performance" (Lomtadze pers.comm).

Many interviewees brought the issue of the absence of environmental training centers which can build the capacity of the industrial sector's employees, decision-makers, and other stakeholders in the field of environmental protection including CP. Heart (2000) emphasized that training and education for CP approaches have become indispensable for various professions. First, it can be assumed that most of employees in industries need to have the knowledge on CP, EMS, ISO and other modern environmental tools in order to increase the quality of operations. As Venselaar (1995) states everyone working in enterprises should

possess some knowledge in the environmental field applicable for her or his work, even though not to the same extent.

Second, quite a few interviewees talked about importance to have a special training progamme for governmental officials since many decision-makers see environmental regulations as the obstacle for development of businesses. In this regard, "CP is the best approach to show how the operation of the industrial sector and environmental protection actions can lead to the mutual benefits" (Lagidze pers.comm.). Again, the established CP centre can take the responsibility to set up the training programme in order to enhance the basic knowledge on CP. Lastly, web-based resources can be used to support self-directed education, and as a means of providing multiple perspectives and alternative standpoints (Heart 2000). Several interviewees support the idea since this initiative is valuable for stakeholders who wish to acquire the appropriate knowledge in this field in a cost-effective manner. However, the internet is still not used by large part of the population especially outside of the capital and, consequently, this approach can be basically useful in the future.

The research shows that many experts support the idea to include into the curricula of universities the CP concept and principles particularly in specialties such as engineering, business administration, marketing, technological practices and others. One of the interviewees from MEPNR stated "If universities address the issue of CP related education, students will become more aware and, as a result, it supports to have the next generation of decision makers and managers who will be conscientious about CP and good practices". Another interviewee proposed a number of subjects for future curricula of universities such as introduction to sustainable production and consumption, environmental economics, CP and Life Cycle Assessment (LCA), hazards and risk-based techniques, energy and water efficiency measures, waste management and other relating topics (Girgvliani pers.comm). Therefore, it is essential to provide students with a good practical grounding in the application of Best Available Techniques (BAT).

Many interviewees stressed the importance to provide a basic knowledge for students with regard to the Multilateral Environmental Agreements such as the Montreal Protocol on Substances that Deplete the Ozone Layer and the Kyoto Protocol of the United Nations Framework Convention on Climate Change regarding the emission to air of global warming substances as well as national legislation and regulations on the subject of emissions to air,

wastewater discharges, disposal of solid wastes, management/transport of hazardous wastes, Environmental Impact Assessment (EIA), Cost-Benefit Analysis (CBA), procedures and penalties for non-compliance. Moreover, students from technical departments should be provided with opportunities to perform most of the techniques such as general and environmental auditing, CP or technological process assessment as well as health and safety reviewing.

In view of the fact that Georgia announced its aspiration for joining the European Union in the future, it is crucial to include into the curricula the following CP related subjects: Integrated Pollution Prevention and Control (IPPC), eco-labeling, waste electrical and electronic equipment, packaging and packaging waste, urban wastewater treatment, emissions permit trading, mandatory disclosure of (environmental) information etc. It is essential to implement these activities since "the major current challenge is the lack of knowledge, expertise and professionalism in the field of environmental protection particularly in the industrial ecology and CP" (Gujaraidze pers.comm.).

5.7. Stakeholders, consumers and general public awareness for promotion of the CP concept in Georgia

In order to expand political support for the adoption and promotion of CP principles, it is also necessary to raise general awareness of consumers and the entire public regarding benefits arising from application of cleaner technologies in the industrial sector. The greatest challenge is how to integrate issues relating to cleaner technologies into the agenda of public concern in Georgia, which is a transitional country with various political, economic and social problems. The current research has brought some proposals from the interviewees which are summarized and presented below.

A few interviewees emphasize that a focus of the awareness raising campaigns should be directed to the health impacts occurring because of the pollution by enterprises of atmospheric air, water, and soil. The reason is that the general public is commonly unaware of the dangers posed by the poor industrial processes and the current public pressure on improvements is extremely little in Georgia. Furthermore, one of the interviewees said "it is necessary to make known that children are predominantly at a risk and our actions can significantly reduce this

threat" (Suladze pers.comm.). Therefore, the common view is that consumers can play an important role in forcing enterprises to improve the performance and introduce cleaner technologies.

The research shows that there is a lack of interest in and coverage from the mass media for the issues regarding operation and performance of the industrial sector. One interviewee stated that "the commercial nature of the broadcast media or periodical press dictates the rules and, as a result, environmental challenges are not highlighted in view of the low public interest." In contrast, another expert highlighted that "the public may be interested but a number of mass media representatives do not wish to disturb large and powerful businesses without political support". Many interviewees said that TV programmes and the press mostly cover official statements, press releases and/or articles which have been developed by large commercial enterprises themselves.

