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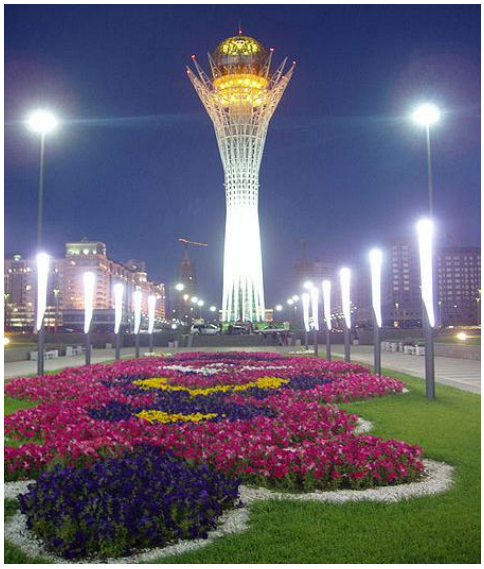

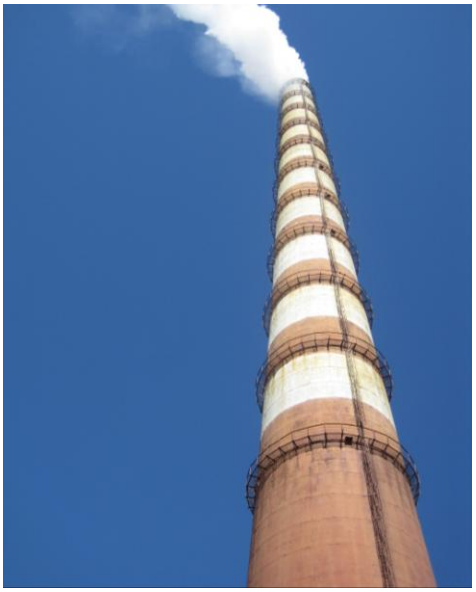

Modern Companies, Healthy Environment

Improving industrial competitiveness through potential of cleaner and greener production

July 2012

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Glossary of Terms

ALRI	Acute Lower Respiratory Infection
BAT	Best Available Techniques
BATNEEC	Best Available Techniques Not Entailing Excessive Costs
BREF	Best Available Techniques Reference
CO	Carbon Oxide or Carbon Monoxide
CO_2	Carbon Dioxide
CP	Cleaner Production
EC	European Commission
EE	Energy Efficiency
EIA	Environmental Impact Assessment
ETS	Emission Trading Scheme
EU	European Union
GG	Green Growth
GIG	Green Industrial Growth
GHG	Green House Gas
GP	Greener Production
GDP	Gross Domestic Product
IPPC	Integrated Pollution Prevention and Control
KP	Kyoto Protocol
OECD	Organization for Economic Co-operation and Development
MEP	Ministry of Environmental Protection of the Republic of Kazakhstan
MOH	Ministry of Health of the Republic of Kazakhstan
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
O_3	Ozone
Pb	Lead
$PM_{2.5}$	Particulate Matter – diameter less than 2.5 microns
PM_{10}	Particulate Matter – diameter less than 10 microns
SO_2	Sulfur Dioxide
TSP	Total Suspended Particulates

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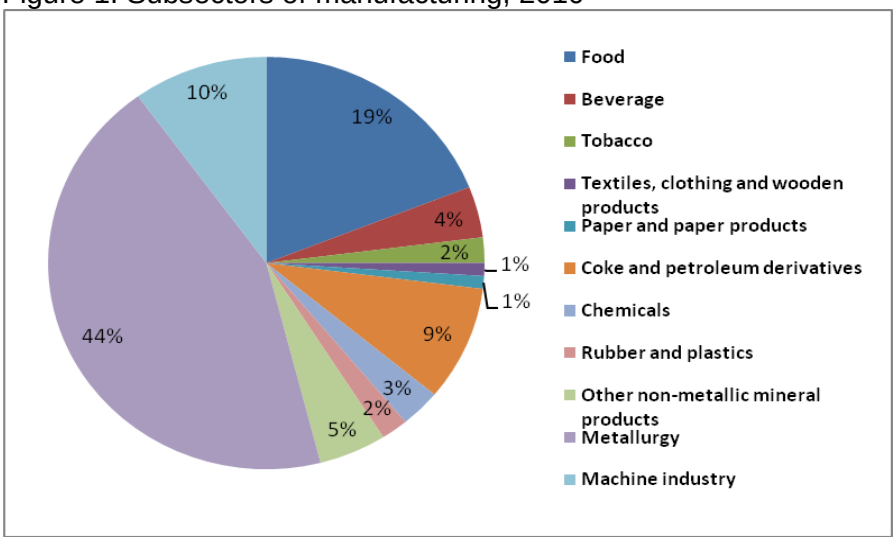
Executive Summary

Mining and industry contribute a third to Gross Domestic Product (GDP), but at a significant social cost. Kazakhstan is well endowed with oil and gas resources, land and a wide range of valuable minerals. Industry in Kazakhstan contributed 31.3% of the country's GDP in 2011, of which mining, which includes oil and gas production, contributed 17.8% (EIU, 2012). Manufacturing contributed to 11.5% of GDP, electricity and power 1.7% and water, sewage and wastes treatment 0.3%. The manufacturing sector can further be broken down into individual sub sectors, as presented below in Figure 1. Four sectors are dominant in the manufacturing sector: (i) metallurgical sector (e.g. iron and steel, zinc, precious metals production), (ii) food and drink, (iii) machinery; and (iv) petroleum derivatives production. These four sectors account for 82% of the total GDP contribution from the manufacturing sector.[1]

Figure 1. Subsectors of manufacturing, 2010



The environmental impact of extraction and manufacturing industries from the Soviet times to today has been associated with significant health damages to the population and excessive pressure on scarce water and other natural resources. Many industrial sectors are characterized by high material use, low energy efficiency and dirty production processes which affect the competitiveness of these industries as well as place a substantial health burden on neighboring cities and villages. For example, the impacts of air pollution are substantial – especially for particulate matter (fine dust) – because of its established link to adverse respiratory and cardiovascular illness and disease.[2] Using monitoring station data among major cities in Almaty, Karaganda, Pavlodar and Ust-Kamenogorsk oblasts on the ambient air concentration of suspended solids – it is estimated that particulate matter pollution causes over 2,800 premature deaths and costs the economy over $US1.3 billion annually (or 0.9% of GDP) in terms of increased health care costs. The total impact for all of Kazakhstan is approximately $US2.5 billion annually (or 1.7% of GDP) – thus half of the impact originates in these four highly-industrialized oblasts. Interventions to control or reduce air pollution in these locations would result in the largest social benefits. Reducing particulate matter concentrations by 1

[1] Statistics Agency of the Republic of Kazakhstan.
[2] See Ostro 1994; Ostro 2004; Pope *et al*., 2002.

microgram per meter cubed ($\mu g/m^3$) would result in $US57 million in annual health cost savings through reductions in premature mortality and improved worker productivity.

The Government's response through the Green Development Program (2010-2014) sets ambitious targets, but will require a clearer link to cleaner production and the adoption of Best Available Techniques (BATs) in industries to meet its objectives.[3] The government has begun to formally recognize these industrial and environmental challenges in their development plans through economic diversification, accelerated industrial modernization policies and specifically with the approval and launch of the ambitious Green Development (Zhasyl Damu) Program for 2010-2014 focusing on the development of a green economy; mitigation of man-made environmental and health impacts; preservation and rehabilitation of natural ecosystems; and development and improvement of the environmental quality management system. The Zhasyl Damu Program contains ambitious targets for reduction of pollutant emissions to air and water, recycling of waste, reduction of greenhouse gases. For example, the Program contains the following policy objectives:

1. By 2014, a reduction of air (pollutant) emissions will be not less than 5.9 % compared to 2009;
2. By 2014, the level of pollutants discharged to water resources will be not less than 3.5% compared to 2009;
3. By 2014, the share of waste utilization from total waste generation will be 21.9%;
4. By 2014, the volume of greenhouse gases emissions will not exceed 96% of emissions in 1992.

The program also foresees to develop guidelines and plans for the transition to standards based on BATs for large industrial enterprises and introduce energy-saving technologies which will reduce costs and improve competitiveness of companies. The Ministry of Environmental Protection was tasked as the agency responsible for preparing proposals to develop the transition of standards based on BATs for the largest industrial enterprises.

Using BATs to increase resource-use efficiency and optimize production processes are also attractive to industries seeking lower cost structures, reductions in pollution-intensity and greater recycling – which can be financially profitable and can contribute to a healthier

[3] **Cleaner Production** (CP), also termed Greener Production or Waste Minimization, is a methodology which aims to find real business benefits by taking a structured look at how raw materials are used and how waste is produced in a company. The focus is placed on using raw materials, including utilities such as electricity and water, more efficiently, therefore reducing the amount of wastage. This in turn leads to both less impact on the environment and economic savings. Cleaner Production is not about end-of-pipe treatment or waste disposal issues. The EU Directive on integrated pollution prevention and control (IPPC) provides a definition for **Best Available Techniques** (BAT) which is closely linked with cleaner production, as BAT is also a tool aiming to prevent, reduce and eliminate pollution at source.
Cleaner Production/Greener Production and BAT are obviously related, but they are not the same thing. Cleaner Production emphasizes the opportunities to make cost savings, and these opportunities most often lead to a reduction in emissions of pollutants, whereas BAT is a regulatory approach used to determine what emission level values (ELV) should be applied to a specific company or process within that company. What both CP/GP and BAT have in common is that in both cases emphasis is placed on pollution prevention techniques rather than end-of-pipe treatment. Pollution prevention techniques such as BAT and CP/GP have successfully been carried out in many countries over the years, and substantial experience and results have been gained. Cleaner production programs have also been undertaken in Kazakhstan and has shown to deliver both financial savings to the companies as well as reducing emissions and energy with more than 50% of the measures being either at zero or low costs, with a payback period of less than one year.

environment. Cleaner and greener production typically also improves the competitiveness of exports to markets that demand efficient, low environmental-impact materials and products.

The current system of Kazakh BATs should be harmonized with international good practice covering a wider array of industries and processes. Reform should also attempt to shift the current perception of BATs as an "end-of-pipe" solution to one that is both cost saving and preventative. BATs included in the integrated environmental permits must comply with the list approved by the Resolution of the Government of the Republic of Kazakhstan. The current list of national BATs approved for Kazakhstan reflects the type of industry and industrial sectors commonly found in the country, and includes two "horizontal" BAT documents (compared to seven in the international experience) and six industry-specific reference documents (compared to twenty-six internationally) which cover, for example, marine and continental oil production and non-ferrous metal industries. Although the approved list of Kazakh BATs includes a number of technical and technological solutions, there is a predominance of end-of-pipe techniques to reduce emissions to air, water and land. In addition: (i) enterprises are typically poorly informed about the approved list of BATs, and even those which are informed do not systematically use them in their activities; and (ii) the approved list insufficiently expresses the concept of BAT as an economically-based approach, primarily aimed at **preventing** pollution, rather than an "end-of-pipe" technique.

Integrated Environmental Permits require greater linkages with BATs and greater streamlining and consistency with other environmental regulations and permit conditions. For industries to obtain an Integrated Environmental Permit a transition to BATs is required, but these BATs are either not related, or are insufficiently taken into account when permit conditions, technological rules, regulations and other environmental documents are developed. Kazakh BATs are often weakly linked to related subordinate regulations – and one possible reason is the use of Integrated Environmental Permits is not an obligation for all companies, and as a consequence, the BATs are not implemented by industries.

A pilot industrial benchmarking study, executed as part of this JERP study, revealed significant environmental and financial gains could be realized from cleaner production; however major constraints exist from a lack of awareness, regulatory consistency, appropriate skills and financing. A survey of five industries conducted in the spring of 2012 confirmed that significant opportunities exist for Cleaner/Greener Production (CP/GP) and BATs to make a substantial impact on reducing emissions and energy in an economically viable manner. These results were combined with an earlier benchmarking exercise which included a greater number and variety of industries in Kazakhstan.

Results from earlier benchmarking exercises showed that participating industries saved about US$400,000 per year and 876 000 m^3/yr of natural gas with an accompanying reduction of emissions of pollutants such as nitrogen oxides and sulphur dioxides to air as well as a reduction of CO_2 emissions of over 13,000 t CO_2 /yr. Similarly for electricity, savings of 2,300 MWh per year were already achieved the first year after the program was completed, resulting in reduction of 3,400 t CO_2 /yr as a result.

The pilot benchmarking exercise undertaken as part of this JERP program also showed great potential for savings of dust emissions, raw materials, final products, energy, water utilization and waste reduction.

Although CP/GP programs have shown to have a lot of potential in Kazakhstan, these CP/GP programs have until now been carried out on a limited and ad-hoc basis. There is a need to formalize these approaches through institutional and regulatory means if they are to result in significant and country-wide reduction of emissions, reduction of energy-intensity, water and resource use and improving the financial performance of companies.

Based on the pilot benchmarking exercise various barriers and disincentives for a wider adoption of CP/GP and integrated permitting were highlighted, and most of these are typical for a country which is at an early stage of CP/GP adoption. Although the survey highlighted a dozen general barriers and disincentives to wider adoption of CP practices, the most important of these were:

- Deficiencies in the regulatory framework; particularly that the approved BAT list does not sufficiently present the concept of BAT as an approach which can also bring financial benefits to companies and aimed to **prevent** pollution rather than emphasizing them as only end-of-pipe techniques. Lack of sufficiently developed National Reference Documents on BATs, examples and standards as well as lack of issuance of Integrated Environmental Permits;;
- Low costs of raw materials and environmental fees and fines; current level of environmental fees and fines does not act as an incentive for industries to invest in environmental improvements and prevents the proven approach of the "Polluter Pays Principle"[4]. In addition, in cases where possibilities exist to obtain a permit based on incorrect or un-precise calculations of maximum quantities of pollution, incentives for modernization and cleaner/greener production disappear;
- Lack of integration of the Best Available Technique legislation with current system of environmental permitting and reporting and other environmental and energy saving programs; Kazakh BATs are weakly linked to related subordinate regulations. Industries obtaining an Integrated Environmental Permit need a transition to BATs, but these BATs are insufficiently taken into account when technological rules, regulations and other documents are developed[5];
- Lack of awareness of CP/GP and BATs stemming from a lack of available information and lack of public pressure on industry and government for continuous environmental improvements through application of good housekeeping measures, cleaner and greener production and Best Available Techniques;
- Lack of project development and organizational skills that could help in maintaining environmental initiatives as priorities;
- Lack of financing opportunities specifically targeting environmental investment in order to create a pool of environmental demonstration projects and programs for industries and improve capacity building for industries and regulator as well as practical application of integrated permits and Best Available Techniques..

Kazakhstan should prioritize its industrial environmental policy towards key environmental parameters which impact human health and reflect inefficient resource and energy utilization; and base industrial environmental policy on actual monitored and registered emissions. The starting point could be the key environmental priorities of pollution parameters and the key polluters, for instance: Particulate Matter, SO_2, NO_x, Ozone, CO_2 and

[4] In addition, it appears that companies which consistently perform better environmentally are subject to the same level of stringency as those companies that perform poorly. Increased flexibility in regulatory requirements would provide incentives to improve performance.

[5] One of the possible reasons could be the voluntarily nature of integrated environmental permits and as a consequence the voluntary implementation of BATs.

energy use, waste production, water (re)use and resource efficiency. Upgrading the state monitoring network measuring ambient air pollution concentration levels is a key step for focusing efforts towards those air pollution parameter associated significant health impact costs and which can form the basis for subsequently increasing the effectiveness of the environmental air emission limits currently in place for industries.

Regulatory changes are also required to establish an **Industrial Emissions Registration System** for key sources of industrial pollution both at a central and decentralized level and based on actual self-monitoring of emissions by industries with spot checks from the environmental authorities rather than calculated emissions.

Better information on the state of the environment and actual emissions of industries will also assist environmental authorities in their permitting, monitoring, compliance and enforcement functions related to industrial emissions, water use, energy intensity, waste management and reductions of CO_2 emissions in line with the Kyoto Protocol. It will enable authorities to improve financial incentives for industries to adopt clean and green modern technologies and **move towards a system of Best Available Techniques**. Currently, companies that stay within the approved levels of pollution have no incentive for further environmental improvement. Increasing environmental charges and fines for industries combined with **increased frequency of actual monitoring and inspection[6], and subsequently compliance enforcement** will help ensure that industries stay within established Emission Limit Values, invest in cleaner and greener production, and achieve further emission reductions rather than paying the environmental charges and fines.

As a signatory to the Aarhus Convention, Kazakhstan should not only modernize and expand its environmental information system, but also make them publically available to allow for more transparent decision-making and increase support for policies targeted at industrial pollution reduction. The Aarhus Convention grants the public rights regarding access to information, public participation and access to justice, in governmental decision-making processes on matters concerning the local, national and trans-boundary environment. It focuses on interactions between the public and public authorities. Kazakhstan was an original signatory to the Aarhus Convention in 1998 and later ratified it in 2001. The Convention, as an international treaty, has direct applicability in the Kazakh legal system. All provisions of the Convention are directly applicable, including by the courts. The State Fund for Environmental Information includes a wide range of environmental information, but a significant proportion is not publically available or in a format that could be useful for transparent planning purposes.

Publically available information on the State of the Environment with key pollution sources will facilitate public and political support to increase industrial fines and charges can lead to a reduction in emission levels, preserve the natural resource base and improve energy efficiency. Increased charges and fines would raise the private sector's share of environmental expenditures and internalize the environmental costs is imposes - following the Polluter Pays Principle. Increasing charges and fines already defined in the law would be a good start to promote change in the environmental performance of the biggest polluters, particularly for air pollution which carries the largest share of total heath impact costs. Enforcing current environmental regulations will also help ensure private sector investment in environmental mitigation measures, generating health co-benefits and at reasonable costs. For energy efficiency, measures could even be implemented with minimal cost or even with a revenue gain

[6] Including the possibility for environmental inspectors to have unexpected and unannounced inspections.

in the longer term. This approach can work only when the private sector invests in pollution reduction and when fines and charges are brought into line with the environmental damages they cause.

Coordinated policies will be required in the regulatory framework; removal of barriers and introduction of financial incentives; and proper state and industrial monitoring systems are required to ensure a broad adoption of Clean & Green Production and Best Available Techniques in Kazakhstan. The industrial sector in Kazakhstan is heterogeneous, with many types of companies of different size, sector, mode of operation, conditions, level of energy consumption, potential for savings, etc. Various factors may influence successful application of CP/GP, for example business interests, corporate governance, management practices and other fundamental factors typical for economies in transitions. In addition there exist various technical, economic and institutional barriers.

Development of an integrated CP/GP policy which addresses these barriers and which will ensure further recognition of the CP/GP concept by Kazakh legislation, would give a major impetus to the adoption of CP/GP at all levels of authority and among companies. This will, in turn, ensure broader adoption of CP/GP within the country.

Technical assistance could speed up this process by raising awareness and facilitating the process of removing barriers. Since CP/GP activities in Kazakhstan are at early stage of development, it may be beneficial to involve various stakeholders into policy development. In an ideal situation, it would be a collaborative effort addressing all barriers at an early stage, rather than one by one. However, promoting single elements of market development can also have a positive effect.

A Government's main role in facilitating the introduction and broad adoption of CP/GP and BAT can be grouped under three main strategies. Each of these three strategies address significant barriers, and along with policy options to overcome these barriers can be summarized as follows:

1. **Improving regulations to facilitate implementation of CP/GP and BAT:**
    - Recognition of CP/GP on a political level and an integrated policy development on CP/GP adoption;
    - Development of environmental permitting: review and harmonize current norms and threshold values and update of national BAT;
    - Integrate elements of pollution prevention and control into current permitting procedures to foster a preventative approach;
    - Improvement of state environmental monitoring;
    - Establishment of an Industrial Emission Registration System based on actual self-monitoring of emissions by industries.
    - Stronger monitoring, inspection, and enforcement of environmental compliance
    - Linking CP/GP and BATs into sector strategies, plans and programs;
    - Involving a wider array of NGO's, industrial associations and individual industries in the development of CP/GP policies and BATs;
    - Improve the involvement of regional authorities.

2. **Strengthening financial incentives for industries to invest in CL/GP:**
    - Strengthen payment discipline and increase environmental fees and charges for non-compliance with environmental permit conditions and for those exceeding emission limit values;
    - Apply financial instruments to promote CP/GP project implementation;

- Mobilize resources for environmental investment and offer free government-supported environmental consultation and advice, for instance, through the establishment of a functioning National Environmental Fund. This could help co-finance companies willing to invest in cleaner/greener production and environmental investments to serve as powerful examples to other industries lagging behind. An example of this is the highly successful Polish National Fund for Environmental Protection and Water Management, which provided a big stimulus for companies to invest in emission reduction and assisted substantial environmental improvements (e.g. the amount of untreated sewage discharged to water or land in Poland decreased by 90%; emissions of particulates decreased by 95%; and emissions of greenhouse gases into the atmosphere decreased by 63%). See http://www.nfosigw.gov.pl/en/. The fund also served as a partner for absorbing funds from international financial institutions and other foreign funds allocated for environmental protection in Poland.

3. Facilitating project development and implementation:

- Dissemination of information on CP/GP and BATs to industry and other stakeholders - particularly on the potential financial benefits to companies;
- Capacity building and demonstration projects/programs for industries;
- Training of Regional Environmental Authorities to strengthen their capacity to develop CP/GP policies and process integrated permits;
- Initiate industrial demonstration projects on the application of integrated permits;
- Make public funds available for government-supported environmental consultation and advice.

In addition to providing economically viable options to reduce emissions to air, water and land, pollution prevention techniques such as CP/GP and BAT can effectively highlight opportunities to reduce greenhouse gases (GHG), in particular CO_2. This is currently a significant issue in Kazakhstan. Kazakhstan has taken on a voluntary obligation to decrease GHG emissions by 15% by 2020 and by 25% by 2050. The case studies and pilot benchmarking results of the company surveys demonstrate how CP/GP and BAT can lead to significant reductions in emissions of greenhouse gases, in particular as a result of decreased electricity consumption and energy efficiency measures – and the reduction of other fossil fuels such as natural gas. It is therefore expected that the introduction of initiatives to promote pollution prevention techniques such as CP/GP and BAT would be an effective approach to reducing emissions of GHGs and therefore meeting Kazakhstan's ambition to making a significant contribution to combating global climate change.

1. Introduction

The objective of this report is two-fold. First, it is to raise awareness of the health and economic damages of industrial air pollution in key oblasts and to develop long-term options of improving industrial competitiveness. The second objective is to synthesize the results of a pilot benchmarking exercise of selected industries on natural resource and energy efficiency improvements, cleaner production and identify options for cleaner and greener industrial production in Kazakhstan.

The resulting recommendations are intended to help target advice to the Ministry of Environmental Protection, and the private sector, in identifying future environmental and operational investments as well as general housekeeping measures – in the pursuit of cleaner and greener production. The study provides a description and analysis of the current regulatory framework faced by industry in terms of emissions, energy, water and material use and waste production. Broader policy can also benefit from the pilot assessment where key constraints to cleaner technology adoption are identified. Decision-makers may use this information when considering alternative policy options and the development of mechanisms to greater incentivize cleaner, more efficient, technology investment.

The report is structured as follows. Section 2 motivates the cleaner production topic by providing some estimates of the health impacts and economic costs of air pollution in Kazakhstan. Air pollution is selected because of data availability, but also because it is one of Kazakhstan's major environmental priorities. Section 3 provides a discussion of the current regulatory framework that industry faces as well as its limitations. Section 4 reviews the results from the pilot benchmarking exercise among selected industrial firms that were subject to 'quick-scans' for efficiency and pollution reduction improvements. Section 5 gives some examples how businesses have responded to environmental norms and Section 6 reviews the major constraints faced by industry in environmental compliance and clean technology adoption. Finally, Section 7 provides some concrete recommendations in areas that both Government and industry can pursue in achieving greater environmental compliance and clean technology adoption.

2. Health impacts and economic costs of air pollution

Air pollution is a critical environmental problem in urban areas in Kazakhstan. Ambient air quality is particularly bad in the industrial zones developed as production centers under the Soviet regime. Despite independence, much of that production legacy continues today. About one third of industrial enterprises have no sanitary protective zones of standard size with a significant proportion of the population living in these zones of direct impact – leading to exposure to harmful industrial emissions into the air, and from noise, vibration, electric magnetic fields and other physical factors (Dahl *et al*., 2001; Kaiser and Pulsipher, 2007; Farmer and Farmer, 2000). The principal air pollutants are sulfur dioxide (SO_2), nitrogen oxides and NO_2 (NO_x), ozone (O_3), lead (Pb), carbon oxide (CO), particulate matter (PM or dust), and dioxin.

The main sources of air pollution in Kazakhstan are the combustion and production of fossil-fuel, and emissions from the ferrous and non-ferrous metal industries. From the available (though dated) statistics, stationary sources in Kazakhstan discharged 19,094.2 thousand metric tons (MT) of harmful substances in 1998, while only 16,766.5 thousand MT were captured and treated. The largest discharges by stationary sources were in Karaganda (1009.2

thousand MT), Pavlodar (440.1 thousand MT), East Kazakhstan (164.4 thousand MT) and Atyrau (135.4 MT) Oblasts in 1998 (Agency for Statistics of the Republic of Kazakhstan, 1999).

The Karaganda Oblast, with large heavy industries, has coal mines, steel complexes, metallurgy enterprises and big power stations. The metallurgy enterprises, Ispatkarmet and Zhezkazhansvetmet, are major emitters contributing the most to air pollution in the region and together emit about 30 percent of the country's total. Concentrations of dust, phenol, nitric oxide, ammonia, and carbon monoxide exceed maximum permissible concentrations (MPC) in the Karaganda region. The air condition in the city of Zhezkazgan depends on emissions from Zhezkazhansvetmet (60 percent) and the thermal power station (40 percent). Concentrations of nitric dioxide (1.2 times MPC), phenol (1.7 times MPC), and lead (1.2 times MPC) all exceed permissible levels by Kazakh standards (IEB, III/1999).

Pollution in Kazakhstan now threatens the health of thousands of citizens. In 21 of Kazakhstan's cities the air pollution is ten times the accepted safety levels. The World Health Organization states that several thousand people of Kazakhstan die each year from causes directly attributable to air pollution (Cohen *et al*., 2005; Health Effects Institute, 2004).

The purpose of this section is to estimate the health impact and economic cost of air pollution from particulate matter – considered one of the most serious because of its linkage to human health impacts. The results presented here are meant to provide a range, and if anything a conservative estimate, of the health impact and economic costs to the economy. The procedures are outlined in a series of steps that link air pollution monitoring data from the Ministry of Environmental Protection, health data from the Ministry of Health and epidemiological data from the academic literature. The estimated health costs (or benefits if air pollution were reduced) can help prioritize geographical locations where cleaner technology investment could be further promoted.

Air quality monitoring is carried out by the Center for Environmental Monitoring, a subdivision of the Republican State Enterprise "Kazgidromet". The Center operates a network of manual and automatic air monitoring stations in Kazakhstan. Table 2.1 describes the network for four highly-industrialized oblasts. Parameters monitored vary somewhat from station to station but include formaldehyde, nitrogen dioxide, suspended solids, carbon monoxide, sulfur dioxide, phenol, ammonia, hydrogen sulfide, sulfates and in some selected sites arsenic and hydrogen chloride. Air quality information at the oblast level is publically available but is normally presented as an air quality index with little corresponding information on how it was constructed and information about individual pollutants. Individual parameters are benchmarked according to Kazakh Maximum Permissible Concentrations (MPC). Industries themselves are also obligated to self-monitor and report results to the MEP on a regular basis – but this information is not made public (e.g. Particular Matter such as PM_{10} or $PM_{2.5}$which are known to have the highest health impacts).

Table 2.1 Air quality monitoring network in four selected oblasts in Kazakhstan

Oblast	**City/ Town**	**Number and station type**	**Monitored parameters (2010-11)**
Karaganda Oblast	Karaganda City	4 manual	Formaldehyde, NO_2, TSP, CO, SO_2, phenol
	Temirtau Town	3 manual	Formaldehyde, NO_2, TSP, CO, SO_2, phenol, ammonia, hydrogen sulfide, sulfates
	Balkhash Town	3 manual	NO_2, TSP, CO, SO_2

Oblast	City/ Town	Number and station type	Monitored parameters (2010-11)
	Zhezkazgan City	2 manual	NO_2, TSP, CO, SO_2, phenol
East-Kazakhstan Oblast	Ust-Kamenogorsk City	5 manual	Formaldehyde, NO_2, TSP, CO, SO_2, phenol, arsenic, chlorine
	Ridder Town	2 manual	Formaldehyde, NO_2, TSP, CO, SO_2, phenol, arsenic
	Semei City	2 manual	NO_2, TSP, CO, SO_2, phenol
	Glubokoye Village	1 manual	NO_2, TSP, SO_2, phenol, arsenic
Almaty Oblast	Almaty City	5 manual; 5 ground-based automatic; 6 high-altitude automatic	Formaldehyde, NO_2, TSP, CO, SO_2, phenol
	Taldykorgan City	1 manual	TSP, CO
Pavlodar Oblast	Pavlodar City	2 manual	NO_2, TSP, CO, SO_2, phenol, hydrogen sulfide, sulfates, hydrogen chloride, chlorine
	Ekibastuz Town	1 manual	NO_2, TSP, CO, SO_2, sulfates

Source: Ministry of Environmental Protection (2011)

Air quality information on total suspended solids (TSP) is regularly monitored – however the convention in most developed and developing countries is to measure particulate matter (PM) of smaller particle sizes such as PM_{10} and $PM_{2.5}$ – because of their linkage to adverse health outcomes. Since PM_{10} and $PM_{2.5}$ are fractions of TSP – one can estimate these concentrations as a ratio of TSP. Observations in Western and Eastern European countries suggest that TSP/PM_{10} and $PM_{2.5}$/PM_{10} ratios can vary from 0.35-0.70 (Ostro, 2004). Using a conservative range of 0.35-0.55, Table 2.2 presents the implied annual PM_{10} and $PM_{2.5}$ concentrations from monitored TSP by the Center for Environmental Monitoring. The air quality data show that PM exceeds the EC limit value of an average annual concentration of 40 micrograms per cubic meter ($\mu g/m^3$) for PM_{10}, in most monitored cities – with the exception of a few locations in Karaganda City. Although not presented here, daily observations also exceed the one-day limit value (not to be exceeded more than 35 times a year) of 50 $\mu g/m^3$. EC limit values are set on the basis of scientific knowledge to avoid, prevent, or reduce harmful effects on human health or the environment (or both). They are established in the EC Directive on ambient air quality and cleaner air in Europe (Directive 2008/50/EC).

Table 2.2 Annual average concentration values for TSP and calculated PM_{10} and $PM_{2.5}$, 2011 ($\mu g/m^3$)

Oblast/ City/ Town	Population[1]	Station No.[2]	Location	Average Annual TSP Concentration ($\mu g/m^3$)	Average annual PM_{10} concentration ($\mu g/m^3$) Assuming: PM_{10}/TSP ratio			Average annual $PM_{2.5}$ concentration ($\mu g/m^3$) Assuming: PM_{10}/$PM_{2.5}$ ratio		
					Low 0.35	Mid 0.45	High 0.55	Low 0.35	Mid 0.45	High 0.55
Karaganda Oblast										
Karaganda City	470,749	1	Aerological station in city airport district	46	16	21	25	6	9	14
		3	Corner of Lenin St. and Bukhar-Zhirau Ave.	36	13	16	20	4	7	11
		4	Biryuzov St., 15, near Maikuduk	94	33	42	52	12	19	29
		7	Ermekov St., 116	53	19	24	29	7	11	16
Temirtau Town	172,023	3	Dmitrov St., 212 and S. Ramzin St.	286	100	129	158	35	58	87
		4	Microdistrict 6, Amangeldy/Temirtauskaya St.	309	108	139	170	38	63	94
		5	Microdistrict 3	265	93	119	146	32	54	80
Balkhash Town	69,816	1	Sabitov microdistrict near school No. 6, Ualikhanov St., North	153	53	69	84	19	31	46
		3	Corner of Lenin St. and Alimzhanov St.	160	56	72	88	20	32	48
Zhezkazgan City	85,788	2	Saryarka St., Knitting Factory district	372	130	167	205	46	75	113
		3	Zhastar St., 6, Metallurgist square	354	124	159	195	43	72	107
East-Kazakhstan Oblast										
Ust-Kamenogorsk City	307,026	1	Rabochaya St., 6	168	59	76	93	21	34	51
		5	Kaisenov St., 30	93	32	42	51	11	19	28
		7	Pervo-Oktyabrsksya St., 216 (Zaschita station)	252	88	114	139	31	51	76
		8	Egorov St., 6	153	54	69	84	19	31	46
		12	Satpayaev Ave. 12	104	37	47	57	13	21	32
Ridder Town	49,632	1	Ostrovsky St., 13A	125	44	56	69	15	25	38
		6	Klinka St., 7	122	43	55	67	15	25	37
Semei City	304,531	2	Ryskulov St., 27, cement plant	169	59	76	93	21	34	51
		4	Silicate Plant district, residential quarter 349	95	33	43	52	12	19	29
Glubokoye Village	9,807	1	Lenin St., 15	44	15	20	24	5	9	13
Almaty Oblast										
Almaty City	1,435,555	1	Amangeldy St., Satpayev St. Corner	100	35	45	55	12	20	30
		12	Rayimbek Ave., Nauryzbay Batyr St. corner	273	95	123	150	33	55	82
		16	Ainabulak-3 microdistrict	122	43	55	67	15	25	37
		25	Aksai-3 microdistrict, Marechek St., Momyshuly St. Corner	76	27	34	42	9	15	23
		26	Tastak-1 microdistrict, Tolebi St. corner, 249, City Children's Polyclinic	113	40	51	62	14	23	34
Taldykorgan City	127,324	1	Gagarin St., 216 and Jabayev St.	128	45	58	70	16	26	39
Pavlodar Oblast										
Pavlodar City	321,791	1	Kamzin and Chkalov St. Intersection	153	53	69	84	19	31	46
		2	Aimanov St., 2b	251	88	113	138	31	51	76

Oblast/ City/ Town	Population[1]	Station No.[2]	Location	Average Annual TSP Concentration ($\mu g/m^3$)	Average annual PM_{10} concentration ($\mu g/m^3$) Assuming: PM_{10}/TSP ratio			Average annual $PM_{2.5}$ concentration ($\mu g/m^3$) Assuming: $PM_{10}/PM_{2.5}$ ratio		
					Low 0.35	Mid 0.45	High 0.55	Low 0.35	Mid 0.45	High 0.55
Ekibastuz Town	126,825	2	Microdistrict 8, Berkembayev and Satpayev St.	53	18	24	29	6	11	16

Source: Ministry of Environmental Protection, 2011.

1 – Population as of 2010

2 – Manual stations

2.1 Health impacts of air pollution

Substantial scientific research demonstrates public health impacts from air pollution. The key public health effects are respiratory diseases and cardiovascular effects. According to WHO (2005), the following are attributed to short-term exposure to air pollution: respiratory and cardiovascular hospital admissions, emergency department visits, and primary care visits; use of respiratory and cardiovascular medications; days of restricted activities; work and school absenteeism; acute symptoms (wheezing, coughing, phlegm production, respiratory infections); physiological changes (such as lung function); and even death.

Effects attributed to long-term exposure include mortality due to cardiovascular and respiratory disease; chronic respiratory disease incidence and prevalence (asthma, chronic obstructive pulmonary disease (COPD), and chronic pathological changes); lung cancer; chronic cardiovascular disease; and intrauterine growth restriction (for example, low birth weight at term; WHO 2005).

The following health assessment is based on air pollution by fine particle matter (PM_{10} and $PM_{2.5}$), given the abundant evidence that particles - fine, in particular - have adverse effects on health (for example, Ostro 1994; Ostro 2004; Pope *et al*., 2002). $PM_{2.5}$ increases mortality primarily due to cardiopulmonary diseases and lung cancer, and PM_{10} increases morbidity primarily due to chronic bronchitis, lower respiratory illness in children, and other respiratory symptoms.

This assessment followed five steps to quantify the health impacts of air pollution and their associated costs. Estimates are derived for individual cities for which TSP information was made available and for the country as a whole.

2.2 Step 1: Monitoring data on air pollutants

Station data on TSP was obtained from Kazgidromet for selected major cities (Table *2.2*). For cities with more than one station – an average value was derived for the city. For Kazakhstan as a whole, a population-weighted average TSP concentration was derived for urban-rural areas where PM_{10} and $PM_{2.5}$ concentrations were calculated using the same ratios as described in the previous section: low = 0.35, mid = 0.45 and high = 0.55. This resulted in the following values for the country (Table 2.3):

Table 2.3 Population-weighted, annual ambient PM_{10} and $PM_{2.5}$ concentrations derived from TSP observations, 2011

Kazakhstan		PM_{10}			$PM_{2.5}$		
	TSP	Low	Mid	High	Low	Mid	High
Urban	141	49	63	77	17	29	43
Rural	44	15	20	24	8	9	13

Source: Author's calculations.

2.3 Step 2: Determining the population exposed

Urban and rural population shares were available for each city and oblast (from Census 2009 and 2010 data). The urban share of population in Kazakhstan is approximately 53 percent whereas it varies from 23 percent in Almaty Oblast to 78 percent in Karaganda Oblast. These shares were used in calculating the population exposed to the PM concentration data from Step 1.

2.4 Step 3: Assessing health impacts from exposure using epidemiological data

The third step is to determine the health impacts of exposure based on epidemiological scientific research of the exposure-response function between exposure to PM_{10} and $PM_{2.5}$ and mortality and morbidity.

Mortality. For mortality, the exposure-response functions for long-term exposure to $PM_{2.5}$ provided by Ostro (2004) are applied.[7]

The mortality baseline developed in this assessment used data from the Ministry of Health for each individual oblast and for Kazakhstan as a whole. Oblast-level data are applied to city-level estimates in the absence of city-level data. The following are the major assumptions used for Kazakhstan as a whole:

- The crude death rate is 8.71 per 1,000 people;
- The share of cardiopulmonary mortality in total mortality is 35.5 percent;
- The share of lung cancer mortality in total mortality is 2.0 percent;
- The share of mortality due to acute lower respiratory infections in total mortality among children under-five is 6.8 percent.

Morbidity. Exposure-response coefficients (annual cases per 100,000 people) for PM_{10} from Ostro (1994) and Abbey *et al*. (1995) are used, with Ostro (1994) reflecting a review of worldwide studies and Abbey *et al*. (1995) providing estimates of chronic bronchitis associated with particulates (PM_{10}). Recent epidemiological studies provide relative risks (RR) for morbidity, but without specific knowledge of the particular morbidity rate in Kazakhstan (or in each city), the assessment uses exposure-response coefficients giving numbers of cases per total population, even if these coefficients are not specific to Kazakhstan (Table 2.4).

Table 2.4 Urban air pollution exposure-response coefficients for morbidity health effects

Health impact (PM_{10})	Unit	Impact per 1 $\mu g/m^3$
Chronic bronchitis	100,000 adults	0.9
Hospital admissions	100,000 population	1.2
Emergency room visits	100,000 population	23.5
Restricted activity days	100,000 adults	5,750
Lower respiratory illness in children	100,000 children	169
Respiratory symptoms	100,000 adults	18,300

Source: Ostro, 1994; Abbey *et al*., 1995.

Baseline for PM concentrations. A baseline level (natural background concentration) for $PM_{2.5}$ of 7.5 $\mu g/m^3$ is used (Ostro 2004) and 15 $\mu g/m^3$ for PM_{10} (which is the same as assuming a $PM_{2.5}/PM_{10}$ ratio of 0.5). These limits are used to calculate the total health burden from air pollution – and represent the lowest level that any regulatory or policy intervention could attain. Using these values as the baseline show what realizable health benefits could be obtained through measures that reduce ambient PM concentrations to these limit values.

The health effects of air pollution are also converted to disability-adjusted life years (DALYs)[8] to facilitate comparison with health effects from other environmental factors and between mortality

[7] The relating relative risks (RR) - that is, change of mortality rates—are calculated as follows: cardiopulmonary mortality, RR = exp[0.00893 ($X-X_0$)]; lung cancer mortality, RR = exp[0.01267 ($X-X_0$)]; and acute lower respiratory infection (ALRI) mortality in under-five children, RR = exp[0.00166 ($X-X_0$)], with X = current annual average $PM_{2.5}$ concentration for cardiopulmonary and lung cancer among adults and PM_{10} concentrations for ALRI among children, and X_0 = target or baseline $PM_{2.5}$ concentration. 'exp' stands the exponential function normally written as e^x , where *e* is the number (approximately 2.718281828) and the expression in square brackets is *x*.