The great importance of raising awareness of various stakeholders whose support in the implementation of CP principles is particularly required: business managers and trade union leaders, teachers and researchers from universities, consumer associations, NGOs and civil society groups, journalists from all types of mass media and many others. Additionally, one interviewee from the industrial sector brought the issues of "absence of the technical literature and information in Georgian language which is an obstacle for local enterprises especially SMEs". He also talked about difficulties to "follow complex reports and documents which are typically bulky and contain hundreds of pages. It is vitally important to translate these complex documents into user-friendly and action-oriented language".

Quite a few experts talked about the importance to encourage and support manufacturers to educate consumers on products which are produced in the environmentally friendly ways. Regrettably, eco-labeling is still not widely recognized in Georgia as a tool for promoting and encouraging better environmental performances of enterprises. Furthermore, trade chambers, business associations and professional unions are very weak in supporting industries which have better environmental performances. There is a lack of exhibitions and trade fairs for showing and highlighting environmentally friendly products, tools and equipment. As a result, consumers normally are not aware of the existence of products which are produced by cleaner technologies and their environmental significance.

Finally, the follow-up issue which has been raised by several interviewees is the lack of public awareness activities in this field. Some experts mentioned actions which can help promoting CP principles in Georgia. It is interesting to stress that interviewees mainly named as an initiator of such actions governmental authorities at present or the CP centre in the future. The proposed actions included the following types of activities: organization of industry exhibitions and trade fairs, development of easy language guidelines for consumers to distinguish environmentally friendly products, hand over special awards to companies contributing in promotion of clean technologies, conducting of inventories of bad and good performers (enterprises) and making the list available for the general public, and organization of annual briefings to update stakeholders and the general public with information about achievements and challenges of producers.

6. Recommendations

The following concrete measures are suggested as recommendations for future actions which can stimulate the introduction and implementation of CP measures in Georgia.

The Governmental policies and strategies:

1. It is important to develop the National Action Plan for the implementation of the CP concept in Georgia which can be a set of actions comprising clear short and medium term objectives with time specific benchmarks to support and encourage enterprises to adopt CP.

2. CP principles should be incorporated in the second NEAP since the document is a basis for the implementation of environmental initiatives, activities and actions for next five years in Georgia.

The strengthening of the institutional capacity:

3. The strengthening of institutional mechanisms should be done through the establishment of the National Cleaner Production Center (NCPC). The strong involvement of governmental authorities particularly the MENRP is essential in order to allow the CP Centre persuade decision-makers to establish the policy framework leading to the widespread adoption of CP polices and strategies.

4. The establishment of the Steering Committee under the MENRP is an important step for creation of the political platform to discuss and apply new policy approaches, instruments, methods and tools for implementation of CP principles.

Regulatory framework for CP implementation

5. A number of specific regulatory changes should be carried out in order to encourage the private sector to better performances. First, licenses on water withdrawal and discharge as well as on maximum allowable emissions into the atmospheric air should be renewed taking into account simplified procedures, transparency and efficiency. Second, the Georgian

environmental legislation needs some new provisions which will focus on production and management changes rather than end-of-pipe solutions. Lastly, CP related targets should be applied through media specific laws in various areas namely the resource minimization, energy efficiency, waste management, and others.

6. Negotiated agreements, as a form of cooperation between the MEPNR and several large enterprises within an existing regulatory framework, prove to be an important tool for introduction of new and clean technologies in Georgia. There is a need to further promote such schemes with other large enterprises to attain negotiated levels of compliance for pollution reduction.

7. One of the main barriers to CP introduction and implementation in the industrial sector of Georgia is the lack of enforcement of environmental regulations. In this regard, the capacity of the State Inspectorate for Environmental Protection should be further strengthened which can allow the Agency to focus on the pollution control and pollution prevention issues.

Economic incentives for CP measures

8. There is an urgent need to provide special credit schemes for enterprises especially SMEs to update the technological process. The Government should ensure low interest rates of authorized banks working under the umbrella of CP.

9. Application of the Pollutant Pays Principle should be renewed in the form of fees on the pollution of the environment with harmful substances.

10. The extremely supportive measure will be the introduction of tax deduction schemes on new and cleaner equipment which can help boosting the application of better practices in Georgia.

11. The establishment of the Environmental Fund can be an important step in the field of environmental protection in Georgia since it allows to the MEPNR to implement the second NEAP. Also, the Environmental Fund can become a major source for execution of CP projects and other environmental programmes leading to improvements of the public health and environment.

Demonstration projects for promotion of CP measures

12. CP demonstration projects should be implemented in industrial sectors where they can result in wide scale replications and produce substantial results. As an example, it will be useful for large industries to implement demonstration projects in cement and asphalt production, oil refinery processes, and mining. In case of SMEs, CP demonstration projects can be implemented in agricultural and food production sectors such as dairy products, wine production, food processing, flour mills and bakeries.