[8] DALYs: The sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability.

and morbidity. The DALYs per 10,000 cases for the various health impacts are in Table 2.5 (Larson, 2004).

2.5 Step 4: Physical health impacts

Based on the exposure-response coefficients, annual PM ambient air concentrations, and data on the exposed population, urban air pollution in the four selected oblasts is estimated (midpoint) annually to cause 2,848 premature deaths, 1,016 new cases of chronic bronchitis, 2,040 hospital admissions, and 40,400 emergency visits. The health effects represent a loss of more than 29,584 DALYs a year (Table 2.5).

Table 2.5 Estimated health impacts of air pollution in the four selected oblasts, 2011
(baseline: PM_{10} = 15 μg/m^3 and $PM_{2.5}$ = 7.5 μg/m^3)

Health impact	Cases a year			DALYs/ 10,000 cases[1]	Total DALYs a year		
	Low	Mid	High		Low	Mid	High
Cardiopulmonary mortality ($PM_{2.5}$)	1,330	2,665	4,148	80,000	10,639	21,321	33,187
Lung cancer mortality ($PM_{2.5}$)	93	183	277	80,000	746	1,462	2,220
ALRI mortality (PM_{10})	3	4	5	340,000	99	137	175
Chronic bronchitis (PM_{10})	721	1,016	1,310	22,000	1,587	2,234	2,881
Hospital admissions (PM_{10})	1,470	2,040	2,650	160	24	33	42
Emergency room visits (PM_{10})	28,700	40,400	52,100	45	129	182	234
Restricted activity days (PM_{10})	4,769,000	6,712,000	8,658,000	3	1,431	2,014	2,597
Lower respiratory illness in children (PM_{10})	65,300	92,100	118,800	65	424	599	772
Respiratory symptoms (PM_{10})	15,171,000	21,364,000	27,552,000	0.75	1,138	1,602	2,066
Total					16,216	29,584	44,176

Source: Authors' calculations.
1 – From Larson (2004).
ALRI = Acute lower respiratory infections.

2.6 Step 5: Monetary effects of health impacts

The approach to valuation takes into consideration the (adjusted) Human Capital Approach (HCA)[9], the Value of a Statistical Life (VSL) and the COI (cost of illness). The HCA estimates the indirect cost of productivity loss through the value of an individual's future earnings. Thus, 1 DALY corresponds to one person's contribution to production, or GDP per capita. This method provides a lower bound for the loss of 1 DALY. VSL measures the willingness-to-pay (WTP) to avoid death – using actual behavior on the trade-offs between risks and money. VSL is calculated by dividing the marginal WTP to reduce the risk of death by the size of the risk reduction. Measured this way, the value of 1 DALY corresponds to the VSL divided by the number of discounted years lost because of death. The VSL typically forms an upper bound measure of health damages. The COI approach estimates the direct treatment costs associated to different health end-points (e.g. hospitalization, restricted activity days, and doctor visits).

The cost of mortality is estimated using the HCA value as a lower bound of cost and the VSL as a higher bound. For morbidity, the COI is estimated as a lower bound, and willingness to pay to avoid a case of illness is applied as a higher bound of cost (willingness to pay is assumed to be twice the cost of illness).

[9] The adjusted version avoids the issue of assigning a value of zero to the lives of the retired and the disabled since the traditional approach is based on foregone earnings. It avoids this issue by assigning the same value – per capita GDP – to a year of life lost by all persons, regardless of age.

The costs of treating illnesses and of time lost due to illness are in Table 2.6. Unit treatment costs are economic costs and not subsidized cost of treatment at public medical facilities. Time losses are valued at 50 percent of average wage rates.

Table 2.6 Unit costs of medical treatment and time losses due to illness

Cost of illness	Unit	Unit cost ($US)	Cost of illness	Unit cost per case ($US)
Hospitalization	Day	53	Chronic bronchitis (PM_{10})	14,620
Doctor visits	Visit	3	Hospital admissions (PM_{10})	587
Emergency visits	Visit	25	Emergency room visits (PM_{10})	79
Value of time lost to illness	Day	27	Restricted activity days (PM_{10})	3.4
Value of lost caregiver time	Day	16	Lower respiratory illness in children (PM_{10})	63
			Respiratory symptoms	0.8

Source: Authors' calculations, based on medical costs from the MOH and wage price information from Kazakhstan.

The estimated total economic costs due to health effects of air pollution in the four selected oblasts range from $US171 million to $US3,647 million a year, with a midpoint estimate of $US1,342 million, or 0.9 percent of GDP in 2011 (Table 2.7), based on the three defined ratios of TSP/PM_{10} and $PM_{2.5}$/PM_{10}. Note that mortality represents over 90% of (mid-point) total health costs. A sensitivity analysis revealed that a 1 $\mu g/m^3$ change in TSP corresponds to $US57 million health cost impact or 0.04 percent of GDP. In other words for every 1 $\mu g/m^3$ increase in the PM_{10} or $PM_{2.5}$ concentration – this costs the economy $US57 million (mid-point) in increased health costs from PM air pollution. Alternatively, if interventions were to decrease the PM concentration by 1 $\mu g/m^3$ this would represent a $US57 million cost savings in terms of reduced mortality and morbidity among cities in the four oblasts. These economic benefits constitute important information to policymakers when comparing alternative investment costs of reducing PM air pollution. Table 2.8 provides the potential cost savings for a range of PM reduction targets.

Table 2.7 Costs of health impacts of air pollution in the 4 selected oblasts, 2011 ($US million)

(baseline: PM_{10} = 15 $\mu g/m^3$ and $PM_{2.5}$ = 7.5 $\mu g/m^3$)

Category\estimate	Low	Mid	High
Mortality: adults	121.0	1,237.4	3,469.6
Mortality: children	2.5	3.3	4.0
Chronic bronchitis	11.2	23.7	40.7
Hospital admissions	0.9	1.9	3.4
Emergency room visits	2.4	5.0	8.6
Restricted activity days	16.2	34.2	58.8
Lower respiratory illness in children	4.2	8.8	15.2
Respiratory symptoms	12.9	27.2	46.8
Total cost ($US million)	**171.3**	**1,341.6**	**3,647.2**
Total cost (% of GDP)	**0.11**	**0.90**	**2.45**

Source: Authors' calculations.

Table 2.8 Potential health 'savings' associated with a reduction in PM_{10} and $PM_{2.5}$ among cities in the selected 4 oblasts, 2011 ($US million and % GDP)[1]

Ambient PM concentration reduction ($\mu g/m^3$)	Annual cost ($US million)			% of GDP, 2010		
	Low	Mid	High	Low	Mid	High
1	10.9	56.7	89.8	0.01%	0.04%	0.06%
5	55.1	274.9	457.4	0.04%	0.18%	0.31%
10	104.6	514.1	924.6	0.07%	0.34%	0.62%
15	122.5	762.4	1,312.7	0.08%	0.51%	0.88%

Ambient PM concentration reduction (μg/m^3)	Annual cost ($US million)			% of GDP, 2010		
	Low	Mid	High	Low	Mid	High
20	135.4	1,010.5	1,716.7	0.09%	0.68%	1.15%

Source: Authors' calculations.

1 – Example reductions are applied to both PM_{10} and $PM_{2.5}$ at the same time.

The distribution of air pollution impacts among cities in the four selected oblasts and for all of Kazakhstan is presented in Table 2.9. Using the air pollution assumptions from Table 2.4 and extrapolating these values to all urban and rural locations, the total impact in Kazakhstan is estimated to be between US$326-$7,462 million or 0.2-5.0% of GDP per year. The mid-point estimate of 1.7% of GDP is not unlike estimates of PM air pollution damage in other countries such as China (2.8%)[10] or Mexico City (1.6%) in the 1990's.[11] Approximately half of the impact (0.90%) is among cities in the four selected oblasts, thus interventions focused in these geographical areas would act to substantially reduce the health burden of air pollution in Kazakhstan.

Table 2.9 Distribution of health costs from air pollution in Kazakhstan and cities in the selected 4 oblasts, 2011 ($US million and % GDP)

	Annual cost ($US million)			% of GDP, 2010		
	Low	Mid	High	Low	Mid	High
Kazakhstan	**326.0**	**2528.5**	**7462.4**	**0.22%**	**1.70%**	**5.01%**
Karaganda Oblast						
Karaganda City	1.0	41.6	168.2	0.00%	0.03%	0.11%
Temirtau town	23.0	153.6	375.1	0.02%	0.10%	0.25%
Balkhash town	4.3	33.1	89.2	0.00%	0.02%	0.06%
Zhezkazgan City	14.8	94.2	221.6	0.01%	0.06%	0.15%
East-Kazakhstan Oblast						
Ust-Kamenogorsk City	19.6	156.6	424.3	0.01%	0.11%	0.28%
Ridder town	2.2	19.1	54.3	0.00%	0.01%	0.04%
Semei City	15.2	128.6	359.2	0.01%	0.09%	0.24%
Glubokoye village	0.0	0.3	2.3	0.00%	0.00%	0.00%
Almaty Oblast						
Almaty City	60.8	486.2	1341.5	0.04%	0.33%	0.90%
Taldykorgan City	4.8	39.6	110.9	0.00%	0.03%	0.07%
Pavlodar Oblast						
Pavlodar City	25.4	180.8	465.6	0.02%	0.12%	0.31%
Ekibastuz town	0.2	7.8	34.9	0.00%	0.01%	0.02%
Total (across cities/ towns)	**171.3**	**1341.6**	**3647.2**	**0.11%**	**0.90%**	**2.45%**

Source: Authors' calculations.

2.7 Summary

The health impacts estimated above represent significant losses to the economy and interventions that lead to Particulate Matter reductions could pay for themselves from reduced healthcare costs alone. But there is a classical issue of comparing what would constitute (mostly) private investment costs with (mostly) public health benefits. What incentives do private companies have in 'internalizing' the true social costs of production when benefits accrue mostly to the public? What role does the Government have in incentivizing companies to take on these investments and start to realize the public health benefits of reduced air pollution? This report argues that cleaner and greener production should play an important role in any strategy. In many cases it can serve

[10] World Bank (2012), *China 2030 Building a Modern, Harmonious, and Creative High-Income Society*, in collaboration with the Development Research Center of the State Council, the People's Republic of China.

[11] World Bank (2002), Improving Air Quality in Metropolitan Mexico City – an economic valuation, Policy Research Working Paper No. 2785.

a dual role of increasing efficiency savings for companies (who can improve their business performance through input savings) and at the same time reduce pollution output, improving air quality and reducing the associated public health cost.

In the following sections, the background regulatory framework of Kazakhstan is presented and the incentives and constraints companies face in making cleaner production investment decisions. Later sections describe what measures companies can undertake to realize some of these cost savings. In parallel, Government can also consider what it needs to do in reshaping policy and regulations that will encourage the adoption of cleaner technologies by companies. Since adjustment can be difficult in countries with complex and cumbersome environmental regulatory and management systems, several recommendations are provided that span a menu of policy options to be considered in the short-, medium-, and longer term. One particular area requiring immediate attention is the development of monitoring and industrial registration systems that produce reliable, accurate and publically-available information – and serving as a foundation for future decision-making.

3. The current industrial regulatory framework in Kazakhstan

3.1 Structure of the Ministry of Environmental Protection

The Ministry of Environmental Protection (MEP) of the Republic of Kazakhstan consists of 10 departments, including:

- Department of Strategic Planning and Monitoring
    - Unit of Planning and Analysis
    - Unit of management of science, monitoring and work with NGOs
- Department of International Environmental Agreements
- Department of State regulation of environmental protection
    - Methodological Support Management
    - Unit of Environmental Quality Regulation
- Department of "green" technologies and attraction of investments

The MEP also includes a “Committee of Environmental Regulation and Control”. This Committee performs regulatory functions and state environmental control in the field of environment and natural resources. The committee has eight regional departments of ecology, directly subordinated and accountable to the Committee. The main objectives of the Committee are:

- Improvement of environmental quality, ensuring environmental safety, conservation of natural resources and the achievement of a favorable level of environmentally sustainable social development;
- Improvement of the state regulation system in the field of environmental protection and state environmental control within its competence;
- Organization and conducting of the state ecological expertise in accordance with current legislation requirements of the Kazakhstan Republic;
- Organization, improvement, implementation and coordination of licensing activity in the field of environmental protection;
- Organization, coordination, standardization of emissions and environmental permits issuing;
- Implementation of state environmental control.

In addition, the following organizations are under the authority of Ministry of Environmental Protection:

- The Republican state-owned Enterprise (RSE) “Kazhydromet”;
- Joint Stock Company "Kazaeroservice";
- The Republican State Enterprise "Information-Analytical Center of Environmental Protection";
- The Republican State Enterprise "The Kazakh Research Institute of Environment and Climate";
- Joint-Stock Company "Scientific and Production Association "Eurasian Water Center".

3.2 Environmental Protection Programs

In accordance with the strategy of “Kazakhstan 2030”, the following are the key documents on Environment Protection and Sustainable Development:

- Strategy of Industrial and Innovative Development of the Kazakhstan Republic for 2003 - 2015;
- The Strategic Plan of the Ministry of Environmental Protection of Kazakhstan for 2011-2015
- Sectoral program “Zhasyl Damu” for 2010-2014 (Green Development Program).

In 2010, Kazakhstan adopted the Zhasyl Damu Program for 2010-2014 which is focusing on the development of a green economy; mitigation of man-caused environmental and health impacts; preservation and rehabilitation of natural ecosystems; and development and improvement of the system of environmental quality management. The Zhasyl Damu Program contains ambitious targets for reduction of pollutant emissions to air and water, recycling of waste, reduction of greenhouse gases. The program contains the following ambitious policy objectives

1. By 2014, Reduction of pollutants air emission will be not less than 5.9 % compared to 2009.
2. By 2014, the level of pollutants discharge in water resources will be not less than 3.5 % compared to 2009.
3. By 2014, the share of waste utilization from total waste generation will be 21.9%.
4. By 2014 non-exceedance of the volume of greenhouse gases emissions will be 96% compared to 1992.

The program also foresees to develop guidelines and plans for transition of standardization based on best available technologies for large industrial enterprises and introduce energy-saving technologies which will reduce costs and improve competitiveness of companies and the Ministry of Environmental Protection was tasked as the agency responsible for preparing proposals to develop the transition of standards based on best available techniques for the largest industrial enterprises.

3.3 Environmental quality monitoring

The monitoring of air quality is performed by the Republican State Enterprise "Kazgidromet", which has a subdivision - Center for Environmental Monitoring. The Center operates a network of air monitoring stations and analytical laboratories, conducts research and manages environmental information. In recent years the number of observation posts has been increasing and laboratory facilities are being updated. Monitoring is performed by stationary monitoring stations as well as by mobile laboratories.

. Air quality standards were approved by the Resolution of the Government of Kazakhstan No. 168 of January 25, 2012 Sanitary Rules “Sanitary and epidemiological requirements to air in urban and rural areas, soils and their safety, maintenance of urban and rural areas, conditions of work with sources of physical factors that influence human health”. The comparison chart of the maximum allowable concentrations of air pollutants in Kazakhstan, Russia and the EU is presented in Table 3.1. Air quality standards adopted by the EU are based on the World Health Organization requirements as they aim to reduce and prevent health impacts from key pollutants.

Table 3.1: Limit values for air pollutants in Kazakhstan, Russia and the EU

Substances	Occupational Exposure Limits of Pollutants				
	Kazakhstan	Russia	Directive 2008/50 EU[12]		
	mg/m^3	mg/m^3	mg/m^3	Margin of tolerance	Averaging Period[13]
Lead	0.001	0.001	0.0005	100%	Calendar year
Nitrogen dioxide	0.085	0.200	0.200	0%	One hour
Sulphur dioxide	0.500	0.500	0.350	0.150 mg/m^3 (43 %)	One hour
Carbon monoxide	5.000	5.000	10.000	60%	Maximum daily eight hour mean
Solid particles[14]	0.300-0.500	0.300-0.500	0.050	50%	One day
			0.040		Calendar year

Environmental quality standards/ Environmental Limit values by law are often stricter than comparable EC standards but are established for short term concentrations only (20 minutes exposure), while significant risk of chronic health hazards are associated with long term exposure to pollutants for which the annual limit values have been determined by the World Health Organization and European Commission. In the EC member countries ambient quality standards are derived from assessment of risk to human health and ecosystems, while in Kazakhstan they were derived in the 1980’s from the academically sound scientific theory of maximum absorptive capacity of environment and atmospheric diffusion of pollution. They are based on the concept of zero risk to humans and the environment during the worst possible circumstances (e.g., worst-case meteorological conditions, most vulnerable part of population). Transposing these academic approaches to the legislative and regulatory framework resulted in the very strict ambient quality standards, which would require heavy investments by industries to comply and which may become unfeasible for most companies. In addition, there are a large number of substances for which Maximum Allowable Concentrations have been determined, which are beyond a reasonable capacity to monitor. In OECD/EC countries, ambient quality standards are treated as policy objectives, for which policy makers are accountable, rather than legally binding norms, from which emission caps for individual sources are derived.

Kazakh’ emission limits should be critically reviewed with the objective to give priority to defining emission limits for pollutants with the highest health impacts from air, water and waste and also taking into account which emissions can be registered and monitored in a dense air and water monitoring network would enable these limit values to become strategic policy objectives and built public support to put in place the policy instruments to achieve these values.

[12] Directive 2008/50/EC of the European Parliament and of the Council on Ambient Air Quality and Cleaner Air in Europe.” May 21.
[13] In Kazakhstan and Russia the averaging period of measurement is 20 minutes.
[14] In Kazakhstan, the emission limit applies to the total dust emissions, whereas in the EU it is particulate matter 10 microns in size (PM_{10}).

While equipment of environmental quality monitoring stations is increasing and being updated, systematic environmental monitoring, documenting and reporting could be further strengthened. Putting in place a dense monitoring of air and water quality, for a more limited number of environmental quality parameters, could serve as the basis to define the strategic objectives for environmental policy ambitions and increasing inter-ministerial cooperation. Release of and easy and free access to environmental quality data could build the public support for stricter enforcement of industrial emission standards.

3.4 Permitting

For permitting purposes, different categories of permits exist. To obtain environmental permits, enterprises in the category I, II and III must prepare and submit the following set of documents:

- Application form;
- The conclusion of the State Ecological Expertise on the draft standard for emissions;
- Action Plan for Environmental Protection;
- A program of industrial environmental control.

Requirements for category IV enterprises are simplified, and their required set of documents includes;

- Application form;
- Environment emissions standards estimated by calculations or instrumental measurements.

Environmental Action Plans, as developed by companies, must be communicated to the government agency responsible for issuance of environmental permits. Once the environmental permit has been obtained, the implementation of these activities is controlled by the MEP, though its regional offices. From 2013 the Ministry will require from enterprises a Program of waste management. The Program should aim to minimize the waste generation and to reduce the amount of accumulated waste. The Government of Kazakhstan approved the Program Development Rules

Systematic work towards improving the permitting system is currently being conducted in Kazakhstan. The Environmental Code was developed and adopted in 2007, the main objective of which was to harmonize national environmental legislation with leading international standards. The Environmental Code has superseded and replaced approximately 80 previous regulations since its introduction.

In recent years, the rules for obtaining permits were revised. Previously, companies had to obtain a permit each year. After the adoption of the Environmental Code companies can obtain permits for a three-year period. and which has now been extended to a five-year period. This has reduced the load on enterprises related to the procedures of environmental permits obtaining, although to obtain the permits in the first place enterprises must fulfill tougher requirements and conditions. Today in Kazakhstan there are no temporarily agreed releases.

With respect to environmental fees, these are determined in accordance with current tax legislation.

In the event that the established standards of emissions or discharges (to water) are exceeded, the following three norms apply:

- A tenfold tax payment for excessive emissions;
- The Administrative Code fine;
- Economic charge for environmental damages caused.

In accordance with the Environmental Code the concept of integrated environmental permits, based on Best Available Techniques, was introduced, and the approach to the regulation of large and small businesses was differentiated. Enterprises are classified in four categories (I, II, III and IV). The air impact serves as a criterion for differentiation and IV is the lowest impact category,

because differentiation is based on the size of the sanitary protection zone established by health authorities by impact on air.

In 2008 a national list of Best Available Techniques (BAT) was developed. A comprehensive BAT achievement project, indicating activities and dates, is an obligate requirement for companies in order to obtain temporarily agreed emissions permits. In fact, today Kazakhstan has two permitting systems:

1. Environmental Emissions Permit;
2. Integrated Environmental Permit.

Enterprises are free to choose either type of permit system.

3.4.1 Integrated Environmental Permits

Rules of integrated environmental permits issue were approved by the Resolution of the Government of the Republic of Kazakhstan № 95, on February 4, 2008. The Integrated Environmental Permit is the only document which certifies the right of an enterprise to release emission to the environment, providing best available techniques have been implemented and the enterprise complies with emission limits.

The procedure of obtaining the integrated environmental permit presumes that the emissions limits shall be established on and environmental management is based on application of the Best Available Techniques (BATs). At present, however, there is no experience in Kazakhstan with obtaining integrated permits by enterprises. This is probably due to two main factors:

- Current procedures are not clear and need to be streamlined;
- Related to this, companies do not understand the very need to change over to the new procedures.

3.5 Environmental Emissions Permit

Today, all enterprises obtain permits for emissions to the environment. The current system of obtaining environmental permits is based on the normative legislation inherited from the former Soviet Union. The Environmental Emissions permit is a set of documents that contains:

- Information on the enterprise and its business or other activities;
- The term of the permit;
- Nature management conditions, including emission limits for all of the enterprises' emission sources;
- Environmental action plan for the permitting period;
- A program of industrial environmental control;
- Indicators of the waste management program, which reflect a reduction of waste generation and minimizing of its harmful impact on environment during the term of the permit (from January 1, 2013).

Large companies (category I) receive their Environmental Emissions Permit directly from the MEP, whereas other category companies receive theirs from the environmental department of regional Oblast administration..

3.5.1 Establishment of emission standards

The emission limits are the basis for the issuance of environmental permits. The emission standards include:

- specific technical limits for emissions;
- maximum permissible emissions and discharges of pollutants;
- limits for disposal of waste;
- norms of permissible physical factors (heat, noise, vibration, ionizing radiation and other physical effects);
- standards of the open air sulphur disposal.

Emission limits are defined either as a part of the Environmental Impact Assessment (EIA) for the planned activities, or as separate emission standards for the existing businesses. They can be set at the level of specific technical emission limits or calculated, in case of a combined emission source. In the process of establishing emissions limits, the level of historic pollution and background concentrations of environmental quality parameters are taken into account and despite the fact that the concept of Best Available Techniques has officially been approved, the emission limits in the permitting process are based on the level of historic pollution and background concentrations rather than on the basis what emission limits an industry could achieve when applying BATs.

3.5.2 Specific Technical Emission Limits (Emission Factors)

According to the Environmental Code, specific technical emission limits are set for certain processes and industries based on the introduction of best available techniques. However the approved BATs which are in place today only allows for the setting of specific technical emission limits in rare cases. According to the Environmental Code, specific technical emission limits shall be established and are the basis for integrated environmental permits. The following methodologies, which contain specific technical emission value, are currently approved:

- "Requirements for emissions into environment from various fuels burning in the thermal power plant boilers" (Decree of the Government of the Republic of Kazakhstan issued on December 14, 2007 № 1232);
- "Requirements for emissions into environment during the ferroalloys production" (Decree of the Government of the Republic of Kazakhstan, January 26, 2009 № 46);
- "Requirements for emissions into the environment from the alumina production by the Bayer-sintering process" (Decree of the Government of the Republic of Kazakhstan issued on August 6, 2009 № 1207).

Their comparison with Directive 2001/80 of the EU (Table 3.2) shows that some of the requirements are stricter than the European ones, whereas on others they are softer.

Table 3.2: Comparison of emission standards in Kazakhstan with EC Directive 2001/80

Pollutants	Heating Capacity (P), MW	Emission Standards, mg/m^3		
		Directive 2001/80 the EU		Technical Emission Standards, Kazakhstan (after 01.01.2013)
		New Installations[15]	Modernized installation	
Solid particles	P<300	30	100	150 – 500
	P<500			100 – 200[16]
	P>500		50	
Sulphur dioxide	100<P<199	200	400 - 2000	1200 – 1400[17]
	200<P<249			1800 – 2000
	250<P<300			700
	300<P<500			780
	P>500		400	
Nitrogen oxides	100<P<299	200	600	125 – 640
	300<P<500			125 – 550
	P>500		200	

Despite sometimes stricter emission standards, the allowed quantities of emissions in Kazakhstan companies can be much higher than their equivalent in European companies. Environmental permits for enterprises are based on the design capacity of process equipment, while in reality enterprises frequently do not work at full capacity which facilitates compliance without the improvement of technological processes, reduction of emissions and implementation of BAT.

Also, during the pilot industrial benchmarking exercise inconsistencies were noted between calculated emission limits for an integrated process, where in one industry permissible concentrations of dust in enterprise emissions reached a much higher value than corresponding European standards.

Furthermore, the reference documents for BATs for the heat and power industry in Kazakhstan do not clearly specify emission standards for the key pollutants causing health impacts, but only recommend methods for reduction of polluting gases emissions and methods for estimation of their effectiveness.

3.6 Monitoring and Inspection of Industrial Emissions

Industries are obliged to perform their own environmental monitoring which is conducted to monitor compliance with the requirements of the environmental legislation requirements and to provide information to policy makers with regard to ongoing environmental policy. Environmental monitoring is carried out in accordance with the monitoring plans developed by the enterprises and approved by the authorities in the environmental permits.

Environmental monitoring includes operational monitoring (monitoring of the production process in terms of the sources of emissions), monitoring of emission sources, monitoring of environmental impacts (especially for sensitive ecosystems at the phase of start of operation of object, or after the accidental/emergency air emissions).

[15] Heating Capacity more than 100 MW
[16] Solid particles are determined for all types of solid fuels
[17] Sulphur dioxide is determined for solid and liquid fuels

The industry or polluter is obliged to submit quarterly environmental compliance reports which demonstrate compliance to the requirements set by the environmental permit to authorities. Industries are also required to provide public access to the procedures and results of environmental monitoring. Most countries in western and central Europe make the information from industrial emissions monitoring and registration easily and freely available through a pollutant registry with the Environmental Protection Agency or Ministry's website, however such publicly accessible website does not exist in Kazakhstan as information is to be obtained through formal request (and payment of costs).

Environmental control or monitoring of industrial emissions by authorities is performed in the form of inspections. Such inspections may include laboratory tests at the source of pollution. In the event of deviation with the approved standards, environmental authorities may require an environmental compliance audit of a company. Inspections can be planned, unplanned, counter inspection, or a raid inspection.

Planned inspections are to be carried out in accordance with the law of the Republic of Kazakhstan "On state control and oversight in the Republic of Kazakhstan and are typically executed only once a year. If enterprises do not violate environmental laws for three years, inspections are only held once every three years. Usually inspections are no longer than thirty working days, but they may be extended by the MEP in special cases.

The Kazakh Environmental Code establishes the procedure of environmental inspections and a package of documents to be issued on the results. This package consists of the following documents: a) the act of order, b) a protocol on administrative violation, c) the decision to impose an administrative fine. Today data collection system is gradually improving. However, the methodological basis for collection, data-basing, processing and reporting this information could be strengthened. It would also be important to ensure that this information is used when important decisions are taken in the regions and at the national level

A fundamental part of the BAT concept however, as defined in the EU, is that an installation should not only meet specific technical requirements but also be operated and maintained with the best techniques available. An installation should therefore continuously work with high efficiency and low emissions to the environment. This results in a demand for continuous monitoring when possible and appropriate or monitoring with a high frequency. Monitoring quarterly, as is the general case in Kazakhstan, would not be enough to meet the EU BAT requirements. In the EU, the demand on monitoring has been regulated, where the minimum needed frequency and parameters have been detailed and depend on the sectors and environmental performance. Since it is the responsibility for an industry to comply with BAT, the industries in the EU normally have their own self-monitoring programs. Therefore it is the role of independent state laboratories is mostly to check the quality of the companies' self-monitoring. The role of such self-monitoring is primarily to enable to keep resource consumption and emissions low, which from an environmental point of view is the most important task. Secondly, the companies' self-monitoring is used for enforcement from the authorities as well as regular reporting. It is also common to request a more comprehensive yearly report from the companies.

3.7 Access to Environmental Information

The Environmental Code endorses public access to environmental information. It proclaims that public participation is one of the basic principles of sustainable development in the Republic of Kazakhstan. Public authorities are therefore requested to ensure appropriate public access to environmental information and to improve the quality, efficiency and relevance of the material submitted.

Centralized collection, recording and storage of environmental information is carried out by the State Fund for Environmental Information. The Fund contains:

- Register of natural resources;

- Register of pollutant release and transfer and other registers of environmental information;
- List of environmentally hazardous industries;
- Environmental monitoring data;
- Information on environmental impact assessment and state environmental expertise with the consent of the customer of of the planned activity;
- Standards and regulations in the field of environmental protection and natural resource management;
- Reports on research and development related to environmental protection
- Scientific literature on environmental protection and environmentally clean technologies
- Other materials and documents that contain environmental information..

The Statistics Agency of the Republic of Kazakhstan keeps records of some of the indicators for environmental protection. The agency publishes an annual compendium entitled "Environmental protection and sustainable development of Kazakhstan".

Access to environmental information related to the procedure of environmental impact assessment and to the decision-making process of planned economic activities is carried out in an order that regulates public access to environmental information at the stage of Environmental Impact Assessment, that is «The rules of public hearings» approved as a directive of the Minister of Environmental Protection № 135 from May 7, 2007. The information may be requested in writing or electronic form and a fee for providing the information may be charged. Certain information is distributed by environmental authorities by internet or by using other tools of communication tools, specifically related to the following:

- Environmental Status Reports;
- Drafts and final version of legal acts and international agreements on environmental protection;
- Drafts and final versions of documents related to state policies, programs and plans of the environmental protection field;
- Reports on the results of control, inspection and enforcement activities.

Information on the environmental impact of major pollution should be more transparent and made publically available. Regulations should mandate regular reporting of major pollutants (and their impacts) in a consistent and standardized format.

3.8 Public Involvement

According to the MEP there are about 130 non-governmental organizations (NGOs) engaged in environmental protection. MEP has established a Public Environmental Council - a collective and permanent acting body consisting of representatives from the Ministry of Environmental Protection, NGOs and the business sector, as well as leading scientists and public figures. Personal membership is approved by the Minister of Environmental Protection.

The main goal of the Council is to develop proposals and recommendations for the implementation of government policy in environmental protection, ecological safety and environmental management. Members of the Council participate in the extended meetings of the Board of Ministry of Environmental Protection and make recommendations on the draft documents discussed at the meetings.

Decisions of the Council have a recommendatory nature.

Cooperation of regional authorities with NGOs is based on formal cooperation agreements on various issues, involving them to the work of Ecological Inspection, organization of round tables,

seminars and conferences. Public participation in decision-making on especially important projects, according to the Environmental Code, is carried out through public hearings, which held as a part of the EIAs.

Submission of the permit application requires publication of appropriate notice in mass media, indicating the address where interested organizations can familiarize themselves with the main conclusions of the EIA.

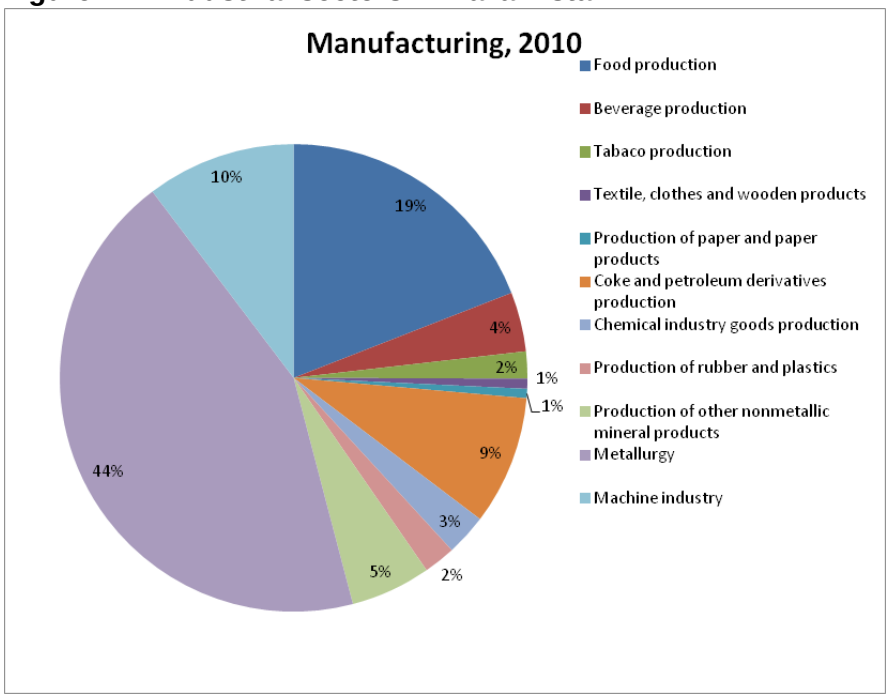
It should be noted that the Ministry accredited five associations that represent interests of subsurface users (Eurasian Industrial Association, Kazakh Union of Producers and Exporters, Republican Association of Mining and Metallurgical Enterprises, Kazakh Association of Subsurface Users for Sustainable Development, Kazakh Association of Oil, Gas and Energy Organizations KAZENERGY). In accordance with the law on Private Entrepreneurship any regulations of the Ministry require reports on expert data examination from associations, without which they cannot become effective.

4. Benchmarking of industries

4.1 Kazakhstan's industrial base

Industry in Kazakhstan contributed 31.3% of the country's GDP in 2011[18], of which mining, which includes oil and gas production, contributed 17.8% of GDP. Manufacturing contributed 11.5% of GDP, electricity and power 1.7% and water, sewage and wastes treatment 0.3%. A total of 1 979 companies were registered in the mining sector in Kazakhstan in 2010, and 17 393 were registered in the manufacturing sector. The manufacturing sector can further be broken down into individual sub sectors, as presented below in Figure 4.1. This figure shows the dominance of the metallurgical sector (e.g. iron and steel, zinc, precious metals production), food and drink, machinery, and petroleum derivatives production. These four sectors account for 82% of the total GDP contribution from the manufacturing sector.

Figure 4.1. Industrial sectors in Kazakhstan



[18] Economic Intelligence Unit, Country report, April 2012; Statistics Agency of the Republic of Kazakhstan.

4.2 Kazakhstan's Industrial Policy and Ambition

The new industrial policy of Kazakhstan (2010-2014), implemented by the President of the Republic of Kazakhstan, aims to reduce raw material use, promote higher value-added production, develop the processing sector, and raise labor productivity through the introduction of innovative technologies. Key actions include the diversification of existing production sectors and improving their (export) competitiveness; increasing manufacturing and agro-industrial labor productivity; developing regional growth centers and improving the public-private interface among priority sectors.

The new policy also includes actions intended to promote cleaner production as part of the (manufacturing) diversification strategy, which can also be viewed as part of sector modernization:

"Successful diversification of economy relates to stable development of the Republic, including the way of optimization of the controlling system of stable development and implementation of "green" policy of low carbonic economy, including the issues of investments attracting, solution of ecological problems, reduction of negative influence of anthropogenic stress on natural ecosystems, strengthening of responsibility of users of natural resources concerning emission reduction in the environment, complex residue utilization."

4.3 Objective of the Benchmarking Pilot in selected industries

The objective of this JERP Study is to develop long-term options for improving industrial competitiveness by initiating a pilot benchmarking exercise of selected industries on natural resource and energy efficiency improvements, cleaner production; and based on the outcomes of the industrial benchmarking pilot propose options for initiation of green industrial growth and cleaner industrial production in Kazakhstan.

4.4 Results of benchmarking pilot for pollution prevention, cleaner and greener production and Best Available Practices

The main benefit of taking a pollution prevention approach in order to reduce emissions to the environment as opposed to implementing end-of-pipe treatment is that the desired emission reductions can be obtained more cost effectively in many instances. In some cases even end-of-pipe treatment to remove a specific contaminant is not possible, or the technology not sufficiently mature, in which case preventing the release of the contaminant in the first place is the only option.

Pollution prevention techniques such as BAT and CP have successfully been carried out in a number of countries for several years, and substantial experience and results have been gained. Cleaner production programs have also been undertaken in Kazakhstan, and the outcome of these programs can give an indication of the expected results with respect to reduction of emissions and raw material use.

4.4.1 Examples of earlier executed pollution prevention and CP/GP programs in Kazakhstan and Kyrgyz Republic

One such pollution prevention program was implemented in Almaty and Bishkek during 2003 and 2004, as part of the Norwegian long-term capacity building program on Energy Efficiency and Cleaner Production in Kazakhstan and Kyrgyzstan. Altogether, twenty-eight production managers and engineers from eight different Kazakh and Kyrgyz companies took part. Five companies participated from Kazakhstan, which operated in the following sectors:

- furniture manufacturing

- textile production
- machine building
- bitumen and asphalt production
- tobacco production

In total, fifty-eight profitable pollution prevention measures of different size were identified over the eight companies during the program, representing total potential savings of 731 000 USD/year (Table 4.1). At the end of the program, measures giving savings of 172 000 USD/year had already been implemented. More than 50% of the measures were at no- and low-cost with a payback of less than one year.

Table 4.1: Results from earlier pollution prevention/cleaner-greener production program in Kazakhstan and Kyrgyzstan

Savings	Identified potential (May 2004)	Achieved results (May 2004)	Achieved results (May 2005)	Unit
Electricity	4 110 412	1 703 347	2 353 334	kWh/yr
Heat	15 562 000	2 813 200	2 849 253	kWh/yr
Gas	1 213 000	84 800	876 000	m^3/yr
Water	143 480	35 361	66 061	t/yr
Condensate	23 481	13 400	13 400	t/yr
Raw materials	176	62	62	t/yr
Waste water	111 036	48 761	79 461	t/yr
Oils	15 000	0.5	0.5	t/yr
Total costs savings	**731 000**	**172 000**	**421 000**	**USD/yr**

The pollution prevention process continued further and new projects were developed and implemented by the companies themselves. In May 2005, the companies had invested approximately USD 81 000 from their own resources, and the total savings had increased to 421 000 USD/year (see table above). More importantly from an environmental point of view was the significant reduction in the use of raw materials and energy. This resulted in a reduction in emissions; f.i. the potential to reduce natural gas use by over 1.2 million m^3/yr was identified, and one year after the program was completed, the companies had already reduced natural gas consumption by 876 000 m^3/yr. This in turn resulted in a reduction in emissions of pollutants such as nitrogen oxides and sulphur dioxide to air, in addition to an estimated total reduction of CO_2 emissions from the combustion of natural gas of over 13 000 tCO_2/yr. Similarly for electricity, the potential to reduce consumption of the utility by over 4 000 MWh/yr was identified, and achieved savings already reached over 2 300 MWh/yr one year after the program was completed. This achieved saving results in an estimated total reduction of CO_2 emissions from electricity use of approximately 3 400 tCO_2/yr[19]. For emissions to water, a reduction in water use and condensate production resulted in an identified potential to reduce waste water discharges by over 100 000 t/yr, and a reduction of close to 80 000 t/yr had already been achieved one year after the program was completed.

Concrete examples of the Cleaner and Greener Production measures which were identified at some of the companies who participated in this Norwegian long-term capacity building program on Cleaner Production in Kazakhstan and Kyrgyzstan are summarized in Annex 2.

[19] Based on a grid emission factor of 1.5 tCO_2/MWh, from "Electricity Emission Factors Review", EBRD, 2009.

4.5 Approach and Results of the Pilot BAT Benchmarking Program

As mentioned above, the objective of this study is to develop long-term options for improving industrial competitiveness by initiating a pilot benchmarking exercise of selected industries on natural resource and energy efficiency improvements, cleaner production; and based on the outcomes of this pilot proposing options for initiation of green industrial growth and cleaner industrial production in Kazakhstan.

The pilot program was based on questionnaires and factory assessments and focused on the following efficiency gains:

- Improving natural resource use efficiency (i.e. raw material usage);
- Minimizing the creation of waste and pollution;
- Minimizing water use (e.g. water recycling);
- Improving energy efficiency.

Implementing these type of measures can assist industries in achieving: (i) improved efficiency and productivity; (ii) reduced operating costs and thereby improved financial performance; (iii) enhanced public image, marketing opportunities and competitive advantages; and (iv) reduced environmental risks and increased regulatory compliance.

The pilot program consisted of the following phases:

Selection of participating industries;
Selection of industries to participate was a very important step as industries might be reluctant to share information which, in their view, may end up with the authorities and be used for regulatory compliance. To avoid any industry reluctance to participate, it was agreed that direct company information would not be shared with Kazakh authorities; only the general conclusions relevant for policymaking. Selection of industries was based on the distribution of questionnaires and letters as well as through a more direct approach.