The CP concept and Multilateral Environmental Agreements (MEAs)

13. CP principles should be considered by the MEPNR as a method and effective tool for achieving some targets which are quantified and set by MEAs particularly Montreal and Kyoto Protocols. CP can be greatly utilized by the private sector under CDM generating technological improvements which can result in increased profitability and better environmental performances of enterprises.

Implementation of CP related education in Georgia

14. CP measures should be introduced in new curricula for professional schools which are established under the State programme "Professional Education Supporting Programme".

15. The establishment of an environmental training center under MEPNR will be a very important step for the capacity building of the employees of the industrial sector, decision-makers, and other stakeholders in the field of environmental protection including CP.

16. The curricula of universities in specialties such as engineering, business administration, marketing, technological practices and others should be updated taking into account environmental issues including CP principles and measures.

Raising of public awareness for promotion of CP principles

17. The intensive awareness raising campaign should be organized by MEPNR in order to increase general awareness of consumers and the entire public regarding the benefits arising from the application of cleaner technologies in the industrial sector of Georgia. Public can apply additional pressure on decision makers and senior management of industries to accelerate adoption of better practices in Georgia.

7. Conclusions

In conclusion, it is important to emphasize that Georgia has experienced the considerable economic growth in the last several years. Economic reforms have resulted in the private sector-led industrial growth accompanied by the significant increase in environmental problems such as discharges of wastewater, release of hazardous substances into air, noise pollution, and generation of all types of waste. In this respect, Cleaner Production (CP) has gained world-wide recognition as an approach which can considerably decrease the pollution intensity of production processes. Therefore, CP can be understood as a solution to long time trade off between environmental protection and economic growth.

The research reveals that the CP concept and its principles can be implemented in Georgia leading to economic and environmental benefits to enterprises, consumers, and the entire society.

There is a common view that CP can bring improvements at the earliest stages of design and cost less than end-of-pipe solutions. The main contribution of the research lies in the evaluation and assessment of CP principles and tools which are suitable for Georgian conditions. First, the research showed that CP should be integrated into the policies and strategies managing Georgia's development. This is a crucial point since CP needs to have a political support which can back up the introduction and implementation CP measures in the whole scope of the country's industrial activities.

Second, findings showed that the implementation of the CP concept requires building institutional capacity of the country to facilitate partnership between the government and the private sector. The establishment of the National Cleaner Production Center (NCPC) through the strong involvement of MENRP seems to be a crucial point in the widespread adoption of CP in Georgia. Third, results of the research revealed that main regulatory barriers for adoption of CP measures are the weak environmental legislation system and its poor enforcement. One of the interesting findings with regard to large industries is that voluntary agreements prove to be an important tool for introduction of better practices in Georgia.

Fourth, the research demonstrated that there is a lack of economic incentives for implementation CP measures in Georgia. The way forward can be application of the Pollutant

Pays Principle, introduction of tax deduction schemes, establishment of the Environmental Fund, and development of special credit schemes for enterprises wishing to introduce new and clean technologies. Fifth, the implementation of demonstration projects seems to be very useful if they have been scaled up. The research also showed that there are opportunities to utilize CP as a method and effective tool for achieving some targets which are quantified and set by MEAs particularly Montreal and Kyoto Protocols. As an example, the implementation of the End-user demonstration project under the Montreal Protocol resulted in major benefits because of integration of CP measures into activities of the project.

Lastly, the need for formation of appropriate professional capacity on CP through vocational schools, training centers, and universities is evaluated and outcomes are presented. The research shows that it is also necessary to increase general awareness of consumers and the entire public in order to expand political support for adoption and implementation of CP principles in Georgia.

There are also many other aspects that the present research could not cover due to the time and resources constraints. For example, it has not been possible to study the view of representatives of SMEs regarding possible benefits or constrains arising from ongoing economic reforms. Moreover, there is a need for more thorough studies on application of economic and regulatory instruments which are key elements for CP adoption. Additionally, it is interesting to look at possibilities to introduce CP measures in a particular industrial sector and examine potential opportunities and barriers.

Finally, in spite of existing challenges in the adoption of the CP concept in Georgia, the industrial sector and the central government have to find ways for introduction of more effective industrial environmental management practices. This is crucially important to the country's future development since the adoption of CP practices leads to the creation of the policy framework which secures economic sustainability of enterprises of all sizes and sectors, boosts technological innovations, establishes competitive environment, and improves public health and environment.

APPENDIX 1. Questions for interviews

Questions for representatives of governmental authorities

- How would you describe the overall general environmental performance of the industry sector in Georgia?
- What do you think about existing opportunities for the industry sector to implement the Cleaner Production activities?
- In your opinion, what are main challenges or barriers in the introduction and implementation of new and clean technologies in Georgia?
- Which policies or policy instruments or institutions are needed, or changes in such a context in order to encourage the environmental performance of the industrial sector?
- What can you tell me about demonstration projects in the industrial sector? Are they helpful? If so, how? If not, in what ways? Are you aware about the TACIS CP demonstration project and companies benefited from it?
- What do you think about activities (projects, programmes, capacity building, technical assistance etc) under Multilateral Environmental Agreement (MEAs) for promotion of Cleaner technologies in Georgia?
- What problems do you see with existing institutional settings for promotion of the Cleaner Production and how could they be solved?
- In your opinion, what do you think about the role that a CP centre might play in facilitating CP?
- In your opinion, what is the role of education, training and other related activities in the field of Cleaner Production? What might improve these activities?

Questions for representatives of the industrial sector

- How would you describe the environmental performance of your company?
- To what extent does your company consider new and clean technologies? What further opportunities exist for promoting CP in your company?
- In your opinion, what if any are main challenges or barriers for your company to introduce cleaner technologies?
- What kind of support the company requiring for establishment of cleaner technologies?

- What is your opinion about demonstration projects in the industry sector? Are they helpful ?

- What measures if any does your Company implement or anticipate implementing with the purpose of ensuring new employees have knowledge on basic environmental issues?

- Are there any environmental initiatives to which your company pays special attention? If so, what are they and can you tell me about them?

Questions for representatives of NGOs and environmental groups

- How would you describe the overall environmental performance of the industry sector in Georgia?

- What do you think are current opportunities and challenges of the industry sector to promote CP in Georgia?

- In your opinion, what are the main obstacles to introduce cleaner technologies in Georgia?

- How would you describe the role of the central government and industry in the improvement of the industry sector's environmental performance?

- What do you think about NGOs activities in promotion of Cleaner Production concept in Georgia?

- In your opinion, would the development of a CP centre facilitate CP, and in what ways or what should be the role of Cleaner production centre?

- What is your opinion about demonstration projects in the industry sector? Are they helpful? Are you aware about the TACIS CP demonstration project and companies benefited from it?

- What do you think about activities (projects, programmes, capacity building, technical assistance etc) under Multilateral Environmental Agreement (MEAs) for promotion of Cleaner technologies in Georgia?

- If you (or your organization) are appointed as an advisor to the governmental authorities (the Ministries of Environment, Finance and Economy), the introduction of which policies or policy instruments or institutions would encourage the industry sector to improve its environmental performance?

APPENDIX 2. Personal Communications

N	Name	Position and the name of the organization
1.	Mr. Zaal Lomtadze	Advisor to the Minister, Ministry of Environment Protection and Natural Resources of Georgia
2.	Ms. Nino Tkhilava	Head of Integrated Environmental Management Department, Ministry of Environment Protection and Natural Resources of Georgia
3.	Ms. Marina Makarova	Head of Division of Water Resources Protection, Ministry of Environment Protection and Natural Resources of Georgia
4.	Mr. Alexander Mindorashvili	Main Specialist of the Water Resources Protection Division, Ministry of Environment Protection and Natural Resources of Georgia
5.	Mr. Grigol Tsotadze	Main Specialist of the Air Protection Division, Ministry of Environment Protection and Natural Resources of Georgia
6.	Mr. Tengiz Gordeladze	Environmental Officer, Batumi Oil Terminal LTD
7.	Mr. Shalva Ninidze	Environmental Department, JSC "Kaspi Cement"
8.	Mr. Zurab Gotsadze	Environmental Department, JSC "Rustavi Cement"
9.	Mr. Ilia Mtskhvetadze	Environmental Officer, JSC “Madneuli”
10	Mr. Vasil Gvelesiani	Chief Engineer, Georgian Manganese
11	Ms. Nona Karalashvili	Economis Programme Coordinator, Free University of Tbilisi
12	Dr. David Girgvliani	Environmental Manager, Environmental consulting company „Gamma”
13	Ms. Marina Shvangiradze	Project Manager, Georgia´s Second National Communication under the Kyoto Protocol
14	Dr. Sulkhan Suladze	Project Manager of Terminal Phase out Management Plan for Georgia under the Montreal Protocol.
15	Dr. Tengiz Lagidze	Professor of the State Technical University, independent expert in the industrial ecology
16	Ms. Mariam Shotadze	Environmental Programme Manager, United Nations Development Programme (UNDP Georgia)
17	Ms. Nino Chkhobadze (the	Head, Environmental League, NGO

	former minister)	
18	Ms. Lia Todua	Environmental Programme Manager, the Center for Strategic Research and Development of Georgia
19	Ms. Ketevan Gujaraidze	Policy Analyst, "Green Alternative", NGO
20	Ms. Neli Verulava	Director of the Center "Energy Efficiency - 21 Georgia", NGO

Reference List

Agardy, F. and Nemerow, N. 2005. *Environmental Problems and the All-inclusive global, scientific, political, legal, economic, medical, and engineering bases to solve them*. London: Academic Press

Air Protection Division. 2007. *atmosferuli haeris dabindzurebis stacionaruli wyaroebidan atmosferul haershi mavne nivtierebata gafqvevebis yovelwliuri angarishi* [The annual report on the emissions of hazardous substances into the atmospheric air from stationary sources]. Tbilisi: MEPNR of Georgia

Ashton, W., Luque, A., and Ehrenfeld J. 2002. *Best Practices in Cleaner Production Promotion and Implementation for Smaller Enterprises.* Washington: Multilateral Investment Fund (MIF) and Inter-American Development Bank (IADB)

Asian Development Bank (ADB). 2002. *Guidelines for Policy Integration and Strategic and Action Planning for the Achievement of Cleaner Production*. Manila: Asian Development Bank.