Pilot benchmarking program of technologies and practices
The following topics were part of the benchmarking exercise: (i) introducing cleaner production techniques/best available techniques; (ii) improving “housekeeping” (reducing raw material and product loss due to leaks and spills, improving monitoring of operations and maintenance, schedule production to reduce equipment cleaning, improve management inventory of raw materials and products); (iii) substitution of materials (e.g. replacing toxic solvent-based coatings with less toxic water-based coatings, eliminate hazardous materials); (iv) reuse and recycle materials on site (utilize wastewater and energy, reuse product rejects, separate waste streams); (v) minimize use of resources (water, energy, chemicals, plastic, raw materials, etc); and (vi) pollution control measures. Benchmarking was done based on questionnaires which companies filled out and on technical visits to the plant to identify further technical improvement opportunities.

In the benchmarking exercise, industries visited were in the mining, metallurgical and energy sectors, the number of industries visited was small and they were relatively modern and/or progressive. This pilot exercise gave good information on the major environmental issues, the present standard and possible options to introduce Cleaner/Greener Production/Best Available Practice options, an overview of all potential CP/GP and BAT options would require more detailed industrial audits, in particular of the larger industries.

Results from the benchmarking exercise, showing the potential and how greener/cleaner industrial production could be applied in Kazakhstan for reductions of Dust Emissions Utilization of Waste Heat, based on Best Available Techniques, are presented below.

4.5.1 Reduction of Dust Emissions

Company visits confirmed severe dust emissions from one of the metallurgical companies. The main sources of dust emissions were overloading and transport of the furnace charge. Dust emissions were also observed at the drying of granulated furnace charge, as well as from metallurgical furnaces. The limits set up by the existing environmental permit are met, however the quantity of dust emissions exceeds the respective European standards.

It should be noted that the dust contained raw materials and final products. Loss of raw materials as well as the final product through air emissions of dust, as well as through the sludge from scrubber can be quantified in monetary terms and therefore the reduction of these dust emissions will have both an environmental benefit, lead to resource conservation and save financial resources.

In addition, several gas cleaning systems such as cyclones and scrubbers, energy intensive and not effective are in operation. One of the alternatives could be to improve effectiveness of the gas cleaning installations by, for example, through the installation of a bag filter[20].

[20] While company visits confirmed the awareness of such technological solutions for installation of bag filter, but the investment cost is a issue together with the existing configuration of the equipment, which is not well suited for such a filter.

Box 4.1 Greener/Cleaner Production options for dust emissions from drying of granulated furnace charge

Application of GP/CP techniques requires to analyze the causes of environmental problems and finding ways to their prevention. Below is an example of how such GP/CP approach could be applied for a specific source of dust emissions, drying of granulated furnace charge. Possible causes of dust generation in the dryer are:

- The dryer is fed not just with granules, but also with fine fractions of furnace charge. These fractions easily 'evaporate' together with exhaust gases;
- Abrasion of granules during their transport from the granulator to the dryer and during the drying process due to insufficient strength of pellets;
- Drawbacks in operation and maintenance of the granulator;
- Poor quality of a glue for granulation or its spraying;
- Wrong aerodynamic regime that is formed in the dryer (velocity of the gas).

The following options were identified:

1) First, analyze factors affecting the quality of the granules and the ability to control these factors:
   a) Better control humidity of granulated material, slope angle, rotation speed, placement of the charge, effectiveness of spraying of glue, etc.
   b) Increase the flow of sprayed glue;
   c) Consider purchasing modern plate granulators, which have automatic control of these parameters;
   d) Use more expensive and better glue compared to what is currently used;
2) Secondly, analyze efficiency of the dryer and options to control the efficiency
   a) Sieve the granules to remove the fine fractions prior they get into the dryer
   b) Analyze the aerodynamic regime in a dryer and possibility of its stabilization. The application of automatic control systems could be beneficial and may reduce dust generation in the dryer and, consequently, its emissions.

Granulated Charge from Granulator

4.5.2 Utilization of waste heat

One of the visited metallurgical companies had a lot of un-recycled waste heat. The company consumes large quantities of fuel oil, steam and hot water for the following processes:

- drying processes;
- steam heating of fuel oil;
- heating of premises;
- hot water supply;
- other processes.

At the same time, superheated flue gases are emitted from the furnaces with temperatures ranging between 1150 to 1500°C, which have significant energy content.

Dust contamination of flue gases is a major problem. While at some points they were relatively clean and could be released without treatment, several other points required treatment first; by cooling down flue gases in different ways, by dilution with air or water. Heat of flue gases is wasted during these processes, although it is technically feasible to recover certain quantities of the energy both from clean and dusty emissions of flue gases.

The site visit executed as part of the pilot program concluded that heat recycling was one of the largest opportunities for savings. Recycling of wasted heat means that less fuel could be used for combustion or heating purposes. One example of a relatively low-cost option is described in the box below.

Box 4.2: Greener/Cleaner Production options for utilization of waste heat

One of the processes is the drying of granulated charge. Exhaust gases from combustion of heavy oil in furnaces are used as a drying agent. To feed the dryers, the temperature of exhaust gases must be cooled down to 160°C. This is achieved by dilution of the furnace exhaust gases with air. The dilution process requires extra energy, while the emissions from drying process contain dust and heavy oil particles.

At the same time, several waste heat flows are generated at metallurgical furnaces. Their recovery and utilization for drying of the granulated charge may eliminate the demand for using heavy oil for this process. The result will be not only in economic savings, but also elimination of one air emissions source, - i.e., emissions from combustion of heavy oil.

Fuel Oil Furnace of the Granulated Charge Drying Department

4.6 Potential and bottlenecks for CP/GP and BAT in Kazakh industries

The results of the pilot benchmarking studies show the relevance of a pollution prevention approach to the types of manufacturing industries which are most widespread in the country. The case studies enclosed to the Annex 2 show examples of what can be achieved in other sectors and international experience has shown that these examples are typically the most suitable for cleaner production initiatives.

5. Business Response to CP/GP and BATs

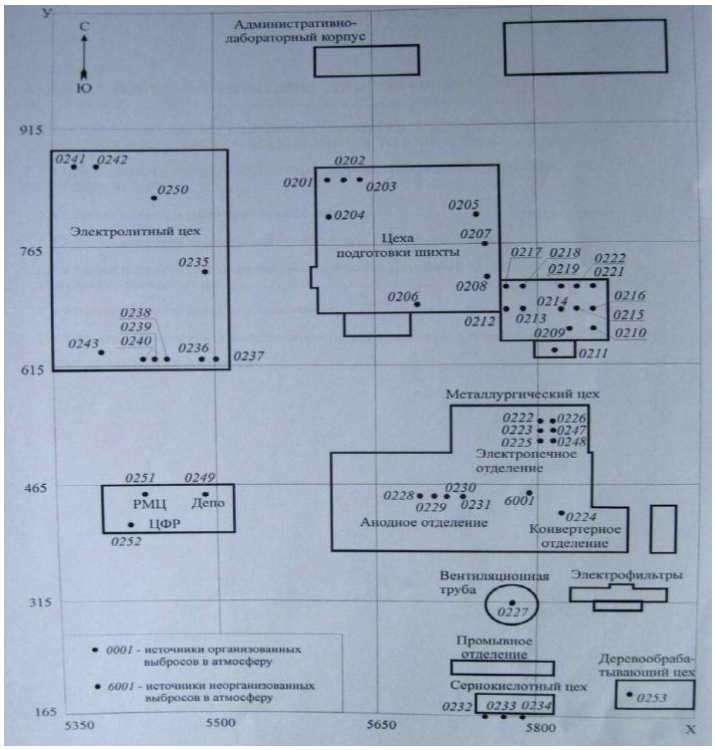
This study reviewed how business in Kazakhstan responded to the challenge of environmental degradation and the need for sustainable industrial development. Production companies in

Kazakhstan have traditionally focused their environmental activities on the clean-up of pollution caused by industrial processes and environmental reporting to authorities. There is a growing awareness of the need of Kazakh companies to do more than clean-up existing pollution. In line with modernization imperative, it would be beneficial for the Kazakh companies to accept a new model of industrial activity based on waste minimization, resource optimization, water recycling and energy efficiency, or Cleaner/Greener Production. This section discusses whether the companies are interested to move towards cleaner/greener production and energy efficiency, adopt BATs and what problems are currently experienced in adoption of such techniques.

5.1 Environmental Management at Companies and their attitude to CP/GP and BATs

Several of the companies visited considered their environmental situation as acceptable and as meeting the related norms and requirements of Kazakh legislation. They also affirm that they operated under environmental permits and they do not have any official environmental claims from regulatory authorities.

However, many of the companies acknowledged that they face environmental challenges and the necessity to improve the environmental situation. The reasons are worn-out, obsolete equipment, lack of money, necessity of full re-equipment of productions lines. The companies therefore have an urgent need to retrofit their production and they are keen to put their efforts and investments to meet this need at first hand.



Example of inventory of air emissions

Another main concern was compliance with frequently changing environmental requirements. Thus, the main content of environmental management was environmental reporting and reviews of industrial sites. Review was possible of annual figures for environmental impacts, as well as their monthly breakdowns of the most of the companies visited.

All companies had an engineer-ecologist or environmental unit who were engaged in drawing up plans for environmental activities, the receipt of environmental permits and preparation of environmental reports. Large companies may have an internal laboratory which performs control of environmental emissions. In some companies, the role of environmental responsibility is somewhat limited to only information collection, whereas 'environmental decision-making', like environmental reporting and preparation of the action plans are coordinated by an environmental department of their parent companies.

All the companies visited presented their environmental programs, but the rate of utilization differed from company to company, depending on their financial situation. For instance, some companies implement programs ahead of schedule; while others have pended their actions until funding is available. All companies however claimed achievement of reductions of emissions over the last decade.

Measures that could be attributed to CP/GP are implemented within the environmental programs but their share is normally very small. In general, these programs comprise of projects initiated by the companies' management with a focus on upgrading production processes, or typical mitigation measures. An example action plan is cited below:

- Development and approving of maximum permissible quantities of emissions;
- High dust emissions in the converter oven. Sealing of the oven has reduced dust production;
- Reconstruction of a oven arch, which partially collapsed. This measure entailed a stop, repair, additional financial and energy costs. Made a flat hood. The problem was eliminated.
- Installed automatic control system;
- Rebuilt a workshop for production of sulfuric acid;
- Replacement of a scrubber;
- Made a basement at the point of feed ore over-loading.

These types of measures and their fragmentary description makes it difficult to analyze economic results of the CP/GP projects, as, for example, it may be a part of a major equipment upgrade program.

Moreover, the economic and environmental results of particular measures are normally not documented due to the 'lack of time or data'.

One company claimed that one of their major projects, installation of bag filter, was a result of public complaints about air emissions. So public pressure can play an informal regulatory role in some cases.

Some company officials did not understand why they were included in the list of category I companies because, for example, "*40% of harmful emissions to atmosphere of all regional emissions is not a criteria if the enterprise permanently implements environmental measures and fulfills Kazakh environmental regulations. If a company is large it will always have a larger contribution of emissions than smaller companies*", as stated by one of the officials.

Most companies, however, believe that the promotion of preventative approaches should be the task for environmental authorities which have to follow up 'innovative preventative concepts' and develop action plans for their improvements.

Stand with health, safety and environmental information at one of the companies

In general, environmental managers at most of the companies were skeptical about support from the Ministry. Some of their arguments are cited below:

- BATs are incomplete and have no regulatory power;
- Current (Kazakh) BATs include currently used clean-up techniques, which are costly and obvious for us;
- We have never seen international benchmarks and outcomes of international projects the Ministry participates in;
- There is no information support to our company on environmental matters;
- We were a part of a working group on improvement of waste regulations, but our arguments were not taken into account;
- There are no environmental funds, all our environmental payments are 'diluted' in the budget;
- Environmental inspectors function often as tax inspectors.

One of the companies reported that it has positive experience with co-operation and information exchange with one the national NGOs, the Kazakh Association of Nature Users.

The companies visited were predominantly large companies, and part of large industrial groups. Most of them introduced environmental management systems according to the ISO-14000 standard. However, these systems do not underpin CP/GP improvements and the adoption of BATs. While environmental managers were not familiar with the "Cleaner Production", all environmental activities focused on "end-of-pipe" solutions.

Even at these large companies, environmental, technical and energy efficiency activities and measures are mainly planned separately and energy efficiency is given the obvious priority. It could be seen from the discussions that process engineers are rarely involved to identify sources/causes of emissions, as well as to the development of environmental action plans. In addition it was also observed that environmental managers were not keen to take part in discussions with process and energy engineers, to tap related ideas. However, this observation is considered subjective.

General impressions were that environmental managers from the management units of large holdings and groups are aware of CP/GP and BATs and are more involved in consultations with the Ministry on the development of environmental policies than their colleagues from production companies. However, there was no evidence that these units will extend the boundary of environmental management beyond suppliers.

In sum, there is very little awareness about CP/GP and BATs within Kazakh companies. While current Kazakh environmental regulations do not call for CP/GP improvements, companies are pushed to utilize end-of-pipe techniques to reduce environmental pollution and emissions. Nevertheless, the commitment of environmental managers to pursuing good practice in environmental management was clear.

5.2 Factors to green innovations by the companies

The survey highlighted a number of issues in relation to the company's attitude to CP/GP, energy efficiency measures and investments, as well as BATs. Differences in company perception and awareness of benefits of energy efficiency and environmental improvements is quite remarkable:

- all companies surveyed were aware of the need to improve the energy use, and in most cases measures resulting in energy savings were already implemented;
- most companies interviewed consider their environmental situation acceptable, as meeting corresponding norms and requirements of the Kazakh legislation.

It was suggested that energy efficiency in the industrial sector has not had high priority up until now, but rapidly rising energy costs now make these investments attractive for companies. Moreover, it was felt that there was increasing interest in energy savings, which translated into increased readiness to implement energy efficiency measures in the coming years. A number of investments are planned or are possible which will result in energy savings, most of which could possibly be justified on the grounds of cost savings due to reduced energy use.

In regards to environmental issues, most of companies acknowledged that they face environmental challenges and the necessity to improve the environmental situation. All companies met presented their environmental programs and implemented environmental measures and projects in the past. It is worth mentioning that all the companies claimed that they observed significant reductions of emissions and waste water generation by about 10% - 40% in past 10 years. However, a simple comparison of historic figures may not give a realistic picture, since there may have been changes in production cycle, increases in actual production or fuel may have changed, etc.

During the survey environmental managers and plant managers were asked what they regard as key reasons behind their investments in environmental improvements. Companies prioritize implementation of modern equipment and technologies, or installation of clean-up equipment. They believe that implementation of environmentally cleaner technologies could be a part of major technology upgrade and production modernization programs. In other words, the key factors for environmental improvements are replacement of worn-out, obsolete equipment, and the necessity in full re-equipment of productions line/cycle rather than consideration of environmental impacts itself.

Companies also seek environmental improvements with end-of-pipe technologies, as the latter are tangible, could be adopted without any need for process change and do not require much in-house expertise. The initial and strongest impetus is to comply to Kazakh environmental requirements and allocate available funds for solving environmental problems. Environmental regulations are viewed as a 'driving force of green innovation'.

A few companies mentioned corporate responsibility ('Our holding has an integrated ISO system in place'), pressure from city authorities and wider public as minor influences to implement environmental projects.

Companies often do not opt for implementation of what they believe are 'preventative' environmental measures, because they may necessitate an internal analysis of technological process, which is difficult for companies. Several examples of measures which could be related to cost savings and greater efficiency in process were implemented solely for the production reasons, with no or little link to the company's environmental activities.

It could be summarized that most of the visited Kazakh companies perceive 'compliance' as the main purpose of their environmental management, i.e., doing what is required to defend the company against the costs of non-compliance with regulatory requirements. The technological aspect of such strategy is likely to be end-of-pipe pollution control technologies.

Corporate visits did not include any 'leading edge' companies that seek an integrated approach to environmental management and a movement towards cleaner production systems. However, it could be assumed that a limited number of companies in Kazakhstan, mainly subsidiaries of international corporations, will go beyond compliance and start re-thinking the relationship

between the corporate goals and environmental policy. They voluntarily developed their own environmental management systems, which introduce greater attention to monitoring and controlling of environmental impacts. This involves a combination of end-of-pipe technologies and preventative techniques.

It is interesting to compare the collected viewpoints of Kazakh industries with that of the industries abroad. The information below refers to the opinions of foreign companies on the factors/reasons for implementation of environmental projects. The information dates back to the mid-1990s, before the idea of Integrated Pollution Prevention and Control (IPPC) and Best Available Techniques was adopted into environmental legislation. In reality, this makes the presented opinions and viewpoints more relevant to the current framework conditions in Kazakhstan.

In 1995, the Policy Studies Institute in London presented a report on extensive interviews of a sample of 30 large companies in the chemical and engineering sectors on the reasons for investments in environmental projects. The main reasons for environmental investments were compliance with regulations, costs savings, greater process efficiency and corporate responsibility. Most of the companies cited compliance with regulations and cost savings as very important factors. Two thirds of the companies had invested in cleaner technologies and anticipated steady progress from end-of-pipe solutions in their plants and towards cleaner production techniques. The following techniques were generally considered as cleaner/greener production:

- energy management systems;
- combined heat and power (CHP);
- new process technologies for waste minimization, recycling and substitution for polluting substances;
- redesign of existing processes to minimize waste and maximize scope of recycling;
- new products that minimize energy consumption and waste generation.

In Lithuania, as many as 319 production companies were studied in 1997 to reveal major stimuli and barriers for environmental management. This research could be of particular interest because the technical and managerial culture in Lithuanian was inherited from the Soviet Union, as is the situation in Kazakhstan. The surveyed companies were asked to rank their incentives to reduce pollution and wastage. Answers on main incentives are summarized in Table 5.1 below:

Table 5.1 Main incentives in reducing pollution and waste among Lithuanian companies

Incentive	Mean Score[21]
Rapid increase of prices for energy and raw materials	4.07
Regulatory pressure, high pollution charges and fines	3.83
Environmental requirements set up by owners/shareholders	3.65
Expectations that regulations will be more stringent in future	3.45
Attempts to catch up with competitors	2.50
Public pressure	2.48
Ecological norms to enter foreign markets	2.30

It is not surprising given international experience that the rapid increase in prices for energy and natural resources, as well as regulatory pressure were given the highest score by Lithuanian companies. Interestingly that the third most important incentive was the corporate responsibility of Lithuanian companies in response to the requirements set-up by (mainly) foreign owners and stakeholders. This trend could also be seen in Kazakhstan.

The review shows that Kazakh companies usually experience the same typical reasons for investing in environmental projects, such as growing prices and compliance to environmental legislation. However, these incentives are in general not as strong and diverse as they were experienced by industries in many European countries, even prior to the IPPC 'era'. In contrast to

[21] Scores are 1 to 5, with 5 being the highest.

even most contemporary Kazakh companies, the surveyed British and Lithuanian industries showed already in the first half of the 1990s some knowledge and interest in cleaner production techniques.

Obviously, environmental behavior changes are the target of environmental policies. But an important lesson learnt from the above review of British and Lithuanian industries is that traditional environmental legislation has the potential to deliver environmental improvements and certain incentives to adopt cleaner/greener production. Education, information, training and capacity building is a policy domain that was present in the reviewed countries by that time, while these could strengthened in Kazakhstan and lead to more motivation for companies to invest in environmental projects and be more informed on CP/GP and BATs.

6. General Barriers to wider adoption of CP/GP techniques and BATs

Kazakhstan faces numerous reasons why adoption of CP/GP strategies has been slow, at the level of the firm and the level of national policy making. These relate to internal influences, technological problems and lack of external incentives as shown in Table 6.1 below. Taken together, these reasons reinforce natural tendencies towards maintaining the baseline situation and technological paths.

Table 6.1 Factors influencing CP/GP technique and BAT adoption

Internal factors in firms	Technology problems	Lack of external incentives
Lack of awareness and interest in CP/GP from company management	Complexity in CP/GP adoption	Low priced (or subsidized) raw materials and environmental costs
Lack of motivation for the middle management to developing CP/GP projects	Costs of CP/GP and BAT technologies	Weak legislative framework to support CP/GP and BATs adoption
Lack of project development skills		Absence to technical assistance and information support
Lack of financing possibilities	Lack of standards	Lack of public pressure on industry and government
		Lack of integration of CP/GP with other policies

Most of these reasons are typical for countries which is at an early stage of CP/GP adoption.