Atkinson. R. 1994. New models of pollution prevention technical assistance. *Journal of Cleaner Production* (2) Vol. 2: 101-106

Australia and New Zealand Environment and Conservation Council (ANZECC). 1998. *Towards Sustainability Achieving Cleaner Production in Australia.* Tasmania: ANZECC

Ayres, R. and Ayres, L. 2002. *A Handbook of Industrial Ecology*. Cheltenham: Edward Elgar Publishing

Bakken, P. 2001. Using Cleaner Production to achieve implementation of MEAs. *Journal of UNEP: Industry and Environment*, Volume 24 No. 1-2, January – June: 54-56

Bakradze, G. 1958. *Vozniknovenie i razvitie promishlennosti v Gruzii v 19 veke* [Beginning and Development of Manufacturing in Georgian in the 19th Century]. Tbilisi: Tipografia Glavpoligrafizdata

Becker, S. and Bryman, A. 2004. *Understanding Research for Social Policy and Practice: Themes, Methods and Approaches.* Bristol: The Policy Press

Boyle, C. 1999. Education, sustainability and cleaner production. *Journal of Cleaner Production* (7): 83–87

Brown, D. and Woods, N. 2007. *Making Global Self-regulation Effective in Developing Countries*. Oxford: University Press

Cassell, C. and Symon, G. 2004. *Essential Guide to Qualitative Methods in Organizational Research*. London: SAGE

Centre of Statistics. 1981. *Statisticheskii ejegodnik: Narodnoe xozaistvo Sovetskoi Gruzii* [Statistical Yearbook of Georgia: National Economy of Soviet Georgia in 1980]. Tbilisi: Sabchota sakartvelo

Clarence-Smith, E. 2001. National centers: delivering Cleaner Production. *Journal of UNEP: Industry and Environment*, Volume 24 No. 1-2, January – June: 48-51

Creese, R. 1999. *Introduction to manufacturing processes and materials*. New York: CRC press

Curtis, G. 2004. *Georgia A Country Study: A Country Study*. Whitefish: Kessinger Publishing

Department of Statistics. 2006. *Statistical Yearbook of Georgia for 2006*. Tbilisi: Ministry of Economic Development of Georgia

Energy Efficiency and Cleaner Production Centre (EECP). 2003. *Energy Efficiency and Cleaner Production in the Industry – completion report (2003)*. Tbilisi: Energy Efficiency and Cleaner Production Centre

Energy Efficiency and Cleaner Production Centre (EECP). 2004. *Energy Efficiency and Cleaner Production in the Industry – completion report (2004)*. Tbilisi: Energy Efficiency and Cleaner Production Centre

Evans, J and Hammer, B. 2003. Cleaner production at the Asian Development Bank. *Journal of Cleaner Production* (11) 639–649

Evans, W. and Stevenson, R. 2001. Policy and planning: a holistic approach to promoting Cleaner Production *Journal of UNEP: Industry and Environment*, Volume 24 No. 1-2, January – June: 46-47

Fitzpatrick, S. and Viola, L. 1990. *A Researcher's Guide to Sources on Soviet Social History in the 1930s.* New-York: M.E. Sharpe

Foxon, T. and Pearson, P. 2008. Overcoming barriers to innovation and diffusion of cleaner technologies: some features of a sustainable innovation policy regime. *Journal of Cleaner Production.* 16S1: 148-161

Gallup, J. and Marcotte, B. 2004. An assessment of the design and effectiveness of the Environmental Pollution Prevention Project (EP3). *Journal of Cleaner Production* (12): 215–225

Georgian Enterprise Growth Initiative (GEGI). 2005. *Tax Code Overview*. Tbilisi: GEGI

Georgian-European Policy and Legal Advice Centre (GEPLAC). 1999. *Georgian Economic Trends: Quarterly review 1999 (3).* Tbilisi: GEPLAC

Georgian-European Policy and Legal Advice Centre (GEPLAC). 2007. *Georgian Economic Trends: Quarterly review (April 2007).* Tbilisi: GEPLAC

Global Environment Facility (GEF). 2005. *Fertile Ground Seeding National Actions for the Global Environment. GEF Annual Report 2005.* 18. Washington: Global Environment Facility.