6.1 Lack of awareness and interest in CP/GP from company management

Despite the fact that many of the companies declare their “environmentally consciousness”, in reality they limit themselves to compliance to environmental requirements. This means that top managers at most companies consider compliance to standards/norms to be the main objective for environmental management at their company. Once this is in place, they allocate financial resources to other needs and purposes, which they find more urgent at present. Awareness on environmental options and their benefits is highest among the technical staff of the companies (e.g. chief engineers), but rather low within company management, the latter being responsible for approving investment decisions.

Awareness with CP/GP technologies is at a very low level within company management. Problems of organizational conservatism and inertia were also indicated during the survey; it is often difficult to persuade top management to accept the arguments in favor of CP. Some referred to 'short-term, commercial behavior' of top management. There is a common myth that BATs comprise expensive, advanced technologies. A majority of company's decision makers were taught that the end-of-pipe approach is the best and technically safest solution, and consequently, they consider preventative approaches to be high-risk.

Many Kazakh companies are subsidiaries of large industrial or communal holdings or groups, with central offices in Astana, Almaty or abroad. In such large companies, decisions on significant investments in environmental management are taken at the "top of the pyramid", while the companies themselves have a lack of power for these decisions.

Finally, frequent changes in company management can lead to changes in company business plans. New "company leaders" do not always know what has been done before and have little time to understand previous CP/GP activities and plans.

This barrier shows that environmental awareness is still weak and of low priority for most companies. Top management usually is not aware of the possibilities of implementing profitable environmental measures using CP/GP techniques and BATs.

6.2 Lack of motivation for the middle management to developing CP/GP projects

In most cases the generation of systematic CP/GP ideas and their economic and environmental assessment is not a part of the daily duties of company personnel. Unfortunately, financial rewards for such activities (bonuses) are not a common practice and depend on the decision of company management. As a consequence, implementation of CP/GP projects is based mainly on the enthusiasm of individuals. However, even if a person would like to find opportunities for CP/GP and adoption of BAT, he/she may be constrained by lack of internal and external information about the methodology and the perceived technology problems. This problem is especially acute for SMEs and municipal companies, which have limited engineering and managerial capacities.

Many believe that a rapid adoption of environmental management systems in Kazakhstan may motivate companies to choose best available technologies. Experience from other countries, as well as from the company visits, suggests that such systems tend to be 'without tangible level', regarding the strength of environmental actions. 'Continual improvement' in pursuit of policy obligations of the environmental management system is not very well defined. Furthermore, one gets the impression from the environmental action plans of ISO-14000-certified Kazakh companies, is that most planned measures cannot be characterized as CP/GP preventive measures.

6.3 Lack of project development skills

A lack of technical know-how to identify profitable preventative measures was highlighted as the major barrier to identifying and implementing CP/GP measures. Although technical skills of local engineers is high and they normally have a lot of sound ideas, they often lack the ability to identify, develop and present good projects (Business Plans) for financing as well as quality assurance and monitoring of the project implementation.

Some companies indicated that they need assistance to identify loss areas and make simple assessments of opportunities within their companies. This reflects the fact that the very development of a preventative option is a difficult task.

To reveal opportunity areas one should first locate, quantify and understand the sources of losses. However large areas of loss are often not detected and their costs are hidden in the company accounting. With no quantitative analysis and sound calculations, these opportunities may not be

regarded as real measures, ready for financing and implementation. However, even systematic identification of such opportunity areas has not previously been carried out, which implies that many are at the beginning of a CP/GP process. With some limited technical and economic support, companies may identify their opportunity areas and convert their ideas into CP/GP measures, many being typical and replicable.

Some companies believe that the potential savings are not enough to justify the high project development costs and the eventual consultancy fee. Respondents were often interested in finding external consultants who could help them identify energy efficiency measures, but were often not aware of any technical consultants who could provide them with this relevant advice. More than one company indicated that the consultants undertaking the survey were “the first experts of that kind we have met”. This was particularly the case in the Jeskazgand region, where it was also clear that companies did not always appreciate the potential benefits of CP/GP for their company.

6.4 Lack of financing possibilities

Lack of financial resources is a strong barrier for environmental project implementation, as noted by almost all companies. The situation became even worse due to the financial crisis, which led to a decline in production.

Large CP/GP projects offering ample environmental improvements may require significant investments, which the companies, especially SMEs, cannot afford. In many Kazakh companies capital for investments is squeezed by the recession and by substantial costs of restructuring. Taking a bank loan does not seems to be realistic for many of the surveyed companies, particularly in situations witch low creditworthiness. The opinion of the companies is that banks, in turn, underestimate the demand for energy efficiency and cleaner production investments.

Loans from financial institutions with lower rates requires co-financing and a bank guarantee, which may be problematic for companies, especially during the crisis. For many respondents, co-financing even 10% of the projects is a burden. Respondents were keen to access low interest (or no-interest) loans or interested in getting grants for financing/co-financing CP/GP activities.

Large companies have a focus on production upgrades and modernization, which may also lead to environmental improvements. Many of them have a large credit portfolio and cannot take additional credits for CP/GP projects at present, or their financial situation is not stable. That is why they also are not willing to take loans.

Low awareness by banks of the advantages of CP/GP was also highlighted as a barrier. It was felt that banks took a “traditional” approach to assessing the viability of projects, and were therefore comfortable with projects which lead to increased production/sales, but less comfortable when the economic viability of a project was dependent on savings and reduced production costs. Establishing alternative financial instruments purposed for environmental improvements would be urgently needed to deal with this barrier.

Several years ago enterprises implementing environmental protection measures could approach Environmental funds (such as national or regional). However today this practice and other similar instruments for co-financing of environmental investments and projects development are no longer available.

6.5 Complexity in CP/GP adoption

Complexity of new techniques underpinning CP/GP, such as preparation of mass balances, benchmarking etc. often results in a reluctance to apply these techniques. This was highlighted by several companies visited.

Preventative measures that go beyond housekeeping typically demand detailed auditing of processes and often several stages of examination to eliminate new problems introduced by a

process change. This calls for time and labor intensive data collection and analysis. This is a constraint for most of the companies, in particular for SMEs.

Savings achieved through the implementation of such projects are difficult to quantify. Many companies don't have tracking or accounting systems that would allow proper documentation of savings or the control and valuation of inputs and outputs. This could lead to problems in demonstrating positive returns to investments made in CP/GP projects.

In contrast, many end-of-pipe technologies are specific and could be promptly implemented. As one company stated, an apparently preventative measure involving recycling of effluents might require an additional investigation and knowledge of auditing techniques that is unfamiliar to them. Therefore, unless environmental regulators require this level of investigation, an investment is likely to be restricted to end-of-pipe.

Companies also expressed the desire to see several demonstration projects testing CP/GP innovations, especially among companies without in-house capacity for major trials of methodology and technology.

6.6 Costs of CP/GP and BAT technologies

Most of companies refer to pressure for short-term cost recovery on capital investments. Payback periods typically reported for waste minimization measures were well under 3 years and this is very favorable. However, experience suggests that the contribution and payback of various types of measures differ substantially. While CP/GP can be obtained through better housekeeping and day-to-day operational controls, radical improvements are often connected to process innovations. Companies that go beyond the stage of improving their process housekeeping and product modification may achieve greater environmental gains.

Therefore, costs of some larger CP/GP investments would be high and the payback period would be extended beyond short-term interests. This is usually a problem for companies which place the maintenance or upgrading of production processes as a first priority.

In this respect one of the fundamental problems is a failure to identify the 'true cost' of wastage (hidden costs) to adequately account for environmental impacts and its associated costs which are not easily quantifiable. If this could be done, many more CP/GP measures would meet company's requirements on the return on investment.

6.7 Low prices of raw materials and environmental fines

One of the main disincentives to wider adoption of CP/GP projects are the relatively low environmental fees, as well as tariffs for water, energy and other natural resources.

The "polluter pays principle" is an approach to control environmental impacts of industrial activities in Kazakhstan. Many companies, including those which were interviewed, tend to stay within the established norms of environmental pollution. According to legislation, such an approach is believed to be an effective mechanism to stimulate enterprises to reduce the negative impacts on the environment - less pollution, less payment.

In reality, the current level of environmental fees and payments does not act as an incentive for environmental improvement. For the "polluter" it is cheaper to pay all the necessary fees than to implement environmental protection measures.

Costs for water, energy and other resources, as well as environmental fees seem to grow slower than prices for the final products (likely due to subsidization or the lack of scarcity pricing). This is another disincentive to CP/GP improvement. Companies often pay utility costs in advance, according to consumption plans. If a company reduces energy and water consumption, its quota for usage of these resources may be reduced for the next period, with an adverse effect on production growth. These companies would have to pay a fine as well, for undelivered services.

Therefore, many companies are interested in keeping their consumption of resources stable, rather than to economize. Most companies however are of an opinion that these payments would increase in the future, but it was not clear how fast these changes may happen in the next three years.

With regard to environmental fines, companies that consistently perform better environmentally usually are a subject to the same level of stringency as those that perform poorly. Increased flexibility in regulatory requirements provides incentives to improve performance.

Strong enforcement of environmental payments is a pre-requisite for enabling the “polluter pays principle”. One of the potentially detrimental issues is evasion of environmental fees, in cases where possibilities exist to obtain a permit based on incorrect or un-precise calculations of maximum quantities of pollution, incentives for modernization and cleaner production disappear.

6.8 Lack of public pressure on industry and government

Even though the current legislation contains provisions on information sharing of environmental performance, actual practices and possibilities to put pressure on industrial companies are not well tested or known. Public demand for such information is also quite limited – but this is primarily due to the lack of environmental impact awareness. Decisions on requiring companies to submit periodic environmental reports is said to be dependent on personal opinion. It is easy to find information on environmental pollution in settlements, but it is difficult to relate this information to a specific production site.

In many countries, the dissemination of information on environmental pollution and pollutants, through for example web-portals, the involvement of NGOs and industry branch organizations in establishing environmental policies and programs is inclusive and highly appreciated and leading to better environmental performances of companies.

6.9 Lack of sufficiently developed National Reference Documents on BATs/standards

Best Available Techniques, which are included in an Integrated Environmental Permit, must comply with the list of BATs approved by the Government of the Republic of Kazakhstan. The purpose of a BAT reference document for a certain sector is to give information on a specific industrial/agricultural sector, techniques and processes used in this sector, current emission and consumption levels, techniques to consider in the determination of the best available techniques (BAT) and emerging techniques. Such a list was approved by Government of the Republic of Kazakhstan on March 12, 2008 № 245. The comparison of Kazakh BATs with the international BATs is presented in Table 6.2 below.

Table 6.2 Comparison of Kazakh and international BATs

Kazakh BAT Reference Documents	International BAT Reference Documents
“Horizontal” reference documents	
1. Waste water treatment for industries ▪ irrigation farming ▪ purification of municipal sewage ▪ light industry ▪ food industry ▪ oil refining ▪ mining ▪ galvanic production ▪ non-ferrous metallurgy	1. Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector 2. Management of Tailings and Waste-rock in Mining Activities 3. Industrial Cooling Systems 4. Emissions from Storage 5. General Principles of Monitoring 6. Economics and Cross-media Effects 7. Energy Efficiency

Kazakh BAT Reference Documents	International BAT Reference Documents
"Horizontal" reference documents	
2. Tailings Storage and Waste-rock in Mining Activities	
Industry reference documents	
1. Combined heat and power 2. Marine and continental oil production 3. Processing and storage of oil, petroleum products and hydrocarbon gases 4. Ferrous Metals Processing Industry 5. Non-ferrous Metals Industries 6. Chemicals industry	1. Large Combustion Plants 2. Refining of Mineral Oil and Gas 3. Iron and Steel Production 4. Ferrous Metals Processing Industry 5. Non-ferrous Metals Industries 6. Smitheries and Foundries Industry 7. Surface Treatment of Metals and Plastics 8. Cement, Lime and Magnesium Oxide Manufacturing Industries 9. Manufacture of Glass 10. Ceramic Manufacturing Industry 11. Large Volume Organic Chemical Industry 12. Manufacture of Organic Fine Chemicals 13. Production of Polymers 14. Production of Chlor-alkali 15. Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilizers Industries 16. Large Volume Inorganic Chemicals – Solids and Others Industry. 17. Production of Specialty Inorganic Chemicals 18. Pulp and Paper Industry. 19. Textiles Industry. 20. Tanning of Hides and Skins. 21. Slaughterhouses and Animals By-products Industries. 22. Food, Drink and Milk Industries. 23. Intensive Rearing of Poultry and Pigs 24. Surface Treatment Using Organic Solvents. 25. Waste Treatments Industries. 26. Waste Incineration.

Kazakhstan's developed BATs cover the most common Kazakh industries and has approved a list of BATs, which includes a number of technical and technological solutions and for some technical solutions approximate performance indicators are given. BAT Reference Documents were originally developed for different sectors by the European Commission[22] to set out the main principles for the permitting and control of installations based on an integrated approach and the application of best available techniques which are the most effective techniques to achieve a high level of environmental protection, taking into account the costs and benefits.

The industrial/agricultural sectors for which the implementation of BAT is the most relevant has been defined in Kazakhstan, however information in these BAT Reference Documents still requires serious improvements. These Kazakh reference documents for BATs are mostly based on "end-of-pipe" techniques, typically more expensive, to reduce emissions to air, water and land. These "end-of-pipe" techniques dominate in the approved reference methods rather than process integrated techniques. In addition: (i) enterprises are poorly informed about the approved list of

[22] http://ec.europa.eu/environment/air/pollutants/stationary/index.htm

BAT, and those which are informed do not systematically use in their activities; and (ii) the approved list insufficiently expresses the concept of BAT as an economically based approach, primarily aimed at **preventing** pollution, as the Kazakh BATs emphasizes "end-of-pipe" techniques.

For industries, in order to obtain an Integrated Environmental Permit, the transition to BATs is required, but these BATs either are not related, or are insufficiently taken into account when technological rules, regulations and other documents are developed. Kazakh BATs are weakly linked to the related subordinate regulations. One of the possible reasons for this is the voluntarily nature of integrated environmental permits, and as a consequence, the voluntary implementation of BATs.

Recent meetings with representatives of the MEP revealed that the Kazakh national BATs would be revised in the near future. The effectiveness of such national BAT system would be strengthened with better correlation between Kazakh BATs and international experience in the relevant industries and with more attention to adoption of the pollution prevention concept. Reference documents generally give information on a specific industrial/agricultural sector, techniques and processes used in this sector, current emission and consumption levels, techniques to consider in the determination of the best available techniques (BAT) and emerging techniques which allow the regulator to discuss the adoption of these techniques with other industries who did not yet adopt these processes.

Apart from the EU's BREFs notes there are a substantial and growing number of international reference books, benchmarks, good practices and guidelines which set BATs and show good CP cases. Their purpose is to raise company confidence on CP technologies, techniques, provide methodological support and benchmarks. Many such publications aim at best available technologies and operating practices not entailing excessive costs. Experience has shown that such documents are a very powerful force for CP/GP improvements.

6.10 Lack of integration of CP/GP and BAT in existing environmental and energy saving policies and programs

CP/GP is not integrated into the existing environmental and energy savings programs. Companies that stay within the approved levels of pollution get no impetus for further environmental improvement. The list of BATs approved in Kazakhstan is not well integrated in the current system of environmental permitting and reporting and therefore there is little incentive for the companies to use it.

(Regional) Environmental authorities do not have real policy instruments to perform capacity building and influence companies' environmental behavior and detailed experience and understanding of CP/GP and BATs as well as policy development experience is lacking. This leads to requirements for rapid actions i.e. to invest in end-of-pipe solutions rather than explore preventative options with longer term bigger environmental impacts.

Existing legislation determines a rather distinctive relationship between the regulator and the regulated. An appropriate analogy would be the teacher and pupil. What this relationship does is to place all responsibility for environmental compliance on the 'shoulders' of regional environmental authorities, while the regulated companies, like the pupil, often take the passive role, as receiving external conditions on how to act. One environmental observer stated that SMEs are hardly pressed and tend to see themselves as 'victims' of regional environmental authorities.

7. Recommendations Improving industrial competitiveness through potential of greener and cleaner production

Most of the issues and barriers discussed above were generic, but are similar with other countries at the beginning of adoption of CP/GP and BAT. Ample international experience of dealing with

these issues and barriers is available with descriptions and analysis of several tested policy, which could be used by Kazakh policy-makers to familiarize themselves with international experience and try to apply some of these tested policy instruments.

The introduction and broad adoption of CP/GP and BAT in a country such as Kazakhstan requires coordinated action on various fronts, including the regulatory framework, removal of barriers and the introduction of institutional and economic incentives. Although Kazakhstan has environmental legislation and regulations in place, a comprehensive policy needs to be established which comprises a number of possible tools for policy implementation.

The industrial sector in Kazakhstan is heterogeneous, with many types of companies of different size, sector, mode of operation, conditions, level of energy consumption, potential for savings, etc. Various factors may influence successful application of CP/GP, for example business interests, corporate governance, management practices and other fundamental factors typical for economies in transition. Development of an integrated CP/GP policy which will address these barriers and which will ensure further recognition of the CP/GP concept by Kazakh legislation, could give a major impetus to adoption of CP/GP at all levels of authorities and companies. This will, in turn, ensure broader adoption of CP/GP within the country.

Technical assistance could speed up this process by raising awareness and facilitating the process of removing barriers. Since CP/GP activities in Kazakhstan are at early stage of development, it may be beneficial to involve various stakeholders into CP/GP policy development. In an ideal situation, it would be a collaborative effort to address all barriers at an early stage, rather than one by one. However, promoting single elements of market development will also have a positive effect.

Based on international experience, CP/GP policies and programs may have a variety of objectives, but in general they share a number of common basic principles:

- They are likely to be effective only if they have a solid basis within the existing policy framework, and should be integrated/harmonized/consistent with these policies, which in turn need to be enforced;
- They should be promoted as an economic tool that improves production efficiency and competiveness while at the same time preventing environmental degradation;
- They should create conditions and incentives that stimulate companies to adopt preventative practices and technologies;
- They should promote the use of preventative techniques, rather than end-of-pipe technologies.

A Government's main role in facilitating the introduction and broad adoption of CP/GP and BAT may fall within the following categories:

- Improving regulations to facilitate implementation of CP/GP and BAT;
- Strengthening economic incentives;
- Facilitating project development and implementation.

For each of the above three categories, the table below presents an outline of the main barriers and a toolbox of policy options which have been used successfully in other countries to remove or overcome them.

Table 7.1 Toolbox of policy options to overcome barriers of CP/GP implementation

Main Barriers	Policy Strategy	Toolbox of Policy Options
Weak legislative framework facilitating CP/GP projects	**Improving regulations to facilitate CP/GP and BATs implementation**	Recognition of CP/GP on political level and an integrated policy development on CP adoption
Lack of sufficiently developed National Reference Documents on BATs/standards		Evolution of environmental permitting: Review and harmonize current norms and threshold values. Update national BATs
Lack of public pressure on industry and government		Integrate elements of pollution prevention and control into current permitting procedures to foster the preventative approach
Lack of integration of CP/GP with other policies		Improvement of state environmental monitoring
		Linking CP/GP and BATs into sector strategies, plans and programs
		Better involve NGO's and industries in the development of CP/GP policies, as well as BATs
		Better engage regional authorities
Low prices on raw materials and environmental costs	**Strengthen Financial and Economic Incentives**	Strengthen payment discipline and increase environmental fees and charges for incompliance; removal of subsidies or full-cost pricing
Costs of CP/GP and BAT technologies		Apply financial instruments to promote CP /GP projects implementation
Lack of financing possibilities		Mobilizing resources of international programs and financiers
Absence of technical assistance and limited access to CP/GP and BATs information	**Facilitating project development and implementation**	Dissemination of Information on CP/GP and BATs to industry and other stakeholders.
Lack of interest in the CP/GP Program/activity from enterprise management		Capacity building and demonstration projects/programs for industries
Lack of capacity to develop viable projects		Training of Regional Environmental Authorities to strengthen their capacity to develop CP/GP policies and process integrated permits
Lack of standards		Initiate a industry's demonstration projects on practical application of integrated permits and BATs

Main Barriers	Policy Strategy	Toolbox of Policy Options
		Make public funds available to free government-supported environmental consultation, advice

The three categories mentioned above are discussed in more detail in the following sections.