Gombault, M. and Versteege S. 1999. Cleaner production in SMEs through a partnership with (local) authorities: successes from the Netherlands. *Journal of Cleaner Production* (7): 249–261

Government of Georgia. 2004a. *saqartvelos mtavrobis dadgenileba "saqartvelos garemos dacvis da bunebrivi resursebis saministros debulebis damtkitsebis shesakheb"* [the order on the "Status of the Ministry of Environmental Protection and Natural Resources of Geogria"]. N 50

Government of Georgia. 2004b. *saqartvelos mtavrobis dadgenileba "saqartvelos ekonomikis ganvitarebis saministros debulebis damtkitsebis shesakheb"* [the order on the "Status of the Ministry of Economic Development of Georgia"]. N 77

Hamed, M. and Mahgary, Y. 2004. Outline of a national strategy for cleaner production: The case of Egypt. *Journal of Cleaner Production* (12): 327–336

Heart, S. 2000. Education and training for cleaner production: a flexible learning approach. *Journal of Cleaner Production* (8): 361–364

Hicks, C. and Dietmar, R. 2007. Improving cleaner production through the application of environmental management tools in China. *Journal of Cleaner Production* (15): 395-408

Hillary, R. 2000. *Small and Medium-sized Enterprises and the Environment: Business imperatives*. Sheffield: Greenleaf

Hillary, R. and Thorsen, N. 1999. Regulatory and self-regulatory measures as routes to promote cleaner production. *Journal of Cleaner Production* (7): 1–11

Hunt, E. 2003. *History of Economic Thought: A Critical Perspective*. New-York: M.E. Sharpe

IMF, World Bank, OECD, EBRD. 1991. *A Study of the Soviet Economy.* Washington: IMF

International Institute for Environment and Development (IIED). 1992. *Making Development Sustainable: Redefining Institutions, Policy, and Economics*. Washington: Island Press
Jorgensen, S. 1999. *A Systems Approach to the Environmental Analysis of Pollution Minimization*. London: CRC Press

Kacharava, Y., Kikvidze, A., Ratiani, P., and Surguladze, A. 1977. *Istoria Gruzii: Razvitie kapitalizma v promishlennosti* [History of Georgia: Development of Capitalism in the Industrial Sector]. Tbilisi: Ganatleba

Karatnycky, A., Motyl, A., and Schnetzer, A. 2001. *Nations in Transit, 2001: Civil Society, Democracy, and Markets in East Central Europe and the Newly Independent States*. Piscataway: Transaction Publishers

Kenez, P. 2006. *A History of the Soviet Union from the Beginning to the End.* Cambridge: University Press

Kennedy, S. and Frontini, G. 2003. *Manufacturing in real-time: A Guide for Managers and Engineers in an Age of Smart Machines*. Boston: Butterworth-Heinemann

Koehler, J. and Zurcher, C. 2003. *Potentials of Disorder: New Approach to Conflicts Analysis*. Manchester: University Press

Kolominskas, C. and Sullivan, R. 2004. Improving cleaner production through pollutant release and transfer register reporting processes. *Journal of Cleaner Production* (12): 713–724

Krarup, S. 2001. Can voluntary approaches ever be efficient? *Journal of Cleaner Production* (9): 135–144

Lagidze T. 1995. *Georgia's report: Economics and Environment*. Geneva: UNECE

Lieberman, I., Nestor, S. and Desai, R. 1997. *Between State and Market: Mass Privatization in Transition Economies.* Washington: The World Bank

Lindhqvist, T. 2001. Cleaner Production: government policies and strategies. *Journal of UNEP: Industry and Environment*, Volume 24 No. 1-2, January – June: 41-45

Lopes, C. 1996. *Balancing Rocks: Environment and Development in Zimbabwe*. Upsala: Nordic Africa Institute

Luken, R. and Hesp, P. 2004. *Towards Sustainable Development in Industry? Reports from Seven developing and transitional economies*. Northampton: Edward Elgar Publishing

Luken, R. and Navrat, J. 2004. A programmatic review of UNIDO/UNEP national cleaner production centres. *Journal of Cleaner Production* (12): 195–205

Luken, R. and Van Rompaey, F. 2008. Drivers for and barriers to environmentally sound technology adoption by manufacturing plants in nine developing countries. *Journal of Cleaner Production* (16S1): 67-77

Maheshwari, R. 1997. *Principles of Business Studies.* New Delhi: Pitambar Publishing

Marshall, C. and Rossman, G. 2006. *Designing Qualitative Research*. London: SAGE

MEPNR of Georgia and Batumi Oil Terminal Limited. 2007. *Memorandum of Understanding between MEPNR and Batumi Oil Terminal Limited*. Batumi

MEPNR of Georgia and Batumi Sea Port Limited. 2007. *Memorandum of Understanding between MEPNR and Batumi Sea Port Limited*. Batumi

MEPNR of Georgia and Heidelberg Cement Georgia – Saqtsementi. 2007. *Memorandum of Understanding between MEPNR and Heidelberg Cement Georgia – Saqtsementi*. Rustavi

MEPNR of Georgia and JSC "Madneuli". 2007. *Memorandum of Understanding between MEPNR and JSC "Madneuli"*. Tbilisi

Mickwitz, P. Hyvattinen, H. and Kivimaa, Paula. 2008. The role of policy instruments in the innovation and diffusion of environmentally friendlier technologies: popular claims versus case study experiences. *Journal of Cleaner Production* (16S1): 162-170

Miles, M and Huberman, A. 1994. *Qualitative Data Analysis: An Expanded Sourcebook*. London: SAGE

Ministry of Economic Development of Georgia. 2008a. *Privatization*. Available on the internet at:
URL:
http://www.privatization.ge/spp/eng/ [consulted 24 June 2008]

Ministry of Economic Development of Georgia. 2008b. *The goals and objectives of the Ministry of Economic Development of Georgia*. Available on the internet at:
URL:
http://www.economy.ge/geo/main.php [consulted 27 June 2008]

Ministry of Education and Science of Georgia. 2007. Professional Education Supporting programme . Available on the internet at:
URL:
http://www.mes.gov.ge/index.php?module=multi&page=detals&multi_id=30&id=255
[consulted 28 June 2008]

Ministry of Labor, Health and Social Affairs of Georgia. 2006. Main Direction in the Health Sector (2006-2007). Available on the internet at:
URL:
http://www.healthministry.ge/eng/strategy.php [consulted 28 June 2008]

Mitchell, C. 2006. Beyond barriers: examining root causes behind commonly cited Cleaner Production barriers in Vietnam. *Journal of Cleaner Production* (14): 1576-1585

OECD. 1995. *Technologies for Cleaner Production and Products Towards Technological Transformation for Sustainable Development.* Paris: 1995

_____. 1999. *Cleaner Production Centers in Central and Eastern Europe and the New Independent States*. Paris: OECD

_____. 2001. *International Science and Technology Co-operation: Towards Sustainable Development*. Paris: OECD

_____. 2006a. *Debt-for-Environment Swap in Georgia: Pre-Feasibility Study and Institutional Options (Part one)*. Paris: OECD

_____. 2006b. *Debt-for-Environment Swap in Georgia: Potential Project Pipelines for the Expenditure Programme (Part two)*. Paris: OECD

_____. 2006c. *Transition to Integrated Environmental Permitting System in Georgia: Case Study*. Paris: OECD

OECD Centre for Co-operation with Economies in Transition. 1995. *Promoting cleaner and safer industrial production in Central and Eastern Europe.* Paris: OECD

OzonAction Newsletter. 2007. *OzonAction Newsletter: Celebrate the Montreal Protocol 20th Anniversary.* 11. Paris: United Nations Environment Programme

Page, E. and Proops, J. 2003. *Environmental Thought.* Cheltenham: Edward Elgar Publishing

Price, M. 2000. *Cooperation in the European Mountains: The Caucasus*. Tilburg: IUCN

Redclift, M. and Woodgate, G. 1997. *The International Handbook of Environmental Sociology*. Cheltenham Glos: Edward Elgar Publishing

Ritchie, J. and Lewis, J. 2003. *Qualitative Research Practice: A Guide for Social Science Students*. London: SAGE

saqartvelos kanoni garemos datsvis shesakheb [The Law of Georgia on the Protection of the Environment].1996. N 519–Iს

saqartvelos kanoni lizenzirebisa da nebartvebis shesakheb [The Law of Georgia on Licenses and Permits]. 2005. N 1775–რს

Sandelowski, M. and Barroso, J. 2006. *Handbook for Synthesizing Qualitative Research.* New-York: Springer

Sikdar, S. and Diwekar, U. 1999. *Tools and Methods for Pollution Prevention*. Dordrecht: Kluwer Academic Publisher

Sikdar, S., Glavic, P., and Jain., R. 2004. *Technological Choices for Sustainability*. Vienna: Springer

Silverman, D. 2000. *Doing Qualitative research: A practical handbook.* London: SAGE

Staniskis, J. and Stasiskiene, Z. 2003. Promotion of cleaner production investments: international Experience. *Journal of Cleaner Production* (11): 619–628

Stellman, J. 1998. *Encyclopedia of Occupational Health and Safety*. Geneva: International Labor Organization

TACIS project Cleaner Production in the selected countries of the NIS: Moldova, Georgia and Kazakhstan. 2004. *Environmental policy issues CP: strategy development in Georgia. Conference Materials.* Tbilisi: TACIS

TACIS project Cleaner Production in the selected countries of the NIS: Moldova, Georgia and Kazakhstan. 2005. *Cleaner Production Demo Project case-studies: Applying Cleaner Production in Moldova, Georgia and Kazakhstan.* Chisinau, Tbilisi, Almaty: TACIS