7.1 Improving regulations to facilitate CP/GP and BATs implementation

CP/GP has been often considered a voluntary initiative, left to companies to adopt, if appropriate. In contrast, environmental regulations, and the associated permitting needs, are an obligation to be met by companies. Traditional command-and-control legislation is still viewed by many researchers as an inefficient way of achieving environmental quality improvements, as it gives no impetus for continuous improvements.

The movement toward CP/GP and BAT is at its earliest stage in Kazakhstan and adjustment of regulations is seen as the key factor in promoting take-up of preventative approaches. However, while Kazakh environmental authorities increasingly embrace the idea of building an integrated pollution and prevention policy framework, the regulatory changes required will probably take many years. For the short term, therefore, the key focus for government policy in the coming years is recommended to be on strengthening measures to encourage the take-up of CP/GP and BATs within the current policy framework. Below is an outline of a proposed set of policy tools that could be realistically implemented without a major change-over in the current legislation.

7.1.1 Recognition of CP/GP on political level and an integrated policy of CP/GP promotion

Several countries have adopted a policy/declaration that proclaims waste prevention at source and adoption of BAT as one of the major principles of environmental protection. These policies usually provide broad goals, tangible objectives and a broad outline of approaches needed to meet these objectives. It requires the promotion of the concept of preventative strategies in various aspects of governmental policy framework.

As suggested by UNIDO, general national CP/GP policy development cycles may consist of four stages:

1) Analysis of baseline situation and identification of barriers;
2) Setting priorities and objectives;
3) Development of strategies, action plans, policy instruments, etc;
4) Implementation, evaluation and update of the policy;

In Kazakhstan, it might be more suitable and traditional to call such policy initiative as a ‘concept’ or ‘program’. While the actual process of developing a national CP/GP policy and its content may be specific to Kazakhstan, there are certain common principles that should be observed:

- CP/GP and BAT address environmental, technical, economic and social aspects and therefore the policy for their adoption shall be multidisciplinary. The Ministry of Environmental Protection (MEP) does not currently have the capacity to develop such policy and therefore requires strengthening in this respect, and support from other relevant ministries. Usually high level steering committees or inter-ministerial working groups are established for this purpose;
- CP/GP and BAT need a champion: for example a strong and active ministerial unit or independent center;

- Relevant policy development usually includes a mix of regulatory tools, economic incentives and technical assistance/awareness raising programs;
- Adoption of CP/GP policies will involve various stakeholders and influence several interests. Therefore such policy shall encourage greater cooperation between polluters, regulators, decision-makers, universities. etc.
- An essential element of such policy is to define measurable objectives and an effective mechanism to monitor progress and evaluate effectiveness and periodic adjustments;
- There should be reasonable transition period to implementation of CP/GP policy.

7.1.2 Integration of elements of pollution prevention and control into current permitting procedures

It is possible to integrate elements of pollution prevention and control into the existing permitting procedures without a major transition to an IPPC-type legislation. This has been tested in some countries and could be adopted in Kazakhstan. The main task is a requirement that companies perform CP/GP assessments and/or incorporate CP/GP projects and programs as a part of the company's environmental action plans which are subject for approval by the authorities. However, such requirements put no obligation on the regulated companies to implement all potential preventative measures. The following list contains possible approaches:

- Permit application forms may include questions that would help the authorities determine if CP/GP potential exists in the applicant's facility. For example a question on material, water and energy balances;
- The permit application package may include some support materials/information booklets for the companies on how to develop their environmental action plan, with reference to preventative techniques and BATs, as well as contact details for further information;
- A permit can be issued under the condition that a CP/GP program must be developed, or even prescribed that companies must demonstrate that they have a waste minimization plan in place. Companies could then be required to submit a progress report;
- Reduced inspections or environmental charges may apply to companies who implement BAT or CP/GP projects. In addition, supplemental pollution prevention projects could offset fines for non-environmental compliance;
- Environmental permits may be set based on integrated analysis of specific environmental impacts and performance efficiency, as well as current operation & maintenance and housekeeping procedures. They can also include waste prevention targets. This will of course require revision of currently used standards.

It is important to make the industries aware that wider adoption of CP/GP principles in the current permitting procedures would not entail extra costs and burden to the companies in achieving their compliance.

7.1.3 Harmonization of current norms and threshold values

The review and comparison of Kazakh air quality standards with similar EU standards showed that in some cases the former are more stringent than their European analogues, even though the EU standards are based on the World Health Organization recommendations. On the other hand, it could be noticed that at least few companies obtained emission limits values that do not meet stringent Kazakh maximum allowable concentrations and that allow to quite high quantities of air emissions. This current situation allows companies to follow and meet the environmental regulations without improving the technology and it does not stimulate the introduction of CP/GP and BAT. In cases where companies are required to reduce emissions of pollutants, the focus is at end-of-pipe techniques.

Harmonization of the current standards could be achieved by establishing a methodological panel that would review current maximum allowable concentrations and harmonize them, if they are redundantly stringent or low, with due consideration to the World Health Organization recommendations or similar EU's norms. In addition, the current methodology for setting emission limits values could be optimized to avoid that emission level requirements may need to be different for similar companies. This methodology panel is advised to ensure that the methodology takes well into account technical conditions of the companies. In this respect the following recommendation could entail:

- Simplified methodology for Small and Medium Enterprises;
- Development of pre-defined emission limits values for standard equipment. For example, such standard values could applied for small-scale standard emission sources, e.g., boilers, for gas stations, etc.

Such an approach would simplify the permitting procedures for SMEs, reduce the burden on the environmental authorities and will allow them to pay more attention to larger polluters.

7.1.4 Future development of integrated permitting and national BATs in Kazakhstan

Kazakhstan has made progress in the introduction of integrated permitting. Technological regulations for certain categories of equipment is being developed and approved. The concept of integrated environmental permitting based on best available techniques has been formally adopted in Kazakhstan. However, regulation of emissions is still based on compliance with environmental quality standards.

One of the basic constraints is that Kazakhstan currently lacks a methodology of determining of the BATs. Such methodology should include procedures and technical guidelines for setting the BATs based on technical condition of local industries and best international practices.

In principle, the choice of BAT includes a comparison of technical methods that lead to reduction of emissions/discharges and identification of a method which contributes to a best environment effect. These alternatives should be referred to both preventative techniques, dealing with improvement of production processes and end-of-pipe methods. The option that allows minimizing the environmental impact from installations is considered to be BAT. The cost of the option be taken into consideration if a cost-benefit analysis shows that the unit costs associated with this option (compared to the other) are incomparable with environmental benefits. Both operational and capital costs should be taken into account in cost-benefit analysis. The calculations shall include the 'true cost' of environmental pollution. For instance, use of fine raw material may be initially more expensive, but in general its use can lead to savings by increasing product quality and decreasing of waste generating.

There is variety of international references on BATs. These materials contain extensive relevant information and could be carefully reviewed. It should be noted, however, that BAT may vary for different countries because of the different industry profile and background. It is suggested that the above mentioned methodology panel could lead the process of BATs update, which should involve a wide spectrum of scientific institutions, industry associations and other interested parties.

In this respect, it is advisable to fine-tune and clarify current procedures for the integrated permitting. Such process could be done in stages by identifying first priority industries, based on environmental impact, expected compliance costs, economic performance, as well as current capacities of the relevant environmental authorities. In addition, it may be recommended to establish different compliance deadlines for new and existing installations. It is suggested to develop a policy plan of transition to integrated permitting, including a plan of actions and deadlines. Such plan should be coordinated at the level of the Ministry of Environmental Protection and other interested parties, and preferably approved by the Government.

An essential step in transition to an integrated permitting system for large industry is to define the scope of the system, namely preparing a list of affected industries and the minimum size

(production capacity) of units controlled by the integrated permitting. It shall be mentioned that Kazakhstan has already made steps in this direction. However, it is recommended to further develop the method of attributing the categories of environmental burden to the industries. This may involve stakeholder consultations and discussions with industry representatives.

To meet integrated permitting requirements existing industrial companies need to prepare relevant strategies and they will need time to make appropriate investments. Smooth transition to the new permitting system may require methodological support and capacity building of the industries and authorities. International technical assistance may be essential at this point.

Consequently, steps to plan the development of appropriate methodological support and development of the institutional system are necessary. Training of local consultants, which in future could provide technical support to the companies on these issues, could also be considered. One of the elements of capacity building could be further development of national recommendations on integrated permitting and BATs development.

7.1.5 Involve relevant stakeholders in the development of CP/GP policies and BAT

Traditionally, the Government takes a dominant role in policy making. Development of CP/GP policies, however, needs input and support from different interest groups. This will encourage greater co-operation between industry, regulators, NGOs, universities, consultants, etc.

Companies are the main target for the policy and communication with this group is essential. They need to provide feedback to the proposed actions, or on their results. Companies may provide practical information on their needs and barriers faced. They could also be a useful source of information about BAT, realistic performance indicators and maximum permissible quantities of emissions. Often, industries are represented by branch associations that may have better capacity to perform policy analysis and generate policy recommendations. They may, on behalf of the industry, develop voluntary agreements with the Government to meet the policy objectives. In parallel they may disseminate information to the companies and persuade the top management to adopt CP/GP techniques and BATs.

Non-governmental organizations may introduce an element of public pressure on environmental policy makers, and on industries. However, they may also provide useful information and analysis for policy makers. They may often lobby for such policies and implement voluntary activities at local, regional and municipal levels. International experience suggests that it is important to involve non-governmental organizations in the policy making process for CP/GP and BATs. Other stakeholders that could be involved in the policy making process are: (i) environmental consultants, CP/GP Centers; (ii) Financial Institutions; (iii) International Organizations; and (iv) Universities.

7.1.6 Engagement of regional environmental authorities

Engaging the regional environmental authorities in the implementation of preventative measures is an important step in getting more CP/GP projects implemented. The Ministry, in its work in promoting CP/GP improvements, may want to cooperate closely with and communicate clear messages to the regional environmental authorities as one of the main pre-requisites of the success of CP/GP is a pro-active position and attitude of the authorities.

This point may be illustrated by the Norwegian experience. In the 1980's, Norway launched a program on technical and environmental production analysis of industrial companies. There was strong pressure by the Norwegian authorities to push the companies to perform the technical environmental analysis, especially at the start of the program, which would not have been a success without strong support from environmental authorities, as companies would not have readily opted to perform CP/GP reviews and adapt to CP/GP principles.

Below are a few simple practical examples on how environmental inspectors/regulators can play a role in promoting the adoption of CP/GP and BAT:

- Distribute pollution prevention information for specific industries during their inspections;
- Conduct waste minimization reviews;
- Review environmental action plans by the companies and ensure that these contain preventative measures;
- Highlight economic benefits of the preventative options;
- Refer the companies to experts, support schemes and sources of information.

Engagement of regional environmental authorities could practically be encouraged through the introduction of the environmental "Hot Spots concept". It may be expedient for Category 1 companies to be considered as Environmental Hot Spots, as has been done in Russia. Their most acute sources of environmental degradation could be carefully described, while official status recognized. In such a case national/regional environmental authorities could receive a mandate to assist the companies in elimination of these Hot Spots. Kazakhstan may review the effectiveness of Russian procedures for elimination of Hot Spots, in particular with respect to the following:

- Screening and analysis of a Hot Spot;
- Definition of a Hot Spot, identification of exclusion criteria and establishment of its official status;
- Drafting and approval of Plan of Mitigation Actions
- Implementation of Action Plan by a Hot Spot company;
- Application for Exclusion from Hot Spots List.

This scheme commits environmental authorities to guide and support the industries in the process of elimination of the most important environmental concerns.

7.2 Strengthening Economic Incentives to encourage CP/GP and BAT

Economic instruments can be used to integrate costs to the environment into the costs of products, so to make costs of pollution more expensive than the costs of CP/GP techniques. These instruments can be used to shape and direct the investments, influence technologies and techniques used, manage pollution and emissions, as well as use of materials, energy and water. There are two forms of economic instruments: those that provide rewards (incentives, subsidies, etc) and those that penalize (levies).

The advantage of economic instruments is that they do not prescribe specific technical solutions or technology, but leave the target group to decide what options to take. In contrast to environmental regulations, these instruments are more dynamic, as they offer a constant incentive. They do not require extensive control, enforcement arrangements and costs.

It is becoming clear that before applying any advanced economic instruments, the Government evaluates the integrity of prices for resources and environmental pollution, and if any of these are artificially low (i.e. subsidized) this is be addressed (i.e. removal of subsidy). Also, tradable emission schemes for CO have been introduced in many countries as advanced economic instruments, an instrument which the Government of Kazakhstan is also piloting (see box below).

Box 7.1 Using Tradable Emission rights to reduce Greenhouse Gases

In addition to providing economically viable options to reduce emissions of pollutant to air, water and land, pollution prevention techniques such as CP and BAT can effectively highlight opportunities to reduce greenhouse gases (GHGs), in particular CO_2. This is currently of particular relevance in Kazakhstan. Recognizing the potential global challenges resulting from projected climate change and the need for mitigation actions, Kazakhstan has taken on a voluntary obligation to decrease GHG emissions by 15 percent by 2020 and by 25 percent by 2050, both reductions compared to the 1992 level. In order to meet these obligations, Kazakhstan plans to introduce a national emission trading scheme (ETS) designed to encourage economic measures to reduce emissions of GHGs. This aim to reduce national levels of GHGs has been confirmed and ratified in the strategic development plan of the Republic of Kazakhstan until 2020, approved by the Presidential Decree № 922 dated 01 February 2010, and with an initiative to create a National ETS according to the Law "On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan concerning Environmental Issues" № 505-IV dated 3 December 2011 (the Law "On Amendments").

Kazakhstan ratified the Kyoto Protocol on 26 March 2009, which, apart from the wish to take an active part in global abatement of climate change, was also guided in part by economic reasons, including the attraction of foreign investments through the Kyoto protocol mechanisms, in particular Joint Implementation (JI), and participation in the global carbon market, through the potential to link the Kazakh ETS with other systems such as the EU ETS. With respect to the Kyoto Protocol (KP) mechanisms, no JI projects have so far been implemented in the country as Kazakhstan has not succeeded in being included in Annex B of the KP.

With respect to the proposed National ETS, the new law "On Amendments" introduces changes into the Ecologic code that allows Kazakhstan to implement an emission trading scheme and participate in the carbon market by signing international or bilateral agreements. According to the Law "On Amendments", all GHG emitters will be divided into two categories, depending of the annual level of their emissions:

- entities with overall annual emissions exceeding 20,000 tons of CO_2 ("Major Emitters") which can participate in the Domestic ETS;
- entities with overall annual emissions not exceeding 20,000 tons of CO_2.

Allowances for GHG emissions will be allocated by the Ministry of Environmental Protection (MEP) to the major emitters on the basis of the National GHG Emission Allocation Plan that should be developed by the Ministry and approved by the Government in 2012. Allowances will be indicated in a certificate issued by MEP. Those major emitters who need to increase their emissions can buy allowances from those who keep their emissions level below the quota given in their certificates. This will form the basis of the national ETS in Kazakhstan. The first 'trial' period for the Kazakh ETS will be 2013-2015, with the second phase lasting through the next five years (2016-2020). During the following phases, the domestic ETS is planned to be linked to either international or regional systems and their duration will be dependent on the corresponding commitments. Table 7.2 presents the total number of "major emitters" broken down by economic sector, and the proposed reduction of GHG for each sector.

Table 7.2 Total number of "major emitters" by economic sector

Economic sector	Amount of companies in the sector	Total emissions in the sector, tCO_2	Reduction by 7 percent, tCO_2 equivalent	Total reduction in the sector, tCO_2 equivalent
Energy	45	58 155 683	54 084 785	4 070 898
Oil and Gas	52	29 094 836	27 058 197	2 036 639
Coal production	13	14 042 172	13 059 220	982 952
Manufacturing	39	44 694 081	41 565 496	3 128 585
Transport	42	8 943 025	8 317 013	626 012
Agriculture	3	361 189	335 906	25 283
Total	**194**	**155 290 986**	**144 420 617**	**10 870 369**

As highlighted previously, CP/GP and BAT can lead to significant reductions in emissions of greenhouse gases, in particular as a result of decreased electricity consumption and energy efficiency measures which lead to a reduction in the use of other fossil fuels such as natural gas. It is therefore expected that the introduction of initiatives to promote pollution prevention techniques such as CP/GP and BAT would also be an effective approach to reducing emissions of GHGs and therefore meeting Kazakhstan's ambition to making a significant contribution to combating global climate change.

For all economic instruments, the Government may want to carefully evaluate the possible effects of economic instrument measures to avoid unexpected and unwanted results and begin with simple policy measures, which were successfully tested in many other countries. Some of these recommended policy measures are outlined below.

7.2.1 Strengthen payment discipline and increase fees and charges for environmental non-compliance

With regard to resource costs, information suggests that industries in Kazakhstan now face costs that were previously very low; higher costs of raw materials, higher fuel costs, higher utilities costs (in particular energy and water), environmental taxes and often new costs for waste disposal and emissions. All these cost elements are gradually increasing and have reached levels that represent a considerable part of the total production costs and may continue to increase in the future.

An increase of prices on resources does not necessarily have direct implications on environmental pollution. In the 1990s Kazakhstan, underwent a period of rapid rise in energy prices. However, its energy intensity continued to increase at the same time.

Therefore it is important to analyze whether current costs are high enough to encourage waste minimization and reduction of environmental emissions. Typically, economic analysis of environmental charges and fines are undertaken to ensure that the costs of these charges and fines are high enough to encourage companies to start undertaking Cleaner and Greener Production and investments in pollution control. Fines for environmental non-compliance should be high enough to make it economically interesting for companies to comply with the regulations. In many countries, environmental charges and fines are based on a solid and transparent methodology, which is adopted after consultations with affected groups i.e. industry and NGOs. The basic preconditions for an effective application of environmental fees and charges for non-compliance are:

- Rules are possible to meet and regulated effectively;
- State enforcement of compliance is even and acts as a deterrent to non-compliance.

7.2.2 Apply financial instruments to promote CP/GP projects implementation

Most countries started their CP/GP policies by making funding available for some technologies which are considered as BATs. This support may strengthen the focus on the profitability of such projects. A similar type of support may be very welcomed by Kazakh industries, as was highlighted during the pilot benchmarking.

At present, however, there is no Kazakh financial program or facility offering direct financial subsidies for environmental projects. Grants and subsidies are important in many countries to overcome the barriers of organizational conservatism and short-termism in financial appraisals. This form of support was common for the countries promoting CP/GP and BATs at an early stage of CP/GP adoption. Usually grants and subsidies are made available to pilot projects aimed at demonstrating new technologies or techniques. They may be available for companies of all sizes and industrial sectors, but they might be more relevant for SMEs, which have limited capacities and skills. In most cases, this form of financial support was additional, i.e. to initiate improvements in processes which otherwise may not be realized due to the technology used not being tested or its profitability not yet being proven.

Soft loans also have been successfully tested by other countries and companies participating in the pilot benchmarking exercise were quite interested in such potential facility. The size and short term return of many such investments means that the companies may also seek short- and mid-term financing by Kazakh commercial banks. As the demand for such projects is already present and is expected to grow, some of the existing credit organizations and programs could potentially enter the market and begin their operations in the relatively near future (2-5 years).

This instrument would clearly encourage CP/GP improvements. An example is the successful experience of the Nordic Environmental Finance Corporation (NEFCO), which offers small soft loans in Russia and Ukraine. The Russia/Ukraine Cleaner Production Program, started in 2008, is designed to stimulate investment in cleaner production projects and promote cleaner production best practices and policies. It provides financing for preventative measures with a payback of max. 4 years. The loan ranges between € 100 000 and € 350 000, with an interest rate of 6%. This program has significant coverage in these countries and several hundred companies have so far received this form of financing. Large companies, however, stated that they would not be interested in small soft loans, specifically those companies which need to have their loan applications approved by their head offices.

Financial incentives may also include tax incentives. An advantage of this instrument is that they require much less overhead expenses. Tax incentives may require a less selective approach, as they can be provided to all sizes of companies and technologies drawn from an approved list of technologies. One of the effective way of application of tax incentives is so-call 'Dutch model', which takes a form of an extra allowance against tax for depreciation in the first year of CP/GP or BAT investment. This provides an attractive liquidity and interest gains for the companies, since accelerated depreciation allows larger tax deductions in early years.

If such instruments would be applied in Kazakhstan, it would be recommended to start with provision of grants/subsidies for implementation of pilot projects. Since companies in Kazakhstan still often have a misunderstanding of the CP/GP concept, which prevails particularly at top-management level, implementation of pilot and demonstration projects is of vital importance. However, careful design of disbursement provisions would be required for application of such instruments, as companies are skeptical a priori about what they often call as 'fair choice' of a grant beneficiary.