Taylor-Powell, E. 1998. *Sampling*. Madison: Cooperative Extension United Nations. 1992. *Report of the United Nations Conference on Environment and Development.* New York: United Nations

United Nations. 1998. *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. New York: United Nations

_____. 2001. Stockholm Convention on Persistent Organic Pollutants. Available on the internet at:
URL:
http://www.pops.int/documents/convtext/convtext_en.pdf [consulted 4 May 2008]

_____. 2005. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Available on the internet at:
URL:
http://www.basel.int/text/con-e-rev.pdf [consulted 4 May 2008]

United Nations Centre for Human Settlements, Sustainable Cities Programme and United Nations Environment Programme. 2001. *Urban Air Quality: Handbook, Parts A and B*. Nairobi: UN-Habitat

UNECE. 1979. Convention on Long-range Transboundary Air Pollution. Available on the internet at:
URL:
http://www.unece.org/env/lrtap/full%20text/1979.CLRTAP.e.pdf [consulted 4 May 2008]

UNIDO and UNEP. 2002. *Guidance Manual: How to Establish and Operate Cleaner Production Centers*. Paris: UNEP

UNEP. 1996. *Cleaner Production: A Training Resource Package*. Newcastle: Eartprint

_____. 2000a. *Montreal Protocol on Substances that Deplete the Ozone Layer*. Nairobi: Ozone Secretariat of UNEP.

_____. 2000b. *Promoting Cleaner Production Investments in Developing Countries: Issues and Possible Strategies*. Paris: UNEP DTIE

_____. 2001a. *Implementation guidelines for companies*. Paris: UNEP DTIE

_____. 2001b. *Implementation guidelines for facilitating organizations*. Paris: UNEP DTIE

_____. 2001c. *Implementation guidelines for governments*. Paris: UNEP DTIE

_____. 2002a. *Changing Production Patterns: Learning from the Experience of National Cleaner Production Centers*. Paris: UNEP

_____. 2002b. *Sustainable Consumption and Cleaner production: Global Status 2002*. Paris: UNEP DTIE

_____. 2008a. *Planning for Change: Guidelines for National Programmes on Sustainable Consumption and Production*. Paris: UNEP DTIE

_____. 2008b. The National Cleaner Production Centers: building and supporting local capacity. Available on the internet at:
URL:
http://www.unep.fr/pc/cp/ncpc/home.htm [consulted 26 April 2008]

UNEP and SIDA. 2006. *Applying Cleaner Production to Multilateral Environmental Agreements.* Paris: UNEP DTIE

UNEP and UNCTAD. 2007. *A Preliminary Analysis of MEA Experiences in Identifying and Facilitating the Transfer of Technology*. Nairobi: UNEP-UNCTAD

UNEP DTIE. 2000. *Government strategies and policies for Cleaner Production*. Paris: UNEP DTIE.

_____. 2001. The Implementation Guidelines for Government. Paris: UNEP DTIE.

_____. 2002. *Profiting from Cleaner Production: Towards Efficient Resource Management.* Paris: UNEP DTIE

UNEP DTIE and DEPA. 2000. *Cleaner Production Assessment in Fish Processing*. Paris: UNEP DTIE

USAID. 2007. *The 2006 NGO Sustainability Index for Central and Eastern Europe and Eurasia.* Washington: USAID

USEPA. 1998. *Principle of Pollution Prevention and Cleaner Production*. Philadelphia: USEPA

Van Dijken, K., Prince, Y., Wolters, T., Frey, M., Mussati, G., Kalff, P., Meredith, S., Rodrigues, E., Hansen, O., Kerndrup, S., and Sondergard, B. 1999. *Adoption of environment innovations: the dynamics of innovation as interplay between Business Competence, Environmental Orientation and Network Involvement.* Norwell: Kluwer Academic Publisher

Van Ganeri, A., Mol, A., and Van Buuren, J. 2003. *Greening Industrialization in Asian Transitional Economies: China and Vietnam.* Maryland: Lexington

Venselaar, J. 1995. Environmental training: industrial needs. *Journal of Cleaner Production* (3) N1-2: 9-12

Water Resources Management Division. 2007. *tskali da tsklis resursebi* [Water and water resources]. Tbilisi: MEPNR of Georgia

World Bank Group, UNEP, WHO and UNIDO. 1999. *Pollution Prevention and Abatement Handbook, 1998: Toward Cleaner Production.* Washington: World Bank Group

World Bank Group, USAID and IFC. 2007. *Celebrating reforms: Doing Business.* Washington: The World Bank

Zamparutti, A. 1999. *Environment in the transition to a market economy: progress in Centraland Eastern Europe and the New Independent States*. Paris: OECD

Zhao, J and Ortolano, L. 1999. *Implementing the Montreal protocol in china: use of cleaner technology in two industrial sectors*. New York: Elsevier

Zilahy, G. 2004. Organizational factors determining the implementation of cleaner production measures in the corporate sector. *Journal of Cleaner Production* (12): 311–319