Once these economic instruments are successfully tested and significant experience accumulated to allow companies to become aware of the benefits of the preventative approach, more advanced economic instruments could be designed, such as green certificates.

7.2.3 Mobilizing resources of international programs and financiers

So far, there are few instances of demonstration CP/GP projects in Kazakhstan. This challenge could be resolved by mobilizing targeted technical assistance, which may be available with international programs and financiers present in Kazakhstan.

Issues related to energy infrastructure, energy efficiency, renewable energy and climate change have always been high on the agenda of international institutions and they have implemented several energy and environmental projects and programs in Kazakhstan.

Along with the Russian Federation and Georgia, Kazakhstan is one of the major recipients of bilateral and multilateral environmental assistance in CIS countries, according to the OECD (2009). Environmental assistance to Russia has witnessed a structural change since the beginning of the 2000s. Assistance from IFIs has multiplied with respect to assistance to resource and energy efficiency programs. The "Kazakhstan Resource Efficiency Transformation Program" financed by the EBRD is such an example. As of today, there is no credit facility yet supported by IFIs that provides targeted soft financing to CP projects in Kazakhstan.

International programs could be established performing capacity building on energy efficiency, renewable energy and environment. It may be possible to gain a synergy by mobilizing resources from large international credit facilities (e.g., Kazakhstan Sustainable Energy Financing Facility), the Government may promote implementation of CP/GP projects at larger companies.

7.3 Facilitating projects development and implementation

Currently, neither environmental authorities, nor industries possess adequate insights in integrated pollution prevention and control and BATs. Wider adoption of CP/GP and BATs

requires willingness, shared vision and consensus among various stakeholders. It is also important to stimulating the development of an industry culture of committing to achieving an environmental performance beyond minimum environmental requirements.

Governments in many countries have realized that information and technical assistance are of major importance in disseminating innovative technologies and management systems. Industries cannot implement CP/GP techniques if they are not aware of them, and nor can there be any public pressure, if the public is unaware on such approach to environmental protection.

Knowing where to start is another basic and common problem for wider adoption of CP/GP and BATs. As application of the preventative strategies would normally require a systematic analysis or wastage at source, it is essential for the companies to increase their knowledge of project development and implementation. Optimum or correct decisions may even not be taken simply because a decision maker within a company or authorities does not have sufficient information about the available options.

As mentioned, Governments in many countries see themselves as providers of advice and information. Dissemination of information on CP/GP and BAT to industry and other stakeholders, as well as technical assistance on these issues is a policy element which is essentially missing in Kazakhstan and could be developed, starting with basic information and capacity building activities that require less detailed planning. Two general elements are recommended for Kazakhstan as regards promoting awareness on CP/GP and BAT and facilitation of project identification and development:

- Dissemination of Information;
- Technical Assistance and Capacity Building.

7.3.1 Dissemination of Information on CP/GP and BAT to industry and other stakeholders

Fragmentation of information is a concern that was frequently raised by companies in Kazakhstan. In Kazakhstan there is no central point for information to industries on CP/GP and BAT. There are various information sources about energy efficiency and environmental issues, however the companies perceive a lack of information in general. Companies also lack good examples from planned, on-going and completed projects, limited information services through the Internet. The type of information that could be required at first hand:

- Kazakh BATs;
- EU BREF notes translated into Russian/Kazakh (at least the ones related to metallurgy, mining industry and energy generation);
- Typical cleaner production strategies, technologies and techniques;
- Best cases, - this could be both information from Kazakh companies and translations of international experience.

There is a rather limited choice of such information available in Russian, whereas there is a great variety in English. Many such publications are short and easy-to-read. The format of these publication is very important, and it is therefore important to carefully review these publications to ensure that these information materials are user friendly.

With respect to what type of policy should be taken for dissemination of information, the best option would be to develop a Kazakh website with the relevant content (similar to the UK's "Envirowise"). This information center point would serve to develop and maintain information materials, collect best cases from demonstration projects and information on environmental impacts of wastage and emissions. As a further step, one could consider the following information dissemination activities:

- Further develop national directory of BATs and clean technologies;

- Develop benchmarks for different processes (web-based);
- Establish a CP/GP forum;
- Prepare on-line calculation sheets.

7.3.2 Capacity building and demonstration projects/programs for industries.

There was a clear demand from the companies participating in the pilot program for assistance in project identification and development. CP/GP is about finding real business benefits by taking a structured look at how raw materials are used and how waste is produced in a company, and therefore requires systematic analysis.

A lack of technical know-how to identify and develop profitable CP/GP projects, prepare business plan and arrange financing is apparent. Hence capacity building on these issues is essential to initiate and maintain a sustainable adoption of CP/GP and BAT. Several CP/GP programs carried out in the past in Russia, Ukraine and other countries of former USSR have shown that financial savings of 5% or more of total company turnover can be achieved and delivered to the profit line of the balance sheet. Governments are often seen as a main provider and funder of business advice and technical assistance, at least during a program start-up phase. The Government could initiate a range of pilot CP/GP programs that would demonstrate important aspect and benefits of CP/GP, such as:

- Savings need not always require large investments;
- Companies of all sizes can benefit;
- Success is possible in all sectors of industry;
- Investments in CP/GP & Energy Efficiency measures are cheaper than buying “end-of-pipe equipment”.

Thus, the main objective of the program would be to show companies how they can implement measures that benefit both their company finances and the environment. This is achieved as follows:

- By assisting the industrial participants in identifying, developing and implementing their own preventative measures and in initiating a long-term internal process.
- By disseminating know-how to local experts who can promote and implement future CP/GP & Energy Efficiency programs.

It is important to recruit ‘champions’ industry for participating in the first pilot programs. Because it needs to recognize that innovative knowledge and skills in this area is mainly spread by industry’s leaders and not by academic institutions. The spin-off to other industries would be facilitated, the good results would be achieved by those companies which traditional take a role of industry’s champions.

The program may consist of an introduction seminar, a number of workshops and presentation of project reports. The output of the pilot program will be clearly defined measures in each of the participating industries. The participants will make use of the techniques they learn to review their company practices, identify problem areas and define a number of measures that addresses these problem areas. The participants must be able to show that the projects are environmentally sound and create real financial savings. The figures below illustrate the process of capacity building.

Visit at one of the companies after the Training Session

Group work sessions to identify waste flows

Ideally, by the end of the program, several measures will already have been implemented. Larger companies usually have capacity for the development of projects. They often have access to specialists: designers, technologists, economists, etc., which can develop the CP/GP-options and manage their implementation themselves. However, it is often a lack of project development expertise, where institutional and financial issues are given the same attention as the technical aspects.

Another recommended type of capacity building programs could be recommended for SMEs. These organizations have limited engineering capacity and need strong technical assistance and guidance to identify CP/GP-options. Due to limited capacities they are often focusing on a limited number of 'standard cleaner production measures'. The curriculum of the CP/P-program shall include more cases, description of best available technologies, low-cost typical measures, as well as simplified tools and templates for the project's development, financing and monitoring. Simple calculation model for economic analysis, showing how the savings could be used for the loan repayments could be developed.

Furthermore, Government may seriously consider initiating research & development projects and studies on CP/GP in Kazakhstan by Universities and Research Institutes.

7.3.3 Training of Regional Environmental Authorities to strengthen their capacities CP/GP policy making, as well as to process integrated permits applications

Training for environmental authorities on the relevant topics has been highlighted as a priority. Ensuring that environmental authorities are able to both exert pressure and work closely with companies to meet targets is a significant factor in the successful implementation of CP/GP projects. However, it would require an extensive amount of methodological knowledge to ensure effective support and advice to the companies. Regional environmental authorities currently often lack the capacity to facilitate implementation of cleaner production projects as they often do not possess enough information about modern waste prevention strategies and international benchmarks. Their main focus currently is at end-of-pipe strategies.

It is therefore recommended to provide training of environmental authorities on CP/GP and BATs. Such training could be aimed at developing the competence and strengthening the insights based on modern European experiences with integrated pollution prevention and control. Differing from the industrial enterprises the regional environmental authorities will need a lower level of technical details at the training. For them, information seminars on modern environmental management concepts, e.g., IPPC, CP/GP, BATs, EMS may be more applicable than the full scale project development program.

Importance of training Kazakh environmental authorities in processing the integrated environmental permits applications is separately emphasized. A significant component of such capacity building program would be “on the job” training, or ‘learning by doing’, during, for example, the permit development process.

7.3.4 Initiate industry’s demonstration projects on practical application of integrated permits

Creating a common understanding of key requirements and expectations amongst industrial companies will greatly assist the success of integrated permits implementation. Its provisions place a number of new obligations on industrial facilities which have not previously been a focus in Kazakhstan. The effective implementation of these requirements is central to the long term success of this innovative approach in controlling and minimizing industrial emissions.

The task is to develop one or two successful cases of obtaining environmental permits using Kazakh procedures for the integrated permitting. While these procedures are in place now; they are voluntary and none of the industries of the benchmarking pilot have chosen this ‘path’ to obtaining environmental approvals.

It is envisaged that technical assistance shall be a combination of training and practical group-work. External consultants could provide support in permit writing and negotiations, but most of the assistance could be rendered by the MEP, which will in future review such applications. The officer handling the application must also determine necessary conditions and emission limits to prescribe to the applicant. By increasing understanding of the experiences and challenges of different stakeholders, the training will foster greater communication and relationships between authorities and industries in the area of environmental control.

The result of these demonstration projects would establish necessary capacities, both within the industry and the Ministry of Environment, to launch integrated environmental permitting in Kazakhstan.

7.3.5 Make public funds available to free government-supported environmental consultation and advice.

In many countries, Governments offer direct business advice programs, helpdesks, etc. where the companies may receive direct assistance for projects development on CP/GP and BATs. Examples of such assistance are:

- Grants for scoping studies;
- Free-of-charge company visits;
- Assistance in preparation of business plans based on available technical documentation;
- Free-of-charge distribution of calculation sheets and benchmarks;
- Free-of-charge advice on specific area of opportunities.

In addition, public recognition and awards may be an effective instrument for building country-wise awareness and promoting practical implementation of CP/GP. Kazakhstan may also wish to arrange such award programs that recognize individuals and municipalities.

Annex 1
Concepts of Cleaner Production and BAT

The term '**Cleaner Production**' was first coined in 1990 by the UN Environment Program, who defined it as:

"…the continuous application of an integrated, preventive strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment."

In practical terms Cleaner Production (CP), which is also sometimes called Greener Production or Waste Minimization, is a methodology which aims to find real business benefits by taking a structured look at how raw materials are used and how waste is produced in a company. The focus is placed on using raw materials, including utilities such as electricity and water, more efficiently, therefore reducing the amount of wastage. This in turn leads to both less impact on the environment and economic savings. Cleaner Production is not about end-of-pipe treatment or waste disposal issues.

Cleaner Production is typically introduced in a company through a training Program which aims to show how the company can improve their environmental performance whilst making significant cost savings through reducing or preventing waste and pollution at source by implementing measures that result in a more efficient use of raw materials. Early in the CP Program the participating company is expected to identify concrete CP measures that will be developed further through the training sessions. By the end of the Program, the company will be implementing some of the identified no-cost or low-cost measures. They may also have identified some higher cost measures and will have evaluated the economic feasibility of these to determine if and how these can be financed.

The EU Directive on integrated pollution prevention and control[23] (IPPC) provides a definition for **Best Available Techniques** (BAT) which is closely linked with cleaner production, as BAT is also a tool aiming to prevent, reduce and eliminate pollution at source:

"'best available techniques' shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole:

- 'Techniques' shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;
- 'Available' techniques shall mean those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator;
- 'Best' shall mean most effective in achieving a high general level of protection of the environment as a whole."

Cleaner Production and BAT are obviously related, but they are not the same thing. Cleaner Production is a methodology which can often allow companies to identify what is BAT for specific processes within their company. In other words, BAT can be the result of implementing a CP Program within a company. But Cleaner Production emphasizes the opportunities to make cost savings, and these opportunities most often lead to a reduction in emissions of pollutants, whereas BAT is a regulatory approach used to determine what emission level values (ELV) should be applied to a specific company or process within that company. BAT is usually applied when a

[23] Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control, Art. 2 (11).

company (the licensee) is requesting an operating license from the environmental regulator. In this case the licensee must demonstrate to the satisfaction of the environmental regulator that the installation/process will be operated in such a way that all the appropriate preventative measures are taken against pollution through the application of BAT and therefore justify the application of ELVs other than the most stringent in the range.

What both CP/GP and BAT have in common is that in both cases emphasis is placed on pollution prevention techniques rather than end-of-pipe treatment. End-of-pipe treatment are methods used to remove already formed contaminants from a stream of air, water or waste which is discharged to the environment. These techniques are called end-of-pipe as they are normally implemented as a last stage of a process before the stream is disposed. Good examples of end-of-pipe treatment include waste water treatment plants which treat the liquid effluent from a company, or a scrubber installed on a chimney. Pollution prevention techniques allow the identification of options to reduce the formation of contaminants in the first place, and allow ELVs to be met in a more cost effective manner than simply through implementing end-of-pipe treatment. Investments identified through pollution prevention techniques such as CP/GP and BAT mainly deal with process changes, while end-of-pipe measures will be an investment in well-defined equipment, and usually capital costs for measures identified through CP/GP and BAT are lower than end-of-pipe options. However, it should also be acknowledged that in some cases pollution prevention alone cannot cost effectively meet the proposed emission level values, in which case some form of 'end-of-pipe' treatment is required and would be considered to be BAT.

Annex 2

Examples of the Cleaner and Greener Production in Kazakhstan and Kyrgyz Republic

Re-specification of raw materials - engineering company

Previously, this engineering company producing metal parts used solid metal ingots for manufacturing of products with hollow-core structure. Earlier, the process technology involved drilling and grinding the apertures inside the ingots. This technology generated a large quantity of metal waste, called swarf.

Before: *20% of metal wasted*

Solution: *Use of hollow tubes*

During the program the working team identified significant costs, up to 38 000 USD/yr, linked to swarf generation. Since the metal waste was mixed and contaminated with oils, the waste handling companies were reluctant to accept it.

The working team reviewed best practice examples in order to find a solution to the swarf problem. They highlighted that the traditional approach of swarf re-cycling does not prevent costs related to swarf generation. Hence, prevention of swarf became their first priority. It was suggested to re-specify the ingots the company currently purchases in order to start using hollow tubes, instead of the solid ones.

Measure:	Investments (USD)	Savings (USD/year)	Payback
Re-specification of metal ingots	5 000	20 000	3 months

The measure was implemented during the Program. The investments were covered by the company itself. Although, the unit costs of raw materials increased, the total savings being made were significant due to reduced costs of raw materials, waste, cutting fluids, time and labor.

In addition to the above measure, the company identified a further eight measures, most of which were no-cost/low cost measures, which would allow them to make cost effective reductions in energy and raw material use, and also reduce the production of difficult wastes such as lacquers and paints, oils, coolants and solvents.

Better Efficiency of Energy Production - petrochemical plant

During winter time this company, which mainly produces bitumen, demands only 25% of the capacity of its steam boiler. Using an old and over-sized steam boiler is not efficient and leads to additional costs and emissions.

During the program the working team decided to review the performance of the existing steam boiler. It was shown that under existing conditions, the existing steam boiler works most of the time at less than 50% of its capacity.

Further to advice of the working team, the company decided to replace the old boiler with a smaller and more efficient one. In addition, a steam generator was purchased to satisfy peak demands.

Old boiler DE - 25/14

New boiler, DKVR – 4/13

This measure was implemented just after the end of the Program.

Measure:	Investments (USD)	Savings (USD/year)	Payback
Replacement of steam boiler	34 000	147 200	4 months

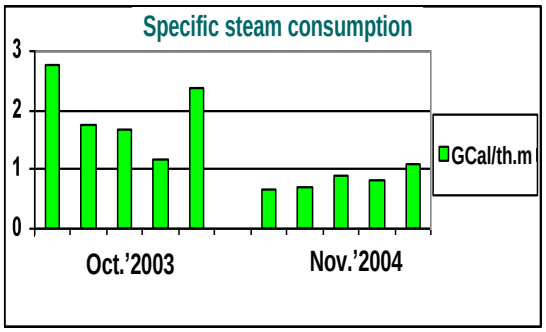
In total, the company identified more than ten pollution prevention measures, most of which were no-cost/low cost measures, that allowed them to significantly reduce their need for electricity and heat, and also reduce production of waste water and sludge. The company also estimated that implementation of the identified measures led to a reduction of approximately 1 000 t/yr in emissions to air.

Better Production Planning - textile factory

Existing production at this cotton processing and textile manufacturing plant did not exceed 10% of the designed capacity. Related to that are increased down-time and change-over of production, resulting in inefficient production and high losses. During the program, it was confirmed that energy contributes to a very considerable share of the production costs. In order to control energy use, it introduced Energy Monitoring and Targeting (EM&T) routines.

The first stage of EM&T started during the Program. It focused on steam consumption, one of the major components of the energy costs for the company.

The working team assessed specific steam consumption and the parameters that influence it. Special routines were established to ensure maximum operational load of equipment, reduction of material change-over and peak loads. In addition steam traps allowing steam condensate re-use were installed.



Improvement of specific steam use through the EM&T and re-use of steam

The initial results after implementation of the EM&T system and new routines indicated 20% reduction of steam use and 10% increase of condensate return. This package of measures required some investments, mainly in steam traps and piping, but the payback of the investments was quite high.

Measure:	Investments (USD)	Savings (USD/year)	Payback
Introduction of EM&T and new production planning routines	-	75 116	0
Installation of steam trap and return of condensate	13 800	20 000	0.7

The pollution prevention program described above, along with a subsequent program implemented the next year in Kazakhstan and Kyrgyzstan, highlighted the significant impact that no-cost/low-cost pollution prevention measures could make in reducing raw material use, waste production and emissions. No-cost/low-cost measures are those that require no or minimal investments (< USD 5000) in order to be implemented, and can usually be introduced as soon as they are identified using, if needed, funding from the operational budget of the company. Over the two programs, the 15 companies who participated identified in total 44 no-cost/low-cost pollution prevention measures, which represented exactly half of all identified measures. These no-cost/low-cost measures varied in nature, but some of the opportunities which were common to more than one company included:

- Re-specification of size and quality of purchased raw materials;
- New quality routines at the reception of raw materials;
- Improved storage of raw materials and finished products;
- Optimizing the load of equipment through new production planning routines;
- Elimination of water leaks;
- Monitoring of water, heat and electricity use;
- Optimization of compressed air use;
- Training of existing staff or hiring of more qualified employees.

In addition to leading to reductions in emissions, implementation of these no-cost/low-cost pollution prevention measures leads to significant savings in costs. The total cost saving from implementation of the 44 identified no-cost/low-cost measures was estimated at over USD 450 000, whereas total capital investment needed was less than USD 25 000.

Annex 3
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Annex 4

Template of company questionnaire

The form of inquiry for enterprise

Type and size of the enterprise	
Company name	
The type of ownership	
Number of employees	
Main activity	

The technical level of main productions *	
The name of production	(e.g., the production coke, sinter, etc.)
The main products	
The annual output	
The values of specific parameters**	
The specific consumption of raw materials (per unit of product)	
The specific water consumption (per unit of product)	
Specific energy consumption (per unit of product)	
Specific indicators of gas emissions, wastewater, waste generation (per unit of product)	

* If company has several productions, the information shall be provided separately for each facility
** The information is provided as a separate application. You must to give a comments according to the methods of determining these parameters.

Environmental aspects * **	
Name of the environmental problem	
A brief description of source of the problem	The description includes the characteristics of the source of waste generation, emissions and effluents. You must specify the actual values of standardized environmental indicators, for which the standard is set. Specify the established standards. Provide the technological scheme of production (area) with the values

	of technological parameters (the values of the main input and output streams)
Indicate the measures which are applied to reduce the environmental pressure on the given site	(what activities were implemented)
Features of environmental protection equipment installed on the site	(equipment for wastewater, exhaust gases treatment etc.)
What measures is planned to implement for solving the problem	
Existing barriers and difficulties (not including financial ones)	

*** Information is given for each environmental issue separately

Energy Efficiency	
Greatest reserve of generation efficiency improvement (reducing losses)	(according to the specialists of the enterprise)
Planned activities	(you must specify the name of the event and the expected result)
What are the sources of funding that will be used	
Existing barriers and difficulties (not including financial ones)